Draft Environmental Impact Statement
for Military Training in the Mariana Islands

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Abstract:

The Commander, Naval Forces Marianas, acting for the Commander in Chief, U.S. Pacific Command, requires training for military forces in its area of responsibility. Approximately 4,600 personnel from the Air Force, Navy, Guam National Guard, Army Reserve, and Marine Corps comprise the force structure depending on Guam and the Commonwealth of the Northern Mariana Islands (CNMI) for training. Training is required to develop war fighting skills and to maintain a state of combat readiness in troops stationed on Guam as well as those stationed in Asia, various other Pacific islands, Hawaii, and Alaska. Most activities proposed in this EIS have been conducted previously in the proposed locations.

Proposed activities include basic military occupational skills training, weapons certification, parachute and aviation certification, logistics training, tactical exercises, combined arms training for large groups, and joint-service exercises involving 1,000 or more personnel. Proposed training locations are active military bases on Guam (NAVACTS Ordnance Annex and Waterfront Annex, Andersen Air Force Base, including the Main Base, Northwest Field, and Andersen South, and two Naval Computer and Telecommunications Area Master Station sites), certain non-military properties on Guam and Rota, the Military Lease Area on Tinian, and the uninhabited island of Farallon de Medinilla.

Alternatives are (1) the "no action" alternative, consisting of all ongoing training activities and locations, (2) the "augmented set of training activities" alternative, consisting of all proposed new training activities and locations as well as ongoing activities, and (3) the "mitigated set of training activities" alternative, which includes ongoing activities plus selected new activities and locations which are not expected to have significant impacts on the environment or which have impacts that can be mitigated. The environmentally preferred alternative is the "mitigated set" alternative, which includes a set of constrained area overlays for each proposed training location.

Seven potentially significant issues were identified and analyzed in detail:

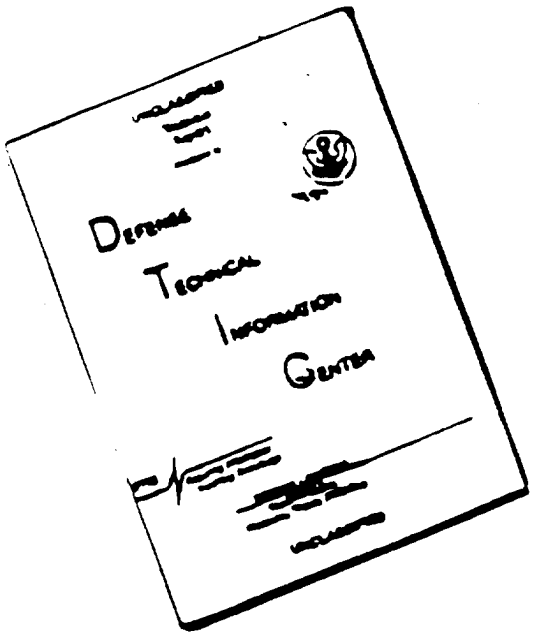
1. Potential impacts on endangered species and other biota are site-specific; proposed mitigation consists of delineated "no wildlife disturbance" and "no ground disturbance" overlays at proposed training locations, as well as time restrictions on certain activities.

2. Potential impacts on archaeological and historic resources are also mitigated by "no ground disturbance" and "off limits" overlays.

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3. Analysis indicates that no significant impacts on existing Tinian wastewater disposal facilities will result from the proposed action.

4. No significant impacts on waste transportation or disposal facilities are expected from continued backhauling of solid waste to Guam for disposal and transport of small amounts of hazardous waste from Tinian via Guam to the continental U.S. for disposal.

5. No impacts of aviation training on public safety are expected which cannot be mitigated by observing existing military and FAA protocols.

6. Potential impacts of civilian hikers entering the proposed Ordnance Annex sniper range will be mitigated by avoiding range training on religious holidays and posting warning signs where trails enter the Annex.

7. Potential cumulative impacts on Tinian's economy from military training and the new casino industry will be mitigated by establishing a communications protocol with Tinian officials requiring 30 days advance notice of any training activity. No disadvantaged or minority population will be disproportionately impacted by the proposed action.

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ABBREVIATIONS:

AAFB	Andersen Air Force Base
AAV	Assault Amphibian Vehicle
ABW	Air Base Wing
AICUZ	Airfield Installation Compatibility Use Zone
ASW	anti-submarine warfare
AT	anti-tank
ATD	annual training duty
ATIS	Airport Terminal Information System
BRAC	Base Realignment And Closure
BTS	brown tree snake
CAA	Clean Air Act
CAD	Cartridge Actuated Device
CCT	Combat Control Teams
CDS	Container Delivery System
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CME	Combat Mobility Element
CNMI	Commonwealth of the Northern Mariana Islands
COMFAIRWESTPAC	Commander Fleet Air Western Pacific
COMPHIBGRU	Commander, Amphibious Group
COMNAVMAR	Commander U.S. Naval Forces Marianas
COM7thFLT	Commander 7th Fleet
CONUS	continental U.S.
CPX	Command Post Exercises
C-RAP	Center Radar Approach Control
CSS	Combat Service Support
CTF	Commander Task Force
CUC	Commonwealth Utility Commission
CZM	Coastal Zone Management
DAWR	Division of Aquatic and Wildlife Resources
DEIS	Draft Environmental Impact Statement
DEQ	Division of Environmental Quality
DoD	Department of Defense
DOT	Department of Transportation
DPW	Department of Public Works

DRMO	Defense Reutilization and Marketing Office
DZ	drop zone
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMO	Emergency Management Office
EMR	Electromagnetic Radiation
EMUA	Exclusive Military Use Area
EMV	Electromagnetic Vulnerability
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ERA	Ecological Reserve Area
EZ	Extraction Zone
FAA	Federal Aviation Administration
FARP	Forward Area Refueling Point
FCLP	Field Carrier Landing Practice
FDM	Farallon de Medinilla
FEIS	Final Environmental Impact Statement
FWS	Fish and Wildlife Service
GAA	Guam Airport Authority
GEPA	Guam Environmental Protection Agency
GIAT	Guam International Air Terminal
GLUP	Guam Land Use Plan
GovGuam	Government of Guam
GPA	Guam Power Authority
GTA	Guam Telephone Authority
HAHO	High Altitude, High Opening
HALO	High Altitude, Low Opening
HC-5	Helicopter Combat Support Squadron Five
HM	Hazardous Materials
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HPO	Historic Preservation Officer
HQ USAR, MAR	Headquarters U.S. Army Reserve, Marianas
HW	Hazardous Waste
IARII	International Archaeological Research Institute, Inc.
ID	Infantry Division
IFR	Instrument Flight Rules
IWS	Individual Wastewater System
km	kilometer
kph	kilometer per hour
KW	kilowatt
L	Light
LAPES	Low-Altitude Parachute Extraction System
LAV	Light armored Vehicle

LBA	Lease Back Area
LCAC	Landing Craft, Air-Cushioned
LCU	Landing Craft, Utility
Ldn	Day-Night Equivalent Soundlevel
LZ	Landing Zone
m	meter
m^3	cubic meter
m^3/d	cubic meter per day
mm	millimeter
MEDEVAC	Medical Evacuation
MEF	Marine Expeditionary Force
MEU	Marine Expeditionary Unit
MHZ	Megahertz
MLA	Military Lease Area
MOA	Memorandum of Agreement
MSL	Mean Sea Level
MTC	Marianas Telecommunications Corporation
MW	Megawatts
NAS	Naval Air Station
NAVACTS	Naval Activities
NBC	Nuclear, Biological, and Chemical
NCB	Naval Construction Brigade
NCTAMS	Naval Computer and Telecommunications Area Master Station
NEO	Noncombatant Evacuation Operations
NEPA	National Environmental Policy Act
NGD	No Ground Disturbance
NKK	Nan'yo Kohatsu Kaisha (South Seas Development Company)
NOI	Notice of Intent
NOTMAR	Notices to Mariners
NOTAM	Notices to Airmen
NRMP	Natural Resources Management Plan
NSWU-1	Navy Special Warfare Unit One
NVG	Night Vision Goggle
NWD	No Wildlife Disturbance
OL	Off Limits
PACAF	Pacific Air Forces
PAG	Port Authority of Guam
POL	Petroleum Oil, Lubricant
PT	Portable Self-Contained Toilet
PUAG	Public Utility Agency of Guam
PWC	Public Works Center
RCRA	Resource Conservation and Recovery Act
RHIB	Rigid Hulled Inflatable Boats
ROWPU	Reverse Osmosis Water Purification Unit

SAR	Search and Rescue
SARA	Superfund Amendment and Reauthorization Act
SDZ	Surface Danger Zone
SFG (ABN)	Special Forces Group, Airborne
SOP	Standing Operating Procedures
SPIE	Special Purpose Insertion and Extraction
SRF	Ship Repair Facility
SRI	Surveillance, Reconnaissance and Intelligence
SUSV	Small Unit Support Vehicles
TACP	Tactical Air Control Party
TCGCC	Tinian Casino Gaming Control Commission
TEWT	Tactical Exercise Without Troops
TOW	Tube launched, optically tracked, wire-guided
TRAP	Tactical Recovery of Aircraft and Personnel
TRUE	Training in an Urban Environment
TSCA	Toxic Substances Control Act
TT	Tandem Thrust
TTPI	Trust Territory of the Pacific Islands
UHF	Ultra-High Frequency
USAF	U.S. Air Force
USARPAC	U.S. Army Pacific
USCG	U.S. Coast Guard
USCINCPAC	U.S. Commander-in-Chief, Pacific Forces
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USMC	U.S. Marine Corps
UXO	Unexploded Ordnance
VFR	Visual Flight Rules
VGS	Variable Grade Sewer
VHF	Very High Frequency
VOA	Voice of America
WESTPAC	Western Pacific

EXECUTIVE SUMMARY

The purpose of this draft environmental impact statement (DEIS) is to provide comprehensive National Environmental Policy Act (NEPA) documentation for all military training in the Mariana Islands which is likely to be required for some years into the future. Therefore, this DEIS presents all ongoing training activities and locations, as well as proposed new activities and locations. The basis for the proposed action is the Marianas Training Plan prepared by the Pacific Division, Naval Facilities Engineering Command on behalf of the Commander, Naval Forces Marianas (COMNAVMARIANAS). All mitigation documented in the Record of Decision for the Final EIS will be included in future training orders, streamlining the process of planning training exercises and assuring that all necessary mitigation will be implemented.

The following sections are numbered to correspond with chapters of this DEIS.

1.0 Purpose and Need for Training in the Marianas

Military training in the Marianas is required to develop war fighting skills and to maintain a state of combat readiness in troops stationed in Guam, Commonwealth of the Northern Mariana Islands (CNMI), Asia, Hawaii, and Alaska. Approximately 4,600 personnel from the Air Force, Navy, Guam National Guard, Army Reserve, and Marine Corps comprise the force structure depending on Guam and the CNMI for training.

Training Requirements. Proposed training activities include basic military occupational skills training and weapons certification, logistics training, tactical exercises, combined arms training for large groups, and joint-service exercises involving 1,000 or more personnel. The largest scale training combines many proposed activities in the biennial Tandem Thrust joint exercise, which has in the past been conducted on Tinian with personnel and materiel staged from Guam. These activities have various training facility requirements, including relatively large areas of undeveloped and wooded terrain, urban areas, beaches with contiguous land maneuver areas, airfields, designated landing and paradrop zones, weapons ranges, and seaports.

Military Land in the Marianas. Undeveloped areas owned by the Department of Defense (DoD) and suitable for training are available on Guam at Andersen Air Force Base (AAFB), NAVACTS Guam Waterfront Annex and Ordnance Annex, and Naval Computer and Telecommunications Area Master Station (NCTAMS) sites at Finegayan and Barrigada. The DoD leases a large portion of the island of Tinian (the Military Lease Area) for training and leases the uninhabited island of Farallon de Medinilla (FDM) for naval gunfire and aerial bombardment. Training at AAFB facilities is administered by Commander 36th Air Base Wing. All other training lands in the Marianas are administered by Commander, Naval Forces Marianas.

The U.S. military presence in the Marianas dates back to the Spanish-American war and was consolidated during World War II, when Guam, Saipan, and Tinian were all retaken from the Japanese. At the end of the war, Guam was under the control of the U.S. Navy. Following the war, Guamanians were granted U.S. citizenship. The islands of the CNMI were administered by the U.S. as the Mariana District of the Trust Territory of the Pacific. The CNMI became a Commonwealth of the U.S., acquiring U.S. citizenship and economic development assistance for its residents and providing land areas on Saipan, Tinian, and FDM for U.S. military use.

Scoping. During the EIS scoping process, seven potentially significant impacts of the proposed action were identified for detailed analysis. These issues were:

- Impacts on biological resources, especially listed endangered and threatened species and wetlands
- Preservation of cultural resources at all training locations
- Wastewater disposal on Tinian, which has no wastewater treatment plant and no permanent military facilities
- Solid and hazardous waste disposal on Tinian, which has no EPA-approved waste disposal facility
- Effects of aviation training on public safety
- Effects of firing ranges on public safety
- Socioeconomic impacts of training on the residents of Tinian, which is relatively isolated from economic opportunities and where land use is 60 percent controlled by the DoD.

Many potential impacts (significant and nonsignificant) will be automatically mitigated by compliance with existing federal, territorial, commonwealth, and military regulations and orders. These impacts include alien species and disease control, surface water quality, range and aviation safety, hazardous materials and hazardous waste management, and construction management practices.

Permits and Approvals. Consultations have been initiated with government agencies to obtain their concurrence with the preferred alternative. Concurrence is required from the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service for activities with the potential to impact threatened and endangered species and migratory birds. Concurrence is required from the Guam and CNMI Historic Preservation Officers for activities with the potential to impact sites determined to be significant under National Register of Historic Places criteria. Finally, the Guam Bureau of Planning and CNMI Office of Coastal Resources Management must concur that the proposed action is consistent with local Coastal Zone Management programs. The agencies may request modifications of the proposed action before providing their concurrence.

2.0 Proposed Action and Alternatives

The proposed action consists of land-based training activities to augment existing training which has been conducted for many years at specific locations in the Marianas. Alternative locations are integrated within the three alternatives:

Alternative 1: No Action. This alternative consists of all ongoing training activities conducted on the islands of Guam, Tinian, Rota, and FDM in recent years. It includes all locations in which such activities have occurred. Most of the training activities and locations identified in this DEIS are part of the No Action alternative.

Alternative 2: Augmented Set of Training Activities. This alternative consists of augmenting ongoing training with all requested new training activities and locations:

- Beach landings by assault amphibian vehicles (AAVs) at Unai Babui on Tinian
- Floating mine neutralization training outside of Apra Harbor on Guam

- Detonation of 20-pound charges at existing underwater demolition site in Apra Harbor (now approved for use with 10-pound charges)
- Establish a new paradrop zone in the NAVACTS Ordnance Annex on Guam
- Configure new firing ranges: a sniper range and shooting house in the NAVACTS Ordnance Annex, extend an existing firing range at NAVACTS Waterfront Annex, reconfigure the closed firing range on Tinian and add a mortar range, and add a range for groundbased sniper, anti-tank, mortar, and artillery fire on FDM.
- Construct shooting houses in the NAVACTS Ordnance Annex and on Tinian
- Construct a small base support camp on Tinian within the Exclusive Military Use Area (EMUA)
- Fence the UXO-contaminated area that has resulted from past use of the closed firing range on Tinian
- Construct security gates at Broadway and 8th Avenue entrances to EMUA on Tinian
- Upgrade targets on FDM

In addition, this alternative proposes additional locations for ongoing training activities:

- Conduct confined area landings (CALs) at Northwest Field, AAFB
- Conduct landing craft, air-cushioned (LCAC) landings at Dadi Beach and NAVACTS Waterfront Annex
- Perform underwater demolition training at several additional sites inside and outside Apra Harbor on Guam
- Conduct river insertions on Ylig and Talofofo Rivers in southeast Guam
- Conduct helicopter insertions/extractions at existing Dandan landing zone and to the rappelling tower at NAVACTS Waterfront Annex
- Conduct live fire urban training at the former Japanese Naval Air Command Post near North Field on Tinian
- Conduct rapid runway repair at Northwest Field, AAFB
- Conduct heliborne firebucket training on AAFB Main Base active runways

Alternative 3: Mitigated Set of Training Activities. This alternative is a modification of the Augmented Set; it consists of ongoing and new training activities, reduced in scope or location to mitigate significant impacts likely to result from the Augmented Set. Most of the modifications are location restrictions for certain activities. The restrictions are categorized as:

- NGD (no ground disturbance): Areas where no excavation is permitted and no vehicles are allowed off road
- NWD (no wildlife disturbance): Areas where there may be no pyrotechnics, no live ammunition or demolition, no motor vehicles off established roads, no mechanical vegetation clearing, no helicopter hovering, and no helicopter landings
- OL (off limits): No training activities are allowed in these areas, except troop and vehicle movement along established roads

Other modifications are:

- Assault amphibian vehicles (AAVs) landing at Unai Babui will be restricted to a single file approach, to minimize damage to coral
- LCAC landings at Dadi Beach will be permitted only after an archaeological survey of the proposed landing area has been performed

- Aircraft overflights of AAFB's Northwest Field, Munitions Storage Area, or Tarague cliffline must remain at least 0.9 km (one-half nautical mile) away from any Mariana crow nesting site identified by the Guam Division of Aquatic and Wildlife Resources during crow breeding season (October 15 through April 15).
- No shallow water mine countermeasures training will be conducted offshore of Gabgab Beach in the NAVACTS Waterfront Annex
- No ground-based weapons training will be conducted on FDM
- No historical artifacts may be collected or vandalized at any location. Troops will be briefed on the importance of cultural resources prior to training in the Tinian EMUA or the NAVACTS Ordnance Annex.

Comparison of Alternatives. The Mitigated Set Alternative best meets the needs for training in the Marianas while avoiding significant impacts to the environment.

3.0 Existing Environment

Physical Environment. The Mariana Islands are an 800-kilometer chain of 15 volcanic islands in the western Pacific. Guam, Rota, Tinian, and Saipan are the southernmost and most populated islands in the chain. The Mariana climate is generally warm and humid, with average daytime temperatures of 29 to 32°C and prevailing east to northeast tradewinds. The two primary seasons are a January–July dry season and an August–January rainy season; typhoons and tropical storms are common in the rainy season. The primary natural hazards are typhoons and earthquakes.

The islands are composed of volcanic rock capped by coralline limestone of varying thicknesses. Soils developed on volcanic rocks are poorly drained clays, while soils developed over limestone are shallow and highly porous. Surface water only exists in areas where clay prevents water from draining through to the porous rock below. Aquifers on inhabited islands are believed to occur primarily in limestone; it is not known whether a freshwater aquifer has accumulated on FDM. Groundwater and surface water quality are good in most cases. Marine water quality around the islands is generally good, except in proximity to sewage outfalls. Air quality is good, due to the lack of emissions sources and the nearly constant tradewinds.

The islands' visual characteristics are defined by the ocean and local topographic features, primarily dramatic ocean cliffs and white sand beaches. Built environment is relatively sparse on Rota and Tinian and absent on FDM. On Guam, urban and suburban areas dominate the central portion of the island.

Biological Resources. Native limestone forests on Guam and Tinian were reduced by the impacts of World War II, as well as by development; much of the limestone forest remains on Rota. Guam and Tinian habitat types now are dominated by secondary growth forest (including tangantangan stands) and grasslands, with some wetlands and strand vegetation. Marine habitat includes coral reefs and benthic communities.

A relatively high number of native Mariana wildlife species are listed as endangered or threatened by the federal and Guam territorial governments, either as a result of loss of habitat or predation by humans and snakes. On Guam, protected species include three plants, three bat species, two sea turtle species, eight skinks and geckos, and 18 bird species (some of which are extinct on Guam). A small number of species has managed to survive predation by the brown tree snake. The few remaining Mariana crows on Guam inhabit areas of AAFB, together with Mariana fruit bats.

Green sea turtles nest on AAFB beaches. Mariana common moorhens and sea turtles inhabit or visit NAVACTS Waterfront Annex, and moorhens, fruit bats, and island swiftlets are found at the Ordnance Annex. The greatest threat to terrestrial endangered species on Guam is from the introduced brown tree snake. The snake is nocturnal and difficult to detect; it can survive for weeks without food and readily climbs into buildings, trees, and aircraft landing gear. The snake has so far not become established on other islands of the Marianas, although isolated snake sightings have occurred on Saipan and Tinian.

Tinian is home to the endangered Mariana moorhen as well as to the endangered Micronesian megapode and threatened Tinian monarch. The monarch is ubiquitous throughout the island in large numbers, but it does not exist anywhere except Tinian. Green sea turtles nest on Tinian's beaches, and coconut crabs inhabit the woods. Mariana fruit bats visit Tinian, although no permanent colonies have been observed.

Rota's forests provide habitat for the Mariana crow and the fruit bat. Several wildlife sanctuaries and conservation areas have been established on Rota to protect endangered species.

FDM is a breeding location for many migratory seabirds, including white terns and three booby species. Several Micronesian megapodes have recently been observed on FDM; it is not known whether they nest on the island.

History and Cultural Resources. The Mariana Islands are part of Micronesia and have been controlled by many different nations since their "discovery" by Magellan in 1521. The oldest dated archaeological remains indicate that humans first settle the Marianas as early as 1500 B.C. At the time of first European contact, the native Chamorro people exhibited a typical Oceanic economy, depending on farming and marine resources. The most notable artifacts of the ancient Chamorro culture are sets of latte stones—upright pyramidal stone pillars topped by capstones and occurring in two parallel rows of 6 to 12 stones. Other artifacts include pottery scatters and stone adzes. Chamorro sites have been identified and investigated at AAFB, the two NAVACTS annexes on Guam, in the EMUA on Tinian, and on non-military lands on Rota. No archaeological or historic resources have been identified on FDM.

After European contact, the Spanish claimed the Mariana Islands, depopulating the northern islands by resettling the Chamorros in "church towns" on Guam. After the Spanish-American war, Guam became a possession of the U.S. and was developed as a naval base. The northern Mariana Islands passed from Spain to Germany, which leased much of Rota and Tinian to the Japanese in the early 1900s. The Japanese South Seas Development Company established sugar cane plantations on Tinian and Rota, bulldozing much of the indigenous forests and other native vegetation. Structures dating from this period still exist on Tinian and have been included in interpretive trails developed by the Navy.

As World War II approached, the Japanese military government took control of Tinian, building Ushi Airfield and other facilities using Korean slave labor. Japan occupied Guam soon after. In a series of battles in 1944, Saipan, Tinian, and Guam were liberated from the Japanese. Extensive rebuilding by the Seabees converted Tinian to a major airfield, from which B-29s flew bombing runs to Japan. In 1945, the *Enola Gay* and *Bock's Car* flew from Tinian's North Field to drop atomic bombs on Hiroshima and Nagasaki, respectively. North Field is now a National Historic Landmark.

Infrastructure. Guam, Tinian, and Rota each have a harbor, a civilian airport, a municipal solid waste landfill, and suppliers of potable water and electricity. Wastewater disposal on Tinian and Rota consists of individual disposal systems (septic tanks and cesspools), while Guam has wastewater treatment facilities. Civilian landfills on Guam and Tinian are not in compliance with federal solid waste regulations; the Guam landfill is under court order to close in 1997. Military bases on Guam provide their own infrastructure and also provide potable water to civilians via the Public Utility Agency of Guam. Both AAFB and NAVACTS Waterfront Annex maintain solid waste landfills and hazardous waste storage facilities, which are in compliance with federal regulations. FDM is not developed.

Socioeconomic Environment. Residents born on Guam and in the CNMI are U.S. citizens. Citizens residing in proximity to military lands are not economically disadvantaged relative to the rest of the Marianas and western Pacific population.

Guam has experienced steady growth of its tourist industry and business community since the end of World War II; it is now a hub of western Pacific transportation, in addition to being the home of the only U.S. military installations on U.S. soil in the region. Military land use on Guam is being reduced, in accordance with the Guam Land Use Plan Update and the Base Realignment and Closure (BRAC) program.

Tinian and Rota continue to develop, but at a much slower pace than Guam. Tinian residents are striving to develop a casino industry, to bring tourists onto the island from Saipan. Rota is experiencing some resort development.

4.0 Impacts and Mitigation

Seven potentially significant issues were identified for detailed analysis. The two types of resource most likely to be adversely impacted are cultural resources and biological resources.

Biological Resources. The major potential impacts on biological resources are (1) possible introduction of the brown tree snake (BTS) to Rota, Tinian, or Hawaii, resulting in likely eradication of endangered bird species on those islands; (2) short-term noise and visual disturbance of individual endangered birds and bats, leading to cumulative nest abandonment or failure to reproduce; (3) potential turtle kills as a result of underwater demolitions training in Apra Harbor; (4) potential destruction of turtle nests and damage of coral at Unai Babui (Tinian) during AAV landings; and (5) potential mortality of endangered and migratory birds from explosives due to bombardment of FDM.

Mitigation consists of (1) following detailed BTS interdiction protocols, (2) limiting certain disturbing activities from occurring during certain species' breeding seasons and observing NWD (no wildlife disturbance) constraints, (3) observing existing underwater demolitions protocols to protect turtles and fish in Apra Harbor, (4) limiting AAV landings to beach areas with no turtle nests and to single lane approaches in an area with less than 3 percent live coral to minimize impacts on coral substrate, and (5) limiting FDM target areas until additional study has been completed.

Cultural Resources. Cultural resources vulnerable to impacts from training activities consist primarily of ancient Chamorro latte sets/habitation sites and important World War II sites, including the National Historic Landmark at North Field on Tinian. Any training activity which involves excavation or disturbs the surface of the ground has the potential to destroy archaeological data by

physically damaging or altering the relative positions of artifacts. Such activities include live fire (projectile impacts) and explosions, excavation (field sanitation, foxholes, construction), and offroad travel by wheeled or tracked vehicles.

Mitigation of these impacts consists of data collection prior to use, imposing NGD (no ground disturbance) or OL (off limits) constraints on certain areas, and following certain mandatory precautions:

- Brief exercise personnel on cultural resources
- Mark boundaries of selected cultural sites prior to exercise
- Have archaeologist monitor sites during and after exercise
- Prohibit collecting historical artifacts or digging within three feet of structures

Wastewater Disposal on Tinian. Analysis indicates that ongoing disposal of portable toilet waste in municipal septic systems is unlikely to adversely affect the systems. The proposed construction of a base support camp on Tinian, with septic tanks and leaching field, would provide a system with known capacity and no potential to cumulatively affect the municipal facilities.

Solid and Hazardous Waste Disposal on Tinian. Consideration of this issue indicated that continued backhauling of solid waste to Guam for disposal at the Navy landfill will not have an adverse effect on the environment or on waste disposal capacity on Guam. Similarly, no adverse effects are expected from continuing to remove very small amounts of hazardous waste from Tinian for temporary storage on Guam and disposal on the continental U.S.

Effects of Aviation Training on Public Safety. Analysis indicated that continued observance of Federal Aviation Administration (FAA) notification requirements and existing military orders regarding aviation training will provide the best mitigation of potential public safety hazards.

Effects of Firing Ranges on Public Safety. In most cases, there is no public access to range training areas, and no impacts are anticipated. Two ranges (one existing, one proposed) are in areas frequently open to the public, i.e., the Orote Point historic trail area and the EMUA on Tinian. Potential public safety hazards will be mitigated by observing standard procedures to prevent public access during range training, i.e., closing public access and posting observers.

In the case of the proposed sniper range at NAVACTS Ordnance Annex, civilians have had unofficial access to the ridgeline along the western boundary of the Annex, within the edge of the surface danger zone for the proposed sniper range. Potential hazards to civilians observing traditional religious practices in this area will be mitigated by avoiding use of the range in the week preceding and including Easter and on other religious occasions to be agreed upon between the Mayors' Council and NAVACTS Guam.

Impacts on Tinian's Economy. Interviews with Tinian citizens and a study of its economy indicates that military training does not have an adverse impact on Tinian's economy. The only identified existing impact is inconvenience to tour operators from unexpected closure of the EMUA during exercises. Anticipated potential cumulative impacts with Tinian's casino industry (currently in the initial stages of construction and planning) are primarily logistical and consist of interference between military and commercial use of the port and West Tinian Airport.

Potential conflicts and inconveniences will be mitigated by formalizing communication protocols regarding training activities. In all cases, COMNAVMARIANAS will notify local Tinian officials of training activities a minimum of 30 days prior to any exercise, facilitating logistics coordination.

Table ES-1 lists all significant and non-significant potential impacts for which mitigative measures and parties responsible for implementing mitigations have been identified.

Table ES-1
Comprehensive Table of Significant and Non-Significant Potential Impacts and Mitigations

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Natural Resources			
All natural resources, generally	• Fire damage in training areas	• Restrict use of open fires and aerial pyrotechnics to paved or low fire hazard areas only.	• Unit Commanders
		• Curtail use of fire-causing objects during periods when fire hazard is high.	• Unit Commanders
		• Brief troops on potential for fire and contingency reactions.	• Unit Commanders
		• Have appropriate fire fighting equipment readily available for response to tent camps, firing ranges, landing zones, airfields, and vehicle maintenance and refueling areas.	• Unit Commanders
		• Plan camp layouts with fire lanes; provide fire extinguishers in accordance with regulations.	• Unit Commanders
		• Incorporate fire fighting response drills into area security plan.	• Unit Commanders
	• Depletion of vegetation by clearing for tactical exercises and bivouacs	• Use and maintain established, surveyed DZs and LZs only.	• Unit Commanders
		• Select already cleared areas for administrative camp sites.	• Unit Commanders
		• Cut no vegetation larger than wrist size.	• Unit Commanders
		• Minimize degree of vegetation clearing when preparing fighting positions and firing lanes.	• Unit Commanders

Table ES-1 *(continued)*:

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Natural Resources *(continued)*:			
Threatened or endangered species, migratory birds	• Introduction of invasive species to training areas and ports of entry for units training in the Marianas	• Implement the *BTS Control/Interdiction Plan* to inspect equipment and cargo originating from or transiting through Guam.	• COMNAVMARIANAS CO AAFB USDA C7F Unit Commanders
	• Disturbance of endangered species and endangered species habitat by noise or by physical interference from offroad vehicles and vegetation clearing	• Restrict training dates, times, and types of training activity to avoid loud noises or physical disturbance of nests by vehicles, aircraft, or personnel during breeding seasons in designated areas.	• COMNAVMARIANAS CO AAFB
		• Designate areas off limits or "no wildlife disturbance" (primary habitat areas and turtle nesting sites), as necessary.	• COMNAVMARIANAS CO AAFB • Unit Commanders
		• Direct personnel to avoid collecting or disturbing wildlife for any reason.	• EOD and NSWU Unit Commanders
		• Conduct training area (land and water) inspections prior to demolition training, to ensure area is clear of wildlife.	
	• Mortality of fish or sea turtles due to shock wave from underwater demolition	• Follow SOPs requiring "scare charge" prior to demolition.	• EOD and NSWU Unit Commanders
Wetlands	• Potential loss of wetland function	• Restrict training access within wetlands.	• COMNAVMARIANAS
Coral reef and sand beach	• Damage to coral reefs from AAV landings at Unai Babui	• Designate restricted lane of approach, maximum of 15 m wide.	• COMNAVMARIANAS
		• Conduct landings at high tide; remain within designated lane.	• C7F MEU

Table ES-1 *continued):*

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Natural Resources *(continued)*:			
Coral reef and sand beach (continued):	• Damage to coral reef from underwater EOD exercises	• Avoid underwater demolition within 100 m of reef.	• EOD and NSWU Unit Commanders
	• Beach vegetation and sand dispersion caused by landing vehicles, landing craft, and embarked vehicles	• Select routes to minimize vegetation impacts; use beach matting to reduce erosion caused by disembarking vehicles traversing soft sand beaches; restore beach topography upon completion of exercise.	• Unit Commanders
Primary habitat	• Damage to habitat by clearing DZs and LZs	• Use and maintain surveyed DZs only.	• Unit Commanders
	• Blast and fire damage to habitat	• Restrict open fires and demolition or pyrotechnics in areas near primary habitat, to prevent spreading fire.	• COMNAVMARIANAS CO AAFB Unit Commanders
Insects and disease	• Introduction of new/noxious insects or weeds	• Adhere to existing quarantine procedures for cargo and equipment inspections. Inspect for presence of noxious weeds in any construction materials imported for training structures.	• COMNAVMARIANAS CO AAFB Unit Commanders
		• Transport all solid waste from Tinian in containers designed for steam sterilizing, and sterilize according to standard procedures upon arrival on Guam.	• COMNAVMARIANAS

Table ES-1 *(continued):*

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Cultural Resources			
Archaeological features, historic structures, National Historic Landmarks	• Damage or data loss from ground disturbance by offroad vehicles or logistics support activities, excavation of fighting positions or latrines, impacts from weapons fire, rapid runway repair, or vandalism	• Publish information and maps identifying known historic and cultural areas for exercise planning.	• COMNAVMARIANAS CO AAFB CO NAVACTS Guam CO NCTAMS
		• Restrict potentially damaging activities from cultural resources. Designate areas as off limits, administrative transit only, no vehicular traffic, no open fires, or no ground disturbance, as appropriate, to provide sufficient levels of protection.	• COMNAVMARIANAS CO AAFB CO NAVACTS Guam CO NCTAMS
		• Physically mark off limits boundaries (that can be identified both day and night) of areas lacking natural boundaries.	• COMNAVMARIANAS CO AAFB CO NAVACTS Guam CO NCTAMS
		• Monitor training activities for adherence to restrictions.	• COMNAVMARIANAS CO AAFB CO NAVACTS Guam CO NCTAMS
		• Document condition of former Japanese Naval Air Command Post (Tinian) before and after use of proposed temporary bullet traps; cease live fire training if damage to walls occurs.	• COMNAVMARIANAS Unit Commanders
		• Provide education handouts for exercise participants to understand and protect resources prior to training on Tinian or at the Ordnance Annex.	• COMNAVMARIANAS

Table ES-1 *(continued)*:

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Cultural Resources *(continued)*:			
Visual resources	• Damage to scenic resources (tourist sites) from demolition or weapons fire	• Avoid demolition and weapons training in proximity to scenic areas.	• COMNAVMARIANAS CO AAFB CO NAVACTS Guam CO NCTAMS Unit Commanders
Environmental Quality			
Air quality	• Increased amounts of training activity-generated smoke and dust	• Do not use smoke or tear gas in areas with civilians present. • Use sanitary waste burn cans in locations downwind of camps and visitor locations.	• COMNAVMARIANAS Unit Commanders • COMNAVMARIANAS Unit Commanders
Climate	• Increased potential for fire within training areas during droughts	• Curtail training as necessary, particularly in areas with rudimentary or non-existent fire-fighting capabilities.	• COMNAVMARIANAS Unit Commanders
Geologic features	• None	• Not applicable.	
Groundwater and soil	• Contamination from improper field sanitation or improper disposal of portable toilet waste • Contamination from accidental release of fuel during vehicle/aircraft refueling, maintenance, or repair activities	• Comply with field sanitation SOP; remove and dispose of solid wastes, grey and black water; ensure contractors dispose of waste appropriately. • Refuel only on paved surfaces or using standard spill containment measures. • Avoid overfilling vehicle fuel tanks to allow for fuel expansion. • Avoid performing scheduled maintenance during field exercises.	• COMNAVMARIANAS Unit Commanders • Unit Commanders • Unit Commanders • Unit Commanders

Table ES-1 *(continued):*

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Environmental Quality *(continued)*:			
Groundwater and soil *(continued)*:	• Soil erosion and rutting from ground excavation, construction activities, grey water disposal to ground, amphibious vehicles traversing beaches, or projectile impacts at firing ranges	• Restore training areas to original grade and revegetate, as necessary, upon completion of training activities.	• COMNAVMARIANAS CO NAVACTS Guam CO AAFB CO NCTAMS
Surface water quality (marine and fresh)	• Potential contamination by fuel and petroleum products	• Comply with SOPs and environmental regulations. • Maintain on-hand spill containment and collection and disposal.	• Unit Commanders • Unit Commanders
	• Siltation of surface water bodies due to increased erosion	• Minimize ground disturbance in areas adjacent to bodies of water.	• Unit Commanders
	• Degradation from runoff of grey water or ROWPU brine	• Direct grey water or ROWPU residual water away from bodies of fresh (and salt) water.	• Unit Commanders
Flooding	• None	• Not applicable.	
Noise	• Disturbances to immediate environment and neighboring communities from fixed- and rotary-wing landings and takeoff	• Establish LZs and conduct flight training where noise nuisance does not extend off of government property or airfield noise zones. • Use established flight tracks.	• COMNAVMARIANAS CO AAFB Aircraft Commanders • Unit Commanders

Table ES-1 *(continued):*

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Environmental Quality *(continued):*			
Noise *(continued):*	• Disturbances to Tipalao residents from LCAC landings at Dadi Beach	• Perform landings during daylight hours only.	• CO NAVACTS Guam
Manmade Hazards and Constraints			
Weapons ranges and demolition pits firing	• Safety hazards to civilians or endangered marine animals	• Publish specific range regulations and distribute to all units planning training activities. • Adhere to all safety requirements prior to and during live fire and demolition activities, particularly required range area sweeps/surveillance to ensure no danger to others. • Restrict public access. • Publish NOTAMS and NOTMARS, as necessary.	• COMNAVMARIANAS CO NAVACTS Guam CO AAFB • Unit Commanders CO NCTAMS • COMNAVMARIANAS CO NAVACTS Guam CO AAFB • COMNAVMARIANAS CO NAVACTS Guam CO AAFB
	• Presence of UXO in existing and proposed mortar range impact areas	• Publish UXO procedures prior to exercises. • Fence and post impact areas. • Sweep impact areas. Maintain clear vegetation using approved herbicides.	• COMNAVMARIANAS CO NAVACTS Guam CO NCTAMS CO AAFB • COMNAVMARIANAS • COMNAVMARIANAS

Table ES-1 *(continued)*:

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Manmade Hazards and Constraints *(continued)*:			
Weapons ranges and demolition pits firing *(continued)*:	• Public access restriction	• Notify public prior to range use. Prohibit public access to SDZs and approaches to live fire areas. • Fence off Tinian Range Impact areas	• COMNAVMARIANAS CO NAVACTS Guam CO NCTAMS CO AAFB • COMNAVMARIANAS
Commercial aviation facilities and traffic	• Interference with commercial aircraft	• Coordinate with FAA during planning and have direct communication with air traffic control officials during military flights in proximity to commercial airfields. • Issue NOTAM for weapons training and use of Northfield on Tinian and FDM. • Maintain lateral safety clearances from active runways and landing zones; avoid conflicts between training activities and accident potential zones at ends of runways. • Restrict training dates/times to avoid major holidays.	• COMNAVMARIANAS CO NAVACTS Guam CO NCTAMS Unit Commanders ALCE • COMNAVMARIANAS CO NAVACTS Guam CO AAFB • COMNAVMARIANAS CO NAVACTS Guam CO AAFB • COMNAVMARIANAS CO NAVACTS Guam CO AAFB

Table ES-1 *(continued)*:

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Manmade Hazards and Constraints *(continued)*:			
Aviation hazards	• Disturbance of endangered species and habitat • Risk of fire due to mishap • Spills during refueling/mechanical repair	• Avoid sanctuary overflights. • Restrict flight tracks/hours, as needed. • Have crash, fire, rescue equipment readily available. • Have spill response kits on hand. • Perform tasks on hard surfaced areas.	• Aircraft Commander • Unit Commander • Unit Commander • Unit Commander • Unit Commander
Electromagnetic radiation (EMR)	• EMR hazards to personnel, fuel operations, and ordnance (HERP, HERF, HERO) • EM interference (EMI)	• Adhere to operational SOPs • Provide EMR hazard overlays to training units as necessary • Establish physical barriers and markers to maintain mandatory safety clearances between emitter sites and personnel, fueling, and ordnance operations.	• Unit Commander • COMNAVMARIANAS CO NAVACTS Guam CO AAFB • Unit Commanders
Hazardous materials storage	• Potential for spills and area contamination	• Establish and comply with spill prevention and response plan.	• COMNAVMARIANAS Unit Commanders
Infrastructure			
Potable water supply	• Depletion of local water supply (Tinian only)	• Conduct advance planning with municipality to identify requirement, times, and places for issue.	• COMNAVMARIANAS

Table ES-1 *(continued):*

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Infrastructure *(continued):*			
Waste collection and disposal (stormwater, wastewater, solid, and hazardous waste)	• Depletion of capacity of the local landfills	• Haul trash to DoD facility for proper disposal.	• COMNAVMARIANAS C7F
	• Disposing of ships' waste near-shore	• Adhere to COMNAVMARIANAS/ C7F directives.	• Ships' Captains
	• Lack of hazardous waste disposal facility (Tinian)	• Haul waste to DoD facility on continental U.S. for proper disposal.	• COMNAVMARIANAS Unit Commanders
Floodwater storage	• None	• Not applicable.	
Electricity and communications	• Increased demand for electricity (Tinian)	• Communicate and coordinate with appropriate local agencies. • Supplement commercial power with field generators.	• COMNAVMARIANAS • Unit Commanders
Airports	• Increased volume of air traffic	• Communicate/coordinate with FAA and civil authorities in advance of any exercise. • Issue NOTAMS and NOTMARS 72 hours prior to any exercise. • Plan Tinian military helicopter activity outside of commercial flight tracks and Saipan approach and departure altitudes. • Reduce parking ramp tieups by military aircraft.	• COMNAVMARIANAS CO AAFB • COMNAVMARIANAS CO AAFB • Unit Commanders • Unit Commanders ALCE
	• Increased demands on Customs and Immigration	• Identify time frames and locations for Customs and Immigration support in advance of the exercise.	• Unit Commanders COMNAVMARIANAS CO AAFB

Table ES-1 *(continued):*

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Infrastructure *(continued)*:			
Harbors	• Interference with civilian ports of entry	• Schedule shipments in advance. Coordinate with civilian authorities in advance of any exercise. • Minimize time necessary to be alongside in port.	• COMNAVMARIANAS C7F CO NAVACTS Guam • Ship's Captain
	• Increased demands on Customs and Immigration	• Provide advance notice.	• COMNAVMARIANAS C7F CO NAVACTS Guam
Roadways and traffic	• Road damage by tracked vehicles	• Limit to rubber padded track laying vehicles. • Inspect tracked vehicles for serviceable track pads. • Avoid neutral steer/pivot turns. • Use equipment haulers for tracked vehicles with all-steel tracks.	• Unit Commanders • Vehicle Commanders • Vehicle Commanders • Unit Commanders
	• Interference with civilian traffic	• Establish military traffic control and security within training areas accessible to others. • Notify civilian authorities 7 days in advance of troop transport on public roads.	• Unit Commanders • COMNAVMARIANAS CO AAFB CG National Guard
Public services	• Increased demands on public safety departments (Tinian)	• Coordinate with the local fire and police departments; augment civilian forces as appropriate.	• COMNAVMARIANAS Unit Commanders

Table ES-1 *(continued):*

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Social Environment			
Land use	• Interference with/encroachment on neighboring land use/property	• Monitor activity within training area to identify potential encroachments.	• Unit commanders
	• Safety risks to neighboring areas and inhabitants from use of firing ranges and established EOD sites on land, in and near Apra Harbor	• Establish buffer zones, traffic control, and area monitors/umpires, as necessary, to avoid encroachment.	• COMNAVMARIANAS NAVACTS Guam CO AAFB CG National Guard Unit Commanders
	• Conflicts with civilian activities	• Schedule/coordinate potentially conflicting activities with appropriate local agencies. Publish NOTAM and NOTMAR.	• COMNAVMARIANAS NAVACTS Guam CO AAFB CG National Guard
	• Noise disturbance for aircraft near residential areas	• Schedule/coordinate potentially conflicting activities with appropriate local agencies. Publish NOTAM and NOTMAR.	• COMNAVMARIANAS NAVACTS Guam CO AAFB CG National Guard
	• Danger to civilians from training on non-DoD lands	• Obtain permission from property owner prior to exercise.	• COMNAVMARIANAS NAVACTS Guam CO AAFB CG National Guard
	• Disfigurement of publicly accessible land areas by littering or effects of bivouacs and logistics support activities (Tinian, Rota)	• Clean and inspect all training areas. Do not bury paper trash or other training residue.	• COMNAVMARIANAS NAVACTS Guam CO AAFB CG National Guard

Table ES-1 *(continued)*:

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Social Environment *(continued)*:			
Land use	• Economic impact from commercial watercraft periodically denied access to areas of Apra Harbor or ocean areas within range SDZs during underwater demolition or use of firing ranges.	• Publish advance notification; observe impact areas during live fire training.	• COMNAVMARIANAS CO NAVACTS Guam CO AAFB CG National Guard • Unit Commanders
	• Danger to civilians inadvertently entering ranges and runways	• Establish traffic control points and observation stations to observe road, air and sea traffic in the vicinity of range training and flight activities.	• Unit Commanders
Socioeconomic conditions	• Increase in demand on various commodities	• Give notice to local officials and merchants so they can prepare for increase in demand and avoid shortages.	• COMNAVMARIANAS CO AAFB
		• Contract locally for required services.	• COMNAVMARIANAS CO AAFB
	• Closure of areas to local residents and tourists	• Give 30 days advance notice before curtailing access to tourist sites within training areas.	• COMNAVMARIANAS
		• Establish an access corridor to accommodate civilian visitors, when possible.	• Unit Commanders
Local government and agencies	• Inconvenience regarding joint use of civilian facilities (West Tinian Airport, field house)	• Notify Mayor's office at least 30 days prior to exercises.	• COMNAVMARIANAS CO AAFB

Table ES-1 *(continued):*

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Environmental justice	• Disappropriate hardship on local minority or economically disadvantaged population	• Design training activities to eliminate conflict, promote mutual understanding, and enhance local economy.	• COMNAVMARIANAS CO NAVACTS Guam CO AAFB

Note: ALCE = Airlift control element
C7F = Commander, 7th Fleet
CG = Commanding General
CO = Commanding Officer
EOD = Explosive Ordnance Disposal unit
NSWU = Naval Sea Warfare Unit (SEALs)
USDA = U.S. Department of Agriculture

CHAPTER ONE
PURPOSE AND NEED FOR TRAINING IN THE MARIANAS

The Commander, Naval Forces Marianas (COMNAVMARIANAS), acting for the Commander-in-Chief, U.S. Pacific Command (USCINCPAC), proposes to augment existing military training on military-controlled lands in the Mariana Islands (Territory of Guam and Commonwealth of the Northern Mariana Islands [CNMI]) (Figure 1-1). The additional training will be conducted by elements of the Army, Navy, Air Force, and Marine Corps, U.S. Army Reserve, Marianas, and Guam National Guard stationed in Asia, various Pacific Islands including the Marianas, Hawaii, and Alaska. These elements must train to develop war fighting skills and to maintain a state of combat readiness in order to carry out unit deployment and assigned missions in an area of conflict.

Adequate training lands in the Marianas are required by the aforementioned forces to maintain certifications and avoid degradation of military readiness. If satisfactory levels of readiness cannot be readily maintained, military units may have to be relocated to areas that can provide the necessary training support. To downplay essential and fundamental training requirements places additional risk on the lives of service personnel, who may be committed to combat with only a few days notice.

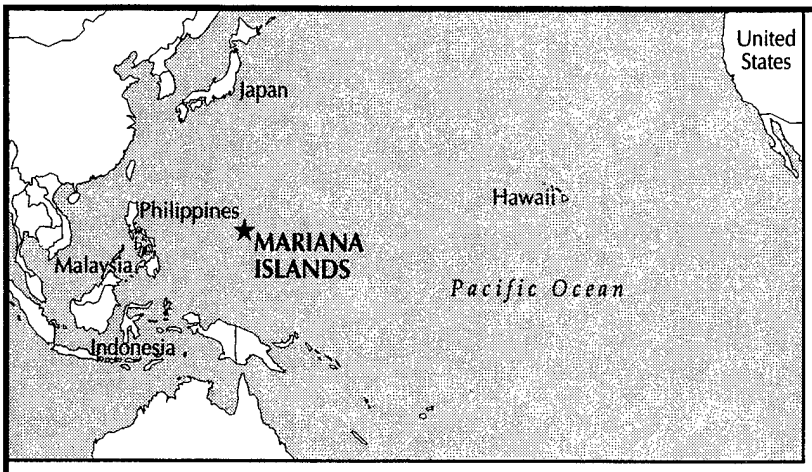
Approximately 4,600 personnel from active, Reserve, and Guard force structure use Guam and the CNMI for training. The size and types of training areas required by these military units are dependent on the size of exercise forces and the types of training to be conducted. The largest contiguous land maneuver area available to COMNAVMARIANAS is the Exclusive Military Use Area (EMUA) on Tinian. It provides approximately 18.2 square kilometers of land suitable for various types of maneuver and contingency training by all of the military services. Smaller training areas exist on Guam's military bases, and small plots of private lands are available for specific types of military training.

This draft environmental impact statement (DEIS) analyzes the potential impacts of the proposed training and cumulative impacts from training activities that have occurred for many years on Guam and Tinian. Training activities addressed in this document include all training currently performed or anticipated to occur in the Marianas in the foreseeable future. While not every action proposed herein would, individually or in combination, be considered a "major federal action significantly affecting the quality of the human environment" requiring an EIS, this document has been designed to unify planning and decision-making for all known future training activities. This chapter provides background on the military need for training and the significant issues identified during scoping.

1.1 DOCUMENT ORGANIZATION

This document is necessarily streamlined, as it covers information and analysis of the effects of a large number of training activities on nine military land parcels and several non-military-controlled areas on four islands in two political jurisdictions.

Chapter One explains why the proposed action—military training in the Marianas—is needed. It documents the scoping process, including issues raised during scoping and those issues eliminated



Farallon de Medinilla

Saipan

Tinian

Saipan Channel

Aguijan

Tinian Channel

Philippine Sea

Rota

Pacific Ocean

Guam

NORTH

0 10 20 30 40 (Km)

0 6 12 18 24 (Miles)

Figure 1-1
SITE LOCATION

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

from detailed consideration. This chapter uses criteria defined in Council on Environmental Quality (CEQ) regulations to identify significant issues for detailed evaluation as part of the EIS process. It also identifies those potential impacts which will be routinely avoided by compliance with existing regulations and standing operating procedures (SOPs).

Chapter Two details the training activities and locations included in the proposed action. It compares the three alternatives in terms of (a) the extent to which they meet the purpose and need for the proposed action, and (b) their overall potential to adversely impact the environment. The preferred alternative is identified.

Chapter Three provides an overview of the affected environment on Guam and in the CNMI. It includes information on physical, biological, and cultural resources as well as on socioeconomic conditions and existing infrastructure.

Chapter Four focuses on the significant issues identified during scoping. Each issue section includes data on existing conditions relevant to the issue, measurement criteria for evaluating potential impacts, proposed activities likely to generate significant impacts, and proposed mitigation for such impacts. Chapter Four also includes a table of all potential impacts and associated mitigation measures and responsible parties, detailing both significant issues and those issues determined to be non-significant and therefore not evaluated in detail.

Chapters Five and **Six** consist of the list of preparers and references, respectively.

1.2 PROPOSED ACTION SUMMARY AND BACKGROUND

This section identifies specific training required by units stationed on Guam and by other units that normally train in the Marianas. It includes a brief history of the presence of the U.S. military forces in the area and a summary of military-controlled lands on Guam and Tinian. This section concludes with a review of training administration and planning and identifies the decision prompting the EIS process.

Table 1-1 identifies the units that must train in the COMNAVMARIANAS area of responsibility, particular training required, mandated frequency (e.g., quarterly) where applicable, facilities required, and potentially suitable locations in the Mariana Islands. The Navy units requiring training include an Explosive Ordnance Disposal (EOD) unit, a Navy Special Warfare Unit (better known as SEALs), a helicopter combat support squadron, the 3rd Naval Construction Brigade (Seabees), two amphibious ready groups (supportive of Marine Corps expeditionary units), and communications personnel. Army Reserve and Army National Guard units based on Guam require regular land-based training. The Marine Corps units based on Okinawa require amphibious and other types of training which cannot be accomplished in Japan. U.S. Army forces stationed in Hawaii, Alaska, and Okinawa participate in joint exercises in the Marianas. Air Force units stationed at Andersen Air Force Base (AAFB) train in air operations and mobility logistics support, and two Air Force squadrons based on Okinawa provide airmobile and airborne training during joint exercises.

Table 1-1
Training Requirements Summary*

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
U.S. NAVY		
Explosive Ordnance Disposal Mobile Unit-Five (EOD MU-5) Stationed at Naval Activities Guam, Waterfront Annex	EOD training is continuous throughout each month, involving about 50 persons in explosive ordnance disposal both on land and underwater. (A high state of readiness is required since EOD MU-5 is responsible for the disposal of any unexploded ordnance discovered on government, private, or submerged lands in the Marianas.) EOD personnel are airborne qualified and are required to complete a minimum of three parachute jumps each quarter.	EOD requires a deep water (greater than 35 m) location free from civilian divers and boat traffic, clear of turtle activity, and sheltered from heavy weather. The Waterfront Annex is suitable for underwater training in inner and outer Apra Harbor and for water parachute drops in the outer harbor. Existing EOD demolition range is located in the Ordnance Annex.
Navy Special Warfare Unit One (NSWU) Stationed at Naval Activities Guam, Waterfront Annex	NSWU, better known as SEALs, conducts extensive small unit training exercises with more than sixteen personnel both day and night that often involves clandestine activities. Equipped with raider craft, this unit is responsible for traversing great distances at sea to conduct tactical missions ashore. Their training in the Marianas often involves establishing a base camp on one island for subsequent operations on another. SEALs are both airborne and SCUBA qualified. Both airmobile and airborne training may be supported by either U.S. Navy or USAF aircraft. Training is performed by small teams that must conduct a variety of functions such as underwater mine countermeasures, beach hydrographic reconnaissance, land reconnaissance, and special operations. SEALs train with a variety of small arms and demolition and undergo sniper training.	The SEALs require ranges for small arms, sniper, patrol, maneuver, land/underwater demolition and stand off weapons. Range usage includes static and tactical applications. Sites for clandestine beach landings, river passage, staging bases (bivouac), underwater training sites, large areas of land for land navigation/tactical movement (no smaller than 6 km^2), and ready access to tactical landing and drop zones are required. • Apra Harbor is suitable for underwater explosives, combat swimmer, parachute, helicopter cast and recovery, boat operations and clandestine beach landings.

Table 1-1 *(continued):*

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
U.S. Navy *(continued):* Navy Special Warfare Unit One (NSWU) *(continued):*		• Orote Point is suitable for small arms and known distance sniper ranges, close quarter battle (Firing Maze), parachute operations, C-130 operations, and limited land movement. • The Ordnance Annex is suitable for unknown distance sniper training, jungle range, demolition training, blank fire training and land navigation. • NCTAMS is suitable for over the beach operations, access by land to AAFB's Northwest Field, small arms training and limited land movement in support of reconnaissance missions. • Northwest Field is suitable for land movement, limited live fire at Mount Machanao, blank fire, evasive maneuver using jungle patrols, combat search and rescue, land navigation and other land warfare training. • Farallon de Medinilla (FDM) is suitable for laser target designation in support of surface to air bombing, stand off weapons and .50 caliber weapons fire. • Rota is suitable as a forward staging base. • Tinian's EMUA and San Jose Harbor are suitable training and support sites respectively.

Table 1-1*(continued):*

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
U.S. Navy *(continued):* Navy Special Warfare Unit One (NSWU) *(continued):*		• Talafofo, Ylig, and Atantano rivers are suitable for riverine operations.
Helicopter Combat Support Squadron Five (HC-5) Stationed at Andersen Air Force Base, Guam	The squadron consists of about 374 persons who are responsible for combat support lift for active, reserve, and guard forces; fast rope and special purpose insertion and extraction (SPIE) training; airmobile assaults; vertical replenishment to ships of the Fleet; fire-bucket training and employment; and search and rescue/medical evacuations. This squadron is the sole helicopter unit and aerial search and rescue unit stationed in the Marianas, and is called upon to support training conducted by all other Marianas based units as well as many transient units lacking their own helicopters.	The squadron supports ground unit training both over water (Apra Harbor and coastlines) and over land at the Waterfront Annex, Ordnance Annex, NCTAMS Finegayan and Barrigada, Harmon Annex, AAFB Main Base, Northwest Field, Rota, and Tinian. Personnel insertions and extractions can also be accomplished at landing zones established at Nimitz Hill and the U.S. Navy Hospital.
	The squadron also must train at night, flying with the use of Night Vision Goggles (NVG) in and out of unlit landing zones and airfields.	HC-5 needs unlighted airfields. Rota's civilian airfield is suitable for NVG training since it has minimal commercial nighttime activity, can remain unlit, and is within reasonable distance from AAFB. NVG training can also be conducted at AAFB (Main Base and Northwest Field) and Tinian's North Field.
	Confined area landing (CAL) training is an additional requirement that requires small landing zones on land, and simulated shipboard landing zones.	CAL zones and simulated landing helicopter, assault (LHA) landing spots can be provided at Northwest Field.

Table 1-1 *(continued)*:

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
U.S. Navy *(continued)*:		
3rd Naval Construction Brigade (3rd NCB) (Seabees) Stationed at Camp Covington, Guam	About twice per year, a Seabee battalion from the continental U.S. (CONUS) deploys to Camp Covington to join the brigade for training prior to assignments on other Pacific islands. The brigade's training program begins by preparing the individual and small units, progressing to a battalion-level field exercise that incorporates airfield defense and rapid runway repair. The battalion must be prepared to establish a base camp in a remote area, conduct a variety of horizontal and vertical construction tasks involving heavy equipment operations, and when necessary, to set aside their tools for weapons and conduct tactical/defensive operations.	Camp Covington is the site for individual skills training and tactical unit training. Orote Point, which has rifle and pistol ranges, is also suitable for tactical unit training. Larger unit training areas at AAFB, NCTAMS Finegayan, or Tinian are suitable for Seabee base camps and maneuvers.
Naval Computer and Telecommunications Area Master Station Western Pacific (NCTAMS WESTPAC) Personnel are stationed at one of two NCTAMS facilities on Guam: Finegayan and Barrigada	This unit's individual skills training is normally conducted at the home stations. The installation serves as a supporting station for other Guam-based units needing rifle and pistol ranges and small maneuver areas.	NCTAMS Finegayan's and NCTAMS Barrigada's primary functions are radio transmission and reception. Their land areas are suitable to support small unit tactics conducted by other units. NCTAMS Barrigada's location is suitable for supporting Army Reserve and Guam National Guard weekend training. The NCTAMS Finegayan small arms range is suitable for pistol and rifle requalification. Access from Haputo Beach is suitable for small SEALs, Special Forces, and Marine Special Ops teams amphibious raids and subsequent traverse for training at AAFB (Northwest Field and Main Base).

Table 1-1*(continued):*

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
U.S. Navy *(continued):*		
Commander, Amphibious Group One and Eleven (COMPHIBGRU ONE/ELEVEN) Homeported in Japan	The Amphibious Groups are the operating platform for the embarked Marine Expeditionary Unit (MEU). They conduct naval gunfire, artillery, and mortar fire exercises, tactical air control party (TACP) training, humanitarian and civic assistance, and amphibious (sea and air) assaults. The embarked ground combat, aviation combat, and combat support elements are deployed to the shore for extended and joint training exercises. Weapons requalification for individuals is required.	DoD training areas on Guam, Tinian, and FDM are suitable for the types of training required by the MEU or amphibious groups and embarked units.
Commander, Task Force 70 (CTF 70) and Commander, Task Force 75 (CTF 75) Homeported in Japan	Battle Group Range training is conducted for about 270 persons in support of 22 F/A-18 fighter/attack aircraft, and 300 persons in support of 20 F-14/EA-6B aircraft. These squadrons may be deployed ashore at AAFB and used as close air support for ground unit training. Aircraft may conduct Field Carrier Landing Practice (FCLP).	Suitable aerial ranges and landing fields are found at AAFB, FDM, and aerial gunnery ranges south of Guam controlled by the U.S. Navy.
COMFAIRWESTPAC: Fighter Squadrons 21 and 154 Homeported in Japan	Five aircraft from each squadron conduct aerial gunnery. Aircraft may conduct Field Carrier Landing Practice (FCLP).	AAFB is suitable as a deployment and ground support site for training that is conducted at an ocean range 30 nautical miles (NM) south of Guam. FCLP patterns are established at AAFB.

Table 1-1 *(continued):*

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
U.S. MARINE CORPS		
III Marine Expeditionary Force (III MEF): 31st Marine Expeditionary Unit (31 MEU), Special Operations Training Group, III Surveillance, Reconnaissance and Intelligence Group (III SRI), Detachment Force Reconnaissance Company Stationed in Okinawa, Japan And I Marine Expeditionary Force (I MEF), 11th and 15th Marine Expeditionary Units (11th MEU, 15th MEU) Stationed at Camp Pendleton and 29 Palms, California	About 150 to 650 persons from any MEU may participate in training events involving amphibious assaults by sea and air, offensive and defensive tactics, urban warfare, tactical recovery of aircraft and personnel (TRAP), and hostage rescue missions. The training integrates Naval ship and air support with Marine amphibious capabilities. Other military services may also participate along with a MEU exercise. Over-the-shore training is needed by equipment operators (trucks, tanks, Assault Amphibian Vehicles [AAVs]), as well as by maneuver units (reconnaissance squads to an entire reinforced battalion of 500+ persons). Weapons training involving live fire is required for individual and crew-served weapons. Forward Aviation Refueling is a capability requiring detailed planning and practice, along with vehicle and equipment maintenance while afloat.	The Waterfront Annex is suitable for landing craft training (at Polaris Point, Drydock Island, and Dadi Beach), bivouacs, helicopter assault, rifle and pistol firing, riot agent and protective clothing training, and hostage rescues (Orote Point). NCTAMS Finegayan, AAFB Main Base, and AAFB Northwest Field provide small boat and combat swimming landings followed by cross-country tactical maneuver and live fire training. Tinian has beaches suitable for Landing Craft Air Cushion (LCAC) and AAV amphibious landings. Tinian's EMUA, airfields, and ports provide the terrain necessary for larger scale, joint-service, combined arms exercises. The Ordnance Annex is suitable for helicopter insertions of small units, patrolling, and land navigation. The FDM range has been requested for artillery and anti-tank missile training (suitability determination pending).
U.S. ARMY		
25th Infantry Division (Light) (25th ID [L]) Stationed at Schofield Barracks, Hawaii	Up to 600 members of various ground combat, combat support, and combat service support battalions may train as integrated Army elements or in combination with other services. Training activities may include airmobile operations, parachute operations, infantry tactics, and combat service support operations, such as base camp establishment, air head and port operations, and civic action.	The Tinian EMUA, airfield, and port provide the variety and size of terrain desired for 25th ID (L) participation in training activities.

Table 1-1*(continued):*

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
U.S. Army *(continued):*		
6th Infantry Division (Light) (6th ID [L]) Stationed at Fort Richardson, Alaska	Types of training required include strategic (long-range), 600-person, parachute drop, and follow-on ground maneuvers. This division trains for airborne insertion into hostile territory after prolonged strategic USAF airlift.	Tinian North Field and AAFB (Main Base and Northwest Field) provide the terrain necessary for airborne training.
1st Battalion, 1st Special Forces Group, Airborne (1st Bn, 1st SFG [ABN]) Stationed in Okinawa, Japan	Types of training required include up to 50 persons conducting High Altitude, Low Opening (HALO) parachute operations, sniper marksmanship, covert tactical ground movement, and airmobile deployments that provide practice in the deployment and employment of personnel and equipment by fixed-wing aircraft.	The airfields at Orote Point, AAFB (Main Base and Northwest Field), and Tinian's North Field Runway #1 support airmobile/airborne training. The West Tinian Airport is also suitable with the appropriate planning. Clandestine insertions and overland movement can be conducted from NCTAMS Finegayan, and Northwest Field. Small unit patrolling can be conducted at the Ordnance Annex.
U.S. ARMY RESERVE-MARIANAS		
Headquarters, USAR-Marianas Armory located at Barrigada, Guam	This unit consists of about 75 persons whose training includes basic skills training, weapons qualification, and command post and field exercises. Training is conducted one weekend per month and during two weeks of annual training duty (ATD). Additional active duty for training is authorized, often to augment active component forces during major exercises.	Suitable training areas on Guam include Andersen South, NCTAMS Barrigada, NCTAMS Finegayan, Northwest Field, Waterfront Annex, and the Ordnance Annex. The rifle ranges at AAFB and Orote Point are also available. Training on Tinian can be conducted on weekends (and during ATD) by using airlift supplied by the USAF.

Table 1-1 *(continued):*

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
U.S. Army Reserve-Marianas *(continued):*		
Company E, 442nd Infantry (Separate Battalion) Barrigada, Guam	Between 40 to 150 persons conduct squad, platoon and company battle drills, movement to contact, attack, defense, security, and reconnaissance. NBC training (the use of riot control agents and protective clothing and masks) and weapons qualification are also conducted.	Same as for Headquarters, USAR-Marianas.
297th Engineer Company Barrigada, Guam	In addition to the infantry training noted above, about 20 persons are involved in heavy equipment training, 80 persons in demolition training, 16 persons in assault boat training, and all 185 members of the unit in rifle qualification.	Same as for Headquarters, USAR-Marianas.
368th Military Police Company Barrigada, Guam	The unit trains about 130 persons in prisoner of war handling, counter-intelligence, battlefield circulation and control, route reconnaissance, and area security operations.	Same as for Headquarters, USAR-Marianas. Waterfront Annex is used extensively for military police training activities.
Guam Army National Guard		
1st Battalion, 294th Infantry (Light) Armory located at Fort Juan Muña, Tamuning, Guam	About 150 persons are required to train in tactical airborne and airmobile deployment of personnel, equipment and cargo, airfield defense, and battle drills. Weapons qualification requirements include small arms (pistols, rifles, and machine guns) and 60 mm mortars.	Training at Fort Juan Muña is limited due to lack of terrain, but suitable bivouac and maneuver areas are located at the nearby NCTAMS Barrigada. Extensive wooded terrain suitable for land navigation and patrolling is found at the Ordnance Annex. The Waterfront Annex offers live fire ranges, helicopter landing sites, and limited bivouac area, landing beaches, and combat swimming areas. Andersen South provides additional patrolling and navigation areas. AAFB Main Base provides an additional rifle range.

Table 1-1*(continued)*:

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
Guam Army National Guard *(continued)*: 1st Battalion, 294th Infantry (Light) *(continued)*:	Training periods include weekend drills and two weeks of ATD. Additional periods of active duty for training are also available, often to augment active force components during major exercises.	Dandan, Ija, and Hamamoto properties (all three private lands), Orote Point, AAFB (Main Base and Northwest Field), and Tinian are suitable for parachute operations.
294th Military Intelligence Detachment Fort Juan Muña, Tamuning, Guam	This unit is comprised of 5 persons involved in command post and field exercises and basic infantry skills training.	Suitable training areas are found at NCTAMS Barrigada, AAFB, and Tinian.
909th Quartermaster Detachment (Water Purification)	This 16-person unit is responsible for operating the Reverse Osmosis Water Purification Unit (ROWPU), as well as being adept in infantry training skills.	Training with the ROWPU can be conducted at the Ordnance Annex (Fena Reservoir), Sumay Cove Marina, and Apra Harbor. The ROWPU is mobile and can be used at other training areas with natural water points, such as Tinian.
1224th Engineer Detachment (Utility) Fort Juan Muña, Tamuning, Guam	This unit consists of 50 persons trained in demolition, target construction, and engineer construction support to infantry units.	Demolition range exists at the Ordnance Annex. Utilities training can be conducted at any bivouac site and would be required at any tent camp site established for major exercises, such as Tandem Thrust on Tinian.
Guam Air National Guard		
254th Civil Engineer, Services Flight	Trains by repairing and constructing facilities on military bases on Guam and the Continental U.S.	AAFB
Weather Reconnaissance Squadron	Future training requirements based on possible activation of a Weather Reconnaissance Squadron, or reactivation of the 54th WRS. Equipped with WC-130 aircraft the squadron will be involved in predicting typhoon intensity and weather tracks.	AAFB

Table 1-1 *(continued):*

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
Guam Air National Guard *(continued):*		
WRS Squadron	In-flight helicopter refueling can be added to the training and support requirement by modifying the WC-130 aircraft in the WRS Squadron.	AAFB
Search and Air Rescue Squadron	Governor of Guam has requested activation of a SAR squadron equipped with HC-130 aircraft. Nearest SAR squadron is currently located in Hawaii.	AAFB
U.S. AIR FORCE		
36 Air Base Wing (ABW) Stationed at Andersen Air Force Base, Guam	Up to 25 personnel participate in an Attack Response Exercise (ARE), which is conducted semi-annually to evaluate the security force defense of assigned resources against offensive threat or terrorist acts. Up to 25 personnel participate in Major Accident Response Exercise (MARE), which is conducted monthly to evaluate base firefighting, casualty, and survivor rescue; security; containment; suppression; and recovery.	AAFB Main Base for scenarios dependent on flightline activity, key buildings, and weapons storage areas. Outlying areas such as Northwest Field and Andersen South as appropriate for other threats. AAFB Main Base for scenarios dependent on flightline activity, key buildings, and weapons storage areas. Outlying areas such as Northwest Field and Andersen South as appropriate for other threats.
36 Civil Engineer Squadron (CES) Stationed at Andersen Air Force Base, Guam	Two 61-person Prime Beef Teams construct Beddown Sites/tent camps, pre-engineered buildings, field-expedient bridges and culverts, perform vehicle and convoy operations and security, and construct defensive positions. The units participate in security and ground defense, first aid and field sanitation training.	AAFB Main Base (Rapid Runway Repair Site), Northwest Field, and Andersen South AAFB Main Base, Northwest Field, and Andersen South

Table 1-1*(continued):*

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
U.S. Air Force *(continued):*		
36 Civil Engineer Squadron (CES) *(continued):*	The units undergo annual weapons training (M-16 and M-9 Requalification).	AAFB Main Base
	The units participate in Rapid Runway Repair (RRR) training on a monthly basis.	AAFB Main Base RRR site adjacent to flight line and taxiway
	This unit participates in NBC Defense training exercises on a semiannually basis.	AAFB Main Base
36 MG (Medical Group) Stationed at Andersen Air Force Base, Guam	This unit conducts quarterly exercises to handle mass casualties with 36 ABW and NCTAMS medical personnel. Conducts similar exercise with Guam government agencies.	AAFB Main Base and Guam International Airport are used for mass casualty (peacetime and wartime scenarios).
	This unit also participates in overnight training exercises.	Bivouac Area in AAFB Northwest Field and Andersen South.
Headquarters, Pacific Air Forces (HQ PACAF) Hickam Air Force Base, Honolulu, Hawaii	This headquarters sponsors airdrop missions of up to 10 C-130 aircraft, five times a year.	Tinian's North Field and AAFB Main Base.
	Combined Force Aircraft Exercises are scheduled five times a year, and may involve up to 150 aircraft of various types. Training uses airspace within 250 NM of Guam, and air-to-surface ranges for airlift drops and live ordnance training.	AAFB Main Base is the supporting airfield. Northwest Field and Tinian may be used for airdrops. FDM provides air-to-ground ordnance range.
HQ PACAF Special Operations Branch Hickam Air Force Base, Honolulu, Hawaii	This branch sponsors Assault Zone training for Air Force flight air crews, Combat Controls Teams (CCTs), pararescue (PJ), and Special Tactics Teams (STSs); Navy SEAL and EOD; Army Special Forces, Rangers, Airborne and Air Crews.	Surveyed Drop Zones on Guam and Tinian; Landing Zones at AAFB Main Base, Northwest Field, and Tinian North Field.

Table 1-1 *(continued)*:

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
U.S. Air Force *(continued)*:		
36 Security Police Squadron (SPS) Stationed at Andersen Air Force Base, Guam	This unit conducts Air Base Defense and Jungle Patrolling exercises semiannually, with up to 44 personnel. Military Working dog training is conducted against aggressor forces who attempt to recon an area being guarded by a dog and handler.	AAFB Main Base "Texas Area" and Northwest Field AAFB Northwest Field
374th Operations Support Squadron (OSS) Stationed at Yokota Air Base, Japan	This unit participates in Joint Airborne/Air Transportability Training (JA/ATT) which tests abilities to deploy and employ personnel and equipment. Aircraft are scheduled for use by various training units.	AAFB Main Base, North Tinian, Apra Harbor, and Agana Drop Zones are suitable for JA/ATT training for cargo and personnel drops on both land and water zones.
374th Transport Squadron, Combat Mobility Element (CME) Stationed at Yokota Air Base, Japan	This squadron conducts about five yearly airdrop missions (up to 10 C-130 aircraft per mission) at Tinian drop zones and landing fields and up to five annual combined force exercises within the vicinity of Guam. In addition, the squadron conducts about 100 aircraft delivery missions that transit to Guam en route to other locations. The airdrops can consist of High-Altitude, High-Opening (HAHO), High-Altitude, Low-Opening (HALO), and static-line jumps by USAF Combat Control Teams (CCT), Pararescue and Special Tactics Teams, Army Special Forces, Ranger, Airborne, Air Crews, Navy SEALs, and EOD.	Areas with sufficient cleared space for personnel and equipment drops are found at AAFB (Main Base and Northwest Field), Orote Point, and Tinian's North Field Runway #1. West Tinian Airport may be suitable with prior planning to integrate training with commercial air traffic. The USAF lists eleven surveyed assault zones (drop zones [DZs], landing zones [LZs], and extraction zones [EZs]) on Guam and five zones on Tinian. Water drop zones also exist in Apra Harbor.

Table 1-1*(continued)*:

Representative Military Units and Bases	Required Training	Required Facilities and Suitable Locations
U.S. Air Force *(continued)*:		
17th Special Operations Squadron, Combat Control Team (CCT) Stationed at Yokota AFB, Japan	This squadron provides ground to air communications at training areas, including communication from training areas to Federal Aviation Administration officials.	AAFB (Main Base and Northwest Field), Orote Point, and Tinian's North Field Runway #1 are suitable for CCT training. Tinian's North Field Runway #1 provides realistic training to integrate military operations within civilian controlled commercial airspace.

*Note: This table is not a comprehensive list of units requiring use of the Marianas for training. Rather it is an example of training activities the identified units have conducted in the past, may do in the future, and which similar units could pursue.

1.2.1 Training Activities and Facilities Required

Proposed training activities comprising the proposed action are detailed in Chapter Two. The training required by various units starts with individual basic military occupational skills training and progresses through more complex activities and larger groups.[1] Many units have specific annual and/or quarterly training requirements for individuals and crews, such as weapons certification. In addition, units must train together periodically, including mutual support between active forces and National Guard/Reserve organizations.

Required training facilities are a function of the training activity. Individual training is conducted at the training unit's home base, whenever possible. Conducting ground maneuvers and bivouacking overnight require relatively large areas of terrain that are preferably undeveloped, isolated from public activities, and wooded. Special operations training often requires access to actual or simulated urban areas. Beach landings by assault craft and amphibian vehicles require beaches with contiguous land maneuver areas. Parachute and aircraft training require suitably sized airfields for equipment and personnel staging, designated drop zones, tactical landing zones for helicopters, and landing fields for both rotary- and fixed-wing aircraft. Weapons training may include the use of training simulators, blank ammunition, or live ammunition at designated weapons training ranges. Available seaport facilities are also needed for training by logistic support personnel. In addition, many types of training are best performed in a variety of environments. Personnel training repeatedly in a single location eventually lose the ability to learn from the situation, as it has become too familiar.

1.2.2 Training Areas in the Marianas

The U.S. military owns or controls land on Guam, Tinian, and Farallon de Medinilla (FDM). The U.S. presence in the Marianas dates back to the Spanish-American War and was consolidated during and after World War II.

1.2.2.1 History of the U.S. Military in the Mariana Islands

As a result of the Spanish-American War, Guam became a U.S. possession under U.S. Navy jurisdiction. Guam served as a location for refueling and radio communication, with a contingent of Marines assigned in the late 1930s. One of the Navy's missions was intercepting Japanese radio transmissions from Micronesian islands. The German colonies in Micronesia north of the equator became a mandate of Japan as a consequence of Japan's declaration of war against Germany in 1914. Toward the end of the 1930s, the Japanese developed airfields, seaplane bases, and defensive positions on Saipan, Tinian, and Rota. World War II arrived in Guam on December 8, 1941, with Japanese aerial bombardment of Guam villages from Saipan-based aircraft. Japanese amphibious assault landings at Tumon and Aporguan led to the defeat of the insular Force Guard and the beginning of two-and-one-half years of Japanese occupation.

In August 1942, the Allies initiated an island-hopping campaign to drive the Japanese from occupied Pacific islands. American aircraft carrier-based forces first invaded the Marianas in February 1944. Saipan was invaded by U.S. forces on June 15, 1944, and secured by the 2nd and

[1]These include, for example, communications, logistics, and tactical exercises for small units such as 13-person infantry squads, 40-person platoons, or weapons and aircraft crews; combined arms training for a company, battalion, or squadron involving hundreds of individuals; and joint-service exercises of 1,000 or more that integrate the various skills of the military services.

4th Marine Divisions on July 9. The invasion of Guam began on July 21, 1944, with the 3rd Marine Division landing at Asan and the 1st Provisional Marine Brigade and the Army's 77th Infantry Division landing at Agat. On July 24, the 4th Marine Division landed on Tinian. Tinian was declared secure on August 1, 1944; Guam was declared secured ten days later. Rota, Aguijan, and islands north of Saipan were not invaded. Instead, their Japanese defenders were shelled, bombed, and bypassed. Massive construction on Guam, Tinian, and Saipan transformed the islands into the sites of major U.S. military airfields and ports needed to continue the war effort. Guam's Northwest Field, Tinian's North and West Fields, and Saipan's Isley Field were constructed in minimum time to support bombing missions in preparation for the invasion of mainland Japan.

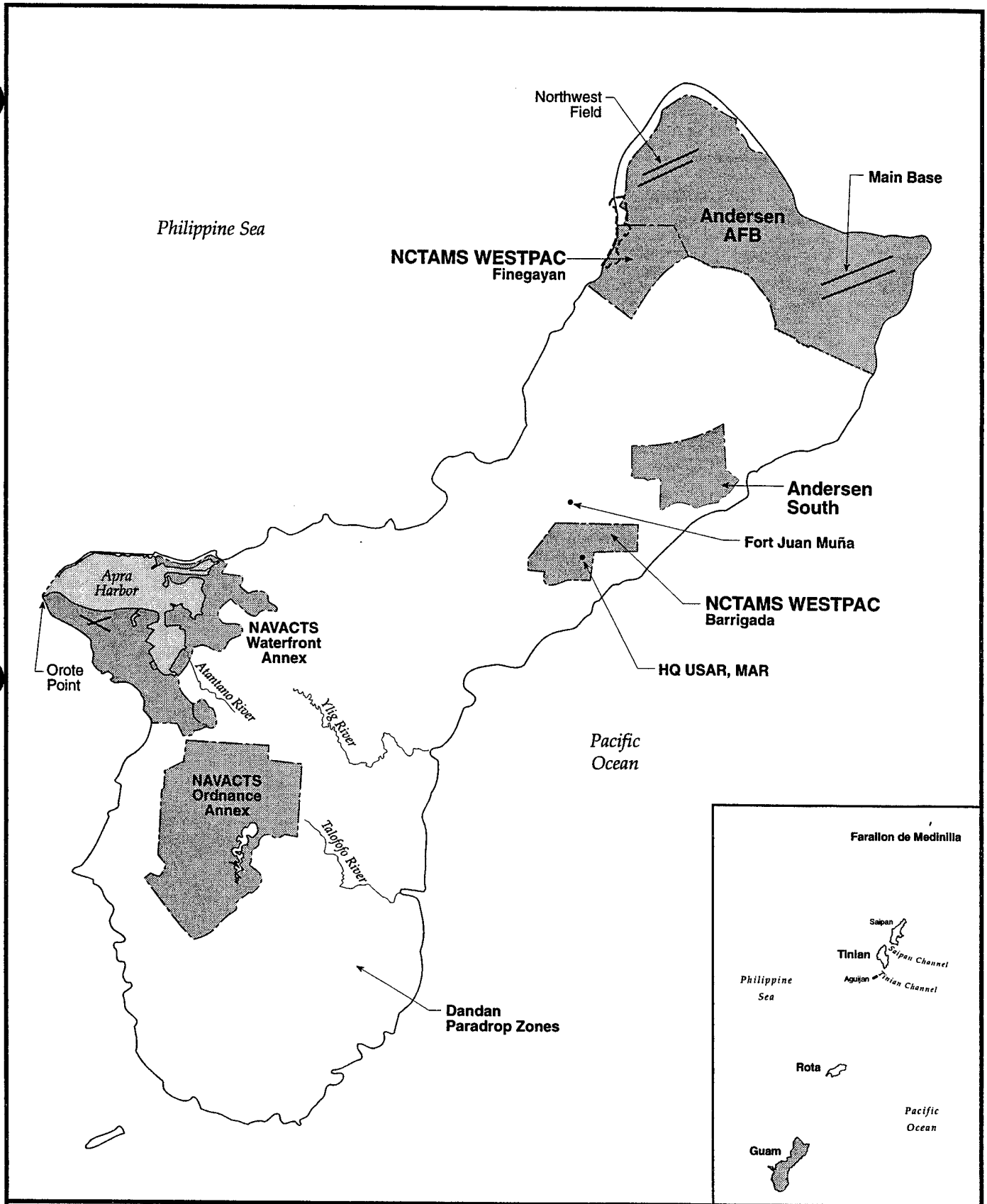
At the end of World War II, all of the Marianas came under the control of U.S. military forces. In 1946, the Military Government of Guam was reestablished as the Naval Government of Guam, and the Navy was allowed to acquire private lands. In August 1950, the Organic Act of Guam gave Guamanians American citizenship. Post-war control of the Northern Marianas passed to the U.N. Trust Territory of the Pacific Islands (TTPI) on July 18, 1947, under U.S. administration. The Department of the Interior took jurisdiction from the U.S. Navy in July 1951. Within one year, control was passed back to the U.S. Navy for the Northern Marianas (less Rota), as the Central Intelligence Agency commenced training of Chinese Nationalists on Saipan and Tinian.

1.2.2.2 DoD Land in the Marianas

The Department of Defense (DoD) owns or otherwise controls lands on four islands in the Marianas: Guam, Tinian, Saipan, and FDM. This DEIS addresses training at most military-controlled land on all of these islands except Saipan. The affected land areas are shown in Figures 1-2 and 1-3 and summarized on Table 1-2.

The Guam Land Use Plan, 1994 (GLUP 94) indicates that the DoD owned approximately one-third of all land on Guam as of 1994. Of this land, approximately 25 percent has been proposed for release and/or has been released under the Base Realignment and Closure (BRAC) program. Both Air Force and Navy properties have been considered for release, but the BRAC 95 decision ratified by the U.S. President and the Congress in September 1995 includes only 2,800 acres of Navy land. The BRAC release affects but does not eliminate training conducted at Naval Activities Guam (NAVACTS Waterfront Annex and NAVACTS Ordnance Annex) and the Naval Computer and Telecommunications Area Master Station (NCTAMS) site at Barrigada. Other training areas on Guam unaffected by BRAC decisions include NCTAMS Finegayan and AAFB, including Andersen South. All of the training areas have active facilities and assigned personnel responsible for non-training activities. Proposed training will occur on areas of land that are compatible with adjacent, non-training activities.

The Northern Mariana Islands were returned to the jurisdiction of the Department of the Interior in May 1962. The TTPI had been divided into six districts; the Mariana Islands (less Guam) were one such district. By 1964, negotiations began regarding the future political status of the Northern Marianas. In February 1975, the Covenant to Establish a Commonwealth of the Northern Mariana Islands in Political Union with the United States of America was signed. The Northern Marianas delegation achieved their main objectives of U.S. citizenship, economic development, control over their internal affairs, and a smooth transition. American military needs were met; FDM was designated as a target range, and the military acquired use of a portion of Tanapag Harbor, joint use of Isley Field, and establishment of a military area on Tinian. The northern two-thirds of Tinian



Source: Marianas Training Plan Briefing Booklet

NORTH

0 3 6 (Km.)

0 1 2 3 4 (Miles)

LEGEND

Runways

Figure 1-2
GUAM TRAINING SITES

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

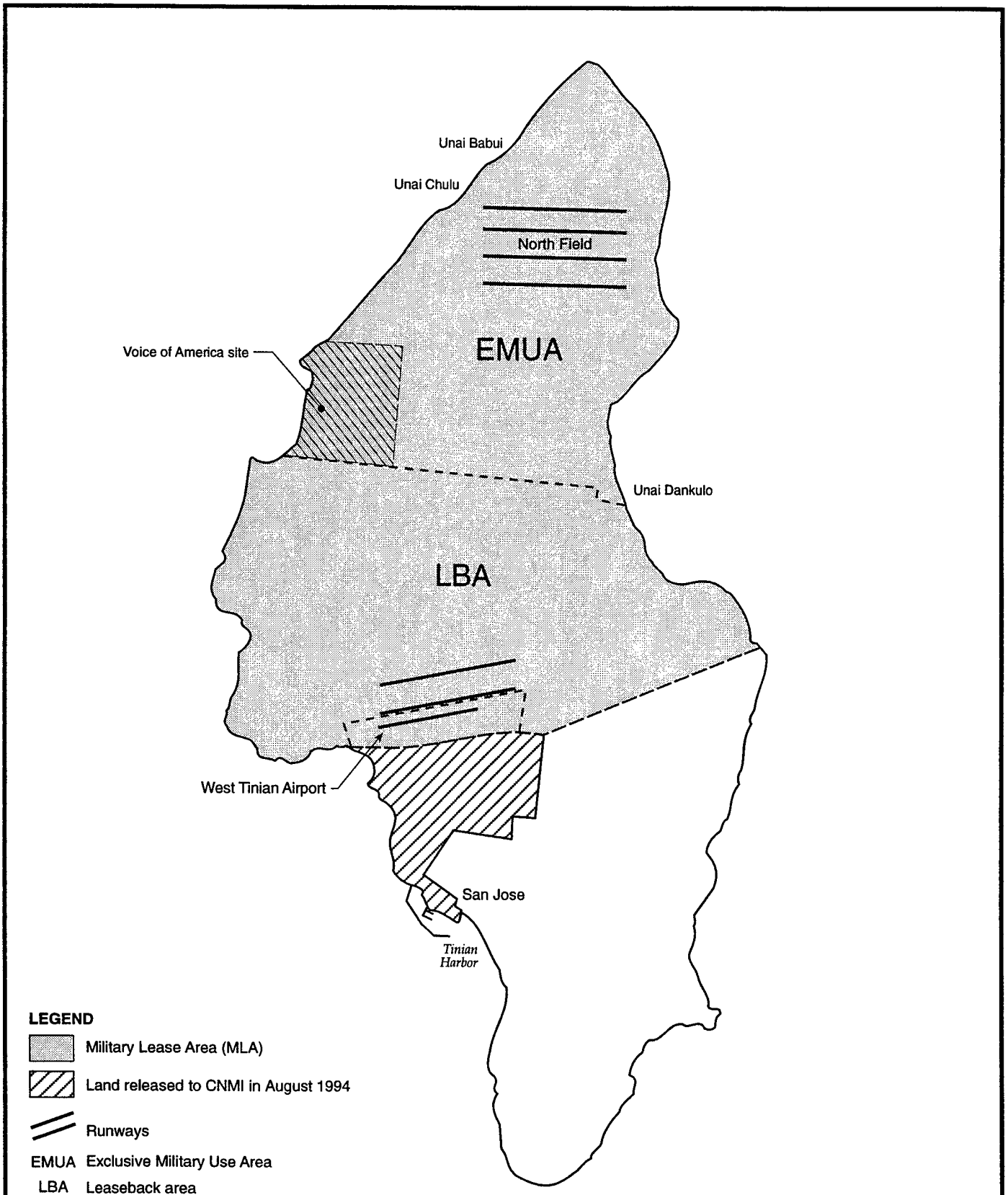


Figure 1-3
TINIAN TRAINING SITES

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

Table 1-2
Military-Controlled Lands Used for Training

Locale	Land Area (km^2)	Primary Function
NAVACTS Guam Ordnance Annex	35.78	Ordnance storage, operations, administration, training, and support
NAVACTS Guam Waterfront Annex	18.13	Houses various activities and entities which fulfill the support role for military operations on Guam
AAFB Main Base	44.72[2]	Basis for support for nearly all military operations in the Western Pacific
AAFB Northwest Field	17.72	Ground and aviation training
Andersen South	9.79	Contingency dormitories and training area
NCTAMS WESTPAC Finegayan	11.95	Receiver facility and communication center
NCTAMS WESTPAC Barrigada	7.48	Transmitter facility
Leaseback Area (Tinian)	36.92	Military training
EMUA (Tinian)	30.66	Military training
Farallon de Medinilla	0.9	Aerial bombardment and naval gunfire training

was planned to support an Air Force and Naval base, and the southern one-third was returned to civilian use.[3]

Training land on Tinian is leased by the U.S. from the CNMI, pursuant to the 1975 Covenant which made the Mariana Islands District of the TTPI a Commonwealth of the United States. Related documents signed between 1975 and 1994 established the current land use configuration (see Figure 1-3). The Military Lease Area (MLA) consists of a 30.68 km^2 Exclusive Military Use Area (EMUA) in the north and a 31.65 km^2 Leaseback Area (LBA) in the south. The EMUA is controlled by the military, with civilian and tourist access permitted except during certain training activities. The LBA, which includes West Tinian Airport, may be used by the CNMI and its sublessees for agriculture, grazing, and other purposes expressly permitted by the U.S. (provided such uses are compatible with Federal Aviation Administration (FAA) safety zone requirements for the airport area). The U.S. may train in the LBA, subject to written notification of CNMI, and has agreed to minimize interference with civilian activity at West Tinian Airport. The U.S. has also retained the following rights in the village of San Jose and the harbor area:

- The right to moor vessels, handle cargo, stage equipment and materiel, and conduct other port-related activities at Tinian Harbor

[2]This is the area of AAFB including the Munitions Storage Area.

[3] Compiled from Farrell, Don A. (1994) *Saipan, A Brief History and Tour Guide*, and Lotz, Dave (1994) *World War II Remnants*.

- The right to temporarily secure and use portions of the area on a not-to-interfere basis to conduct military training exercises or to perform activities in support of military training exercises

- The right to install, operate, and maintain fuel and utility lines from Tinian Harbor over CNMI lands to serve areas in the MLA

A 3.2 km^2 portion of the EMUA has been allotted to the Voice of America (VOA) for installation and operation of a transmitting station (see Figure 1-3). Training cannot occur on the VOA parcel, due to hazards of electromagnetic radiation.

Certain natural and man-made constraints exist at each of the training areas considered in this DEIS. Such constraints affect the training options available to exercise planners and unit commanders operating in the Marianas. These limitations affect the types of training that can be conducted within a given area, the size of exercise forces, types of equipment that may be used, and the exercise schedule.

The Covenant with the CNMI and related documentation also provided for use of the uninhabited island of FDM as a target for aerial gunnery and naval bombardment. The DoD controls access to and airspace around the island.

1.2.2.3 Training Lands Administration

COMNAVMARIANAS is the controlling and scheduling authority for Navy-managed training areas and Navy support services available in the Marianas. It coordinates Navy/Marine Corps unit requests to use Air Force training lands, as necessary. COMNAVMARIANAS, as the representative of USCINCPAC in Guam and the Commonwealth of the Northern Mariana Islands/Federated States of Micronesia/Republic of Palau, also coordinates joint-service uses of training areas and facilities. This responsibility includes maintaining a shore bombardment range at FDM and submarine and anti-submarine warfare (ASW) operating areas on the open sea, as well as the military land maneuver training areas on Guam and Tinian that are the focus of this DEIS. COMNAVMARIANAS is also responsible for managing the use of non-DoD lands that may be made available to Navy and Marine Corps units for military training. A description of Fleet operating areas and training facilities has been published as direction for units requesting training in COMNAVMARIANAS' area of responsibility.[4]

Commander 36th Air Base Wing (36 ABW) is the controlling and scheduling authority for Air Force managed training areas and services available on Guam. 36 ABW is responsible for providing training support at AAFB for units in transit for off-island training. Formalized exercise request procedures are published and followed by all military services requesting use of Air Force training areas.[5]

Other senior commands are responsible for identifying and coordinating training requirements within COMNAVMARIANAS/36 ABW areas of responsibilities. U.S. Army training needs are coordinated by Commander, U.S. Army Pacific (USARPAC), located at Fort Shafter, Honolulu, Hawaii. Coordination of U.S. Army reserve training is conducted by Headquarters IX Corps (Reinf),

[4]U.S. Department of the Navy, Commander U.S. Naval Forces Marianas (31 January 1992) *Instruction 3500.3L Fleet Operating Areas and Training Facilities - Marianas Area.*

[5]36ABW/OSS Memorandum (January 1997) *Andersen Air Force Base Exercise Request Procedures.*

9th Army Reserve Command, Fort DeRussy, Honolulu, Hawaii. Headquarters, The Guam Territorial Area Command, located at Fort Juan Muña, Tamuning, Guam, is responsible for coordinating training requirements for the Guam National Guard. U.S. Marine Corps training requirements are coordinated by either Headquarters, III Marine Expeditionary Force (III MEF), located in Okinawa, Japan, or Headquarters, I Marine Expeditionary Force (I MEF), stationed at Camp Pendleton, California. Headquarters, Pacific Air Forces (PACAF) coordinates training requirements submitted by USAF organizations located in the Pacific and the continental United States (CONUS).

1.2.3 Decision Needed

The decision addressed by this DEIS is how, when, and where to allow and promote military training on lands under military control or authorized for military use by landowners in the Mariana Islands. This DEIS discusses the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment. COMNAVMARIANAS and 36 ABW are responsible for providing both training facilities and guidelines or restrictions for use of lands under their supervision (see Section 1.2.2.3). A primary objective of this DEIS is to identify environmental conditions so that exercise planners know the limitations of each training area well in advance of a given exercise. Mitigative actions identified in the Record of Decision (ROD) will be written into location-specific orders and standing operating procedures (SOPs) for implementation. This will facilitate planning by various training command(s) which must decide to conduct, modify, or curtail training at several stages: during advance planning, during staging of exercise personnel and equipment, and during the exercise period itself. Many variables must be confirmed prior to certain exercises, to ensure that exercise areas remain clear of potential obstacles to training.

1.3 SCOPING SUMMARY

This DEIS has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), which requires an EIS for "major federal actions with the potential to significantly affect the environment." Council on Environmental Quality (CEQ) regulations implementing NEPA require that there be 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.[6] This process is termed "scoping."

1.3.1 Scope of Issues To Be Addressed

The scoping process began with a review of existing documentation and interviews with military organizations regarding military activities and the existing environment in the Marianas. It included opportunities for the public to comment on the proposed action. The scoping process concluded with a review of issues to determine which were potentially significant and which were nonsignificant and/or otherwise outside the scope of this DEIS.

1.3.1.1 Public Involvement Process

In November 1995, a Notice of Intent (NOI) to prepare an EIS was published in the *Federal Register* (Appendix A-1); individual copies were mailed to Guam, CNMI, and federal agency officials, as well as to potentially concerned private parties (Appendix A-2). The public was invited to

[6] 40 CFR §1501.7, Scoping.

communicate concerns, issues, and alternatives at public scoping meetings conducted in December 1995; the meetings were announced in the *Pacific Daily News* (Appendix A-3). Sign-in sheets and an informal record of all public comments are included in Appendices A-4 and A-5, respectively. Written responses to the NOI are included in Appendix A-6. A list of agencies, organizations, and persons to whom copies of the DEIS have been sent is included in Appendix A-7.

1.3.1.2 Issues Raised During Scoping

The primary issues raised by citizens and public agencies were impacts on endangered species—particularly the impact on endangered species caused by the accidental exportation of brown tree snakes off Guam—and safety issues related to live fire, demolition, and aviation training. On all islands, questions were raised concerning the timeframe and range of training covered by the EIS. There was some concern that any training not included in the EIS would be "covered up" and not properly assessed for impacts. Better protocols for communicating with civilian authorities prior to exercises were requested, particularly in regard to air traffic and natural resource impacts.

On Guam, there were also comments on possible future civilian or Government of Guam (GovGuam) reuse of military-owned lands, and questions regarding the need to train in the Marianas at all or on Guam and Rota in particular. Issues raised on Rota included the need to train on Rota, impacts on endangered wildlife species, and requests for civic works projects by visiting military units. Comments on Tinian also included requests for civic works projects, as well as questions regarding use of public beaches, a request for a new landfill, access to historic sites in the EMUA, maintenance of cultural resources in the EMUA, and more economic benefits to Tinian from exercises.

1.3.1.3 Screening Process and Issues Discarded From Detailed Consideration

Issues raised during scoping were evaluated for relevance to the proposed action and, if deemed relevant, for significance.

Several issues raised during scoping were not directly related to the proposed action and were therefore eliminated from detailed consideration in this DEIS. Specific reasons are as follows:

- Issue: Need for mitigation measures to accommodate future civilian reuse of military lands on Guam.

  Reason eliminated: The issue of civilian reuse is addressed in documentation relating to GLUP 94 and BRAC 95 and is not within the scope of this DEIS for training. However, it is in the best interests of the DoD to avoid adversely impacting training lands, and this document identifies numerous mitigation measures intended to prevent or limit such irreversible effects or any other significant permanent damage to military lands.

- Issue: Socioeconomic impact of BRAC 95.

  Reason eliminated: The release of lands on Guam under the auspices of BRAC 95 is not part of the proposed action; therefore, the impact of such releases (e.g., job loss) is not within the scope of this document. With the exception of the positive impact of increased work for shipping companies in association with transporting materiel to and from Tinian, the proposed action is not expected to have any socioeconomic impacts on Guam. The proposed action

identifies training internal to the military and occurring on lands already controlled by the military. It will not create or decrease jobs, reduce land available for civilian activities, affect housing availability, or generate fiscal impacts on the Government of Guam.

- Issue: Cleanup of training areas.

  Reason eliminated: Both the Air Force and the Navy have site investigation and cleanup programs in place to address and implement cleanup of military facilities. All military lands proposed for training are currently under investigation for potential contamination and/or undergoing site remediation. Other than mitigation proposed to avoid future adverse impact, the issue of military land cleanup is not within the scope of this DEIS.

- Issue: Examine graving dock in Apra Harbor as alternative area for demolition training.

  Reason eliminated: The graving dock is located in an active industrial area incompatible with live demolition training. As the dock is now closed off from the harbor, it does not provide the underwater access required by training personnel. In addition, the space is too small for safe training with the 20-pound charges now used by EOD in Apra Harbor.

- Issue: Minimize airport approaches over populated areas on Rota.

  Reason eliminated: The only proposed use of the Rota International Airport is for periodic evening helicopter training. The helicopter flight tracks (presented in Chapter Two) coincide with existing civilian airport approach and departure routes. These routes have been designed to minimize airport approaches over populated areas. Therefore, no further discussion of this issue is necessary.

- Issue: Risk assessment for brown tree snake introduction to Rota as a result of proposed SEAL activities.

  Reason eliminated: This DEIS assumes there is high risk of BTS import during any transport of equipment from Guam to another island. Therefore, all units leaving Guam for Rota (including the SEALs) will strictly comply with the Brown Tree Snake (BTS) Control/Interdiction Plan discussed in Chapters Three and Four of this DEIS. No preliminary risk assessment will be necessary.

- Issue: Need to have more civic works projects, restore the veterans memorial park on Rota, build a road around Rota, and provide MEDEVAC service on Tinian.

  Reason eliminated: Many individual units will arrange for civic works projects in association with training on Rota and Tinian. However, such projects will be performed at the discretion of the units and are not required for training. Therefore, such projects are not part of the proposed action and do not fall within the scope of this document.

- Issue: Develop RCRA-approved landfill on Tinian, preferably in the EMUA.

  Reason eliminated: Construction and operation of a RCRA-approved landfill is a substantial and costly undertaking, involving significant potential liability on the part of the landfill owner/operator. The military has no need for a landfill on Tinian, and construction would require a separate EIS document under NEPA. However, solid waste management in general is an issue examined in this DEIS.

- Issue: Clean up Tinian's port facilities.

  Reason eliminated: Tinian's port facility was turned over to civilians as part of the Lease Agreement signed in 1994. Training vessels using the port operate in compliance with federal regulations prohibiting release of contaminants into the waters of the U.S. The existing condition of the port is outside the scope of this DEIS.

- Issue: Involve Tinian businesses in federal bidding activities.

  Reason eliminated: Tinian businesses are welcome to compete for federal jobs put out for bids. It is the responsibility of the businesses to obtain newspapers or other publications providing notice of such jobs. Government entities are strictly prohibited from giving preferential treatment to particular enterprises in the procurement process without specific Congressional authorization.

Remaining issues were evaluated for significance, to determine the depth of analysis required for this DEIS.

1.3.2 Identification of Significant Issues

CEQ regulations provide that the following should be considered in determining whether an issue is significant under NEPA:[7]

- Affects public health and safety
- Affects unique characteristics of a geographic area (historic/cultural resources, wetlands, ecologically critical areas, wild/scenic rivers, parks)
- Is highly controversial
- Involves highly uncertain, unique, or unknown risks
- Establishes a precedent
- Generates cumulatively significant effects
- Involves sites listed or with the potential to be listed on the National Register of Historic Places
- Affects plants or animals listed as threatened or endangered under the Endangered Species Act
- May violate laws or requirements imposed for protection of the environment

Table 1-3 summarizes the screening analysis and identifies the reasoning by which issues were determined to be significant or nonsignificant. Issues determined to be significant were studied in detail. They are identified below and their potential effects are discussed in detail in Chapter Four. Those issues and potential impacts identified as nonsignificant and readily mitigated have been considered and are itemized in Chapter Four, but detailed analysis was deemed not necessary.

Seven potentially significant issues were identified during the scoping process. Some of these issues are common to all islands considered in this DEIS; other issues are particular to the island of Tinian, which has no permanently staffed military facilities. The significant issues and proposed mitigation measures are briefly identified in this section and are discussed in detail in Chapter Four.

[7] 40 CFR §1508-27(b).

Table 1-3
Screening Process to Identify Significant Issues

General Topic	Potential Issue	Is Issue Significant Due to Training Activities?
I. Biological Factors		
Threatened or endangered species, migratory birds	Will training activities affect the population of threatened or endangered species? Yes.	**Yes** (Issue 1). May disturb or take individuals; may transport BTS to CNMI, Hawaii, or the continental U.S.
Wetlands, reefs, & habitat	Will training activities adversely affect wetlands, reefs, and habitat? Yes.	**Yes** (Issue 1). May damage coral reef.
Wilderness resources	Will training activities affect the islands' wilderness resources? No.	No. No change from existing conditions.
Insects and disease	Will training activities introduce any new/noxious insects to the islands? No.	No. Managed by existing quarantine procedures.
II. Cultural Resources		
Archaeological features, historic structures, National Landmarks	Will training activities affect archaeological/historic resources? Yes.	Yes (Issue 2). May cause damage/loss/destruction of significant resources or resources listed in National Register of Historic Places.
Cultural Practices	Will training activities interfere with traditional cultural practices? Maybe on Guam; not elsewhere.	**Yes** (Issue 6). Guam: May expose public to range safety fan during traditional cultural practice.
Visual resources	Will training activities affect visual resources? No.	No. No substantial change from existing conditions.
III. Physical Factors		
Air quality	Will training activities affect air quality? No.	No. No change from existing conditions.
Climate	Will training activities alter the climate? No.	No. No change from existing conditions. (Weather conditions affect training schedules and construction criteria for training support facilities.)
Geology	Will training activities alter unique landforms? No.	No. No change from existing conditions.
	Will proposed activities generate new hazards associated with earthquakes or flooding? No.	No. No change from existing conditions.
	Will training activities increase erosion? No.	No. No substantial change from existing conditions. Construction has the potential to cause localized erosion, which will be mitigated by routine erosion control practices.

Table 1-3 (continued):

General Topic	Potential Issue	Is Issue Significant Due to Training Activities?
III. Physical Factors (continued):		
Surface water quality (marine and fresh)	Will training activities affect the drainage of surface water? No.	No. No change from existing conditions.
	Will training activities contaminate surface water resources? No.	No. Potential effects mitigated by routine compliance with SOPs and environmental regulations.
Flooding	Will training activities reduce existing flood storage area? No.	No. No change from existing conditions.
	Will proposed action expose facilities or personnel to flood hazards? No.	No. No change from existing conditions.
Groundwater	Will training activities affect groundwater quality? No.	No. No substantial change from existing conditions. Most potential effects will be mitigated by routine compliance with SOPs and environmental regulations. (See Section 4.3 for discussion of wastewater disposal on Tinian)
Noise	Will noise levels increase enough to disturb nesting threatened or endangered bird species and/or civilians? Yes.	**Yes** (Issues 1 & 5). May disturb Mariana crow and fruit bat habitat; may disturb Rota residents.
IV. Manmade Hazards and Constraints		
Airfield approach and departure	Will training activities interfere with existing airfield approach and departure patterns? Maybe on Tinian; not elsewhere.	**Yes** (Issue 5). May interfere with approaching/departing aircraft.
	Will training activities affect health and safety at and near airfields? Maybe on Tinian; not elsewhere.	**Yes** (Issue 5). May pose hazards to civilians on the ground in areas accessible to the public.
Firing ranges	Will proposed weapons training affect public health and safety? Maybe.	**Yes.** (Issue 6). Has potential to interfere with civilian aviation, generate new surface danger zone (SDZ), or generate additional UXO within existing UXO hazard area.
Electromagnetic radiation	Will training activities increase EMR exposure? No.	No. No change from existing conditions. Training personnel will not enter EMR hazard zone to be generated by future VOA transmitter on Tinian.

Table 1-3 (continued):

General Topic	Potential Issue	Is Issue Significant Due to Training Activities?
IV. Manmade Hazards and Constraints (continued):		
Hazardous materials storage	Will training activities increase HM exposure? No.	No. No change from existing conditions.
Contaminated land and water	Will training activities expose the public to contaminated media? No.	No. No change from existing conditions.
Fire	Will training activities increase the number of wildfires? Maybe.	**Yes** (Issues 1 & 6). Demolition, pyrotechnics, and tracers have potential to ignite fires in relatively remote areas.
V. Infrastructure		
Potable water supply	Will training activities affect the supply of potable water? No.	No. Demand on Tinian will be sporadic; public water supply has accommodated Tandem Thrust (TT) in the past.
Waste collection and disposal (stormwater, wastewater, solid & hazardous waste)	Will training activities affect waste collection and disposal? Yes on Tinian; not elsewhere.	Tinian: **Yes** (Issue 4). No EPA-approved disposal facilities exist on Tinian; solid waste will be returned to Guam for disposal.
	Will the waste produced by training activities have adverse effects on the population? No.	No. No change from existing conditions.
Floodwater storage	Will training activities affect existing floodwater storage area? No.	No. No change from existing conditions.
Electricity and communications	Will training activities affect electricity and communications? No.	No. No change from existing conditions.
Airports	Will training activities affect airport operations? Maybe on Tinian during TT; not elsewhere.	Tinian: **Yes** (Issue 7). Increase in aircraft at West Tinian Airport during TT; need to establish communication protocol with civilian authorities.
Harbors	Will training activities affect harbor operations? Maybe on Tinian during TT; not elsewhere.	Tinian: **Yes** (Issue 7). Increase in vessels in harbor during TT; need to establish communication protocol with civilian authorities.
Roadways and traffic	Will training activities affect roadways and traffic? Maybe on Tinian during TT; not elsewhere.	Tinian: **Yes** (Issue 7). Increase in road traffic during TT; need to establish communication protocol with civilian authorities.
Public services	Will training activities affect the availability of public services? Maybe.	**Yes** (Issue 7). Potential forest or grass fire may require substantial use of public fire fighting equipment; certain proposed activities may require periodic agency consultations and/or additional customs/immigration effort.

Table 1-3 (continued):

General Topic	Potential Issue	Is Issue Significant Due to Training Activities?
VI. Social Environment		
Land use	Will training activities affect present land use? No.	No. No change from existing conditions.
Socioeconomic conditions	Will training activities affect present socioeconomic conditions? Maybe on Tinian; not elsewhere.	Tinian: **Yes** (Issue 7). Possible interference with civilian plans for tourist development and with continued tourist access to destinations in EMUA.
Environmental justice	Will training activities affect separate segments of the population differently? No.	No. No change from existing conditions. Tinian: Socioeconomic study did not find that the population is disadvantaged in comparison to the rest of the CNMI population.

Issue 1: Impacts on Biological Resources

Guam, Tinian, and Rota are home to a variety of threatened and endangered species, particularly native birds, migratory sea birds, and sea turtles. On Guam, accidental importation of the brown tree snake (BTS) has resulted in eradication of most native bird species. Prevention of BTS import from Guam to other islands of the CNMI or Hawaii during personnel or equipment transport is probably the most significant issue addressed in this DEIS. In addition, certain proposed training activities might result in an "accidental take" of an endangered or threatened bird, bat, or other listed animal. Finally, proposed amphibious vehicle landings have the potential to damage coral, which would be contacted by the vehicle's tracks in water less than 1.8 meters deep.

Issue 2: Preservation of Cultural Resources

Training sites on Guam and Tinian contain ancient Chamorro archaeological sites valuable for data collection and, in some cases, recommended for preservation. In addition, it is important to preserve the remains of World War II structures as part of local and world history. Proposed training activities include ground disturbance by vehicles and other activities which have the potential to result in loss of data and defacement or destruction of resources.

Issue 3: Wastewater Disposal on Tinian

Tinian currently has no large-scale civilian or military wastewater treatment facility. Wastewater disposal is a major logistical component of large training exercises involving several hundred or more ground troops. Potential concerns are impacts of periodic wastewater disposal on existing municipal septic systems in San Jose, in addition to impacts on groundwater resources, air quality, and public health if wastewater is improperly disposed.

Issue 4: Solid and Hazardous Waste Disposal on Tinian

Tinian has no EPA-approved solid waste landfill and no hazardous waste treatment capability. Training activities routinely generate varying amounts of solid waste (primarily cardboard and paper) and may generate very small amounts of hazardous waste and used oil. Waste will be backhauled to Guam for disposal at the Navy landfill at NAVACTS Waterfront Annex. Potential impacts include shortening the useful life of the Navy landfill, as well as impacts on groundwater resources, air quality, and public health if waste is not properly disposed.

Issue 5: Aviation Safety

Ongoing and proposed new training activities include aviation operations with the potential to affect public safety. Fixed- and rotary-wing aircraft move in and out of military airfields and landing zones, as well as certain civilian airfields. Some military airfields are accessible to the public; others have approach or departure avenues with the potential to interfere with commercial aircraft. Finally, paradrops at an existing parachute drop zone relatively near to the civilian airfield on Tinian could interfere with civilian aircraft approach or departure.

Issue 6: Firing Range Safety

The proposed action includes installation or modification of several ranges to accommodate additional weaponry. Some of these ranges have the potential to introduce new impacts to public

safety. The two ranges proposed for modification on Orote Point are accessible to the public, as would be the proposed range locations on Tinian. The safety fan for the proposed range at the Ordnance Annex includes part of a hiking trail, used by civilians for a traditional Easter celebration. The proposed mortar range on Tinian would generate an unexploded ordnance (UXO) hazard in an area potentially accessible by the public.

Issue 7: Socioeconomic Impacts on Tinian

Tinian's relatively small population is isolated from economic opportunities available to Saipan residents. Training activities have the opportunity to provide economic benefit by generating purchase of local goods and services. Training activities also occasionally impact the cost and logistics of certain public services and facilities, such as firefighting capability, use of the airport and harbor, and potable water supply. Exclusion of tours from sites in the EMUA would have a negative effect. One or more casinos and associated hotels are planned, and cumulative socioeocnomic impacts may result from the combination of military training and large-scale tourism.

1.3.3 Non-significant Impacts Due to Existing Management Requirements

Military organizations are required to comply with existing federal environmental regulations and Executive Orders, as well as with military orders which specify detailed means to implement environmental management and protection measures.[8] Compliance with military orders and with federal environmental regulations enables training units to routinely avoid many otherwise potentially adverse impacts. Therefore, because CEQ regulations direct that environmental analysis in an EIS focus on significant issues, such impacts are itemized but not analyzed in detail in this document. The sections below review certain potential impacts which will be routinely mitigated (i.e., avoided) by adherence to existing orders and regulations. Chapter Four provides a detailed table of all potential impacts resulting from the proposed action, together with mitigation (including the routine management cited below). All mitigation specified in this DEIS will be written into standing facility orders, so that all proposed mitigation will be automatically implemented by units following training orders.

In addition to site-specific orders, all training units have organic orders and SOPs which regulate their activities and mitigate potential environmental impacts. These orders provide information and guidance for certain training activities and for training at specific locations, including notifications, pollution prevention, supply and logistics constraints, BTS interdiction procedures, waste management procedures, and spill prevention for petroleum products and hazardous substances. Specific impacts to be mitigated by compliance with existing orders and regulations are discussed in the following sections.

[8]Specific orders include Department of the Navy, Office of the Chief of Naval Operations (1994) *OPNAVINST 5090.1B Environmental and Natural Resources Program Manual;* Department of the Army (23 May 1990) *AR-200-1 Environmental Quality: Environmental Protection and Enhancement,* (23 January 1989) *AR 200-2 Environmental Quality: Environmental Effects of Army Actions,* (28 March 1995) *AR 200-3 Environmental Quality: Natural Resources—Land, Forest, and Wildlife Management;* and *Air Force Policy Directive 32-70, Environmental Quality. In addition, each military base or training area has site-specific instructions, orders, and sometimes Memoranda of Agreement (MOAs) detailing compliance measures, e.g., for managing hazardous substances, minimizing disturbance of endangered species populations, and avoiding harm to archaeological resources.*

1.3.3.1 Alien Species and Disease Control

The potential to introduce alien species from one location to another will be managed by existing quarantine procedures. BTS interdiction will be accomplished by strict compliance with the *Brown Tree Snake (BTS) Control/Interdiction Plan* discussed in Chapter Four. Other potential pest species include flame tree loopers, Japanese beetles, melon flies, fruit flies, and habu (poisonous snakes native to Okinawa). Standard management procedures consist of the following measures:

- All exercise participants will be briefed on the BTS threat and on prohibitions on importing uncertified fresh produce.
- No fruits or other fresh produce will be transported from Guam to Tinian, Rota, or Hawaii.
- All personnel and materiel will undergo customs inspection prior to shipping off-island from Guam. Trained dogs will inspect all materiel, with the exception of office supplies and personnel luggage.
- All vehicles and mobile equipment will be inspected and steam cleaned prior to staging and embarkation in Guam and Okinawa.
- All materiel designated for transport off Guam will be staged in areas identified as low-risk for BTS, i.e., areas with low or no vegetation and dog surveillance.
- A BTS surveillance and trapping program will be established prior to any exercise involving both Guam and another tropical location.

1.3.3.2 Surface Water Quality

Training units and facility training orders specify measures to prevent contamination of surface waters and groundwater by discharges produced by training personnel. The measures apply to mess and medical facilities, field sanitation, and vehicle fueling, maintenance, and repair. The following preventive measures are specified:

- Containment berms, pans, or liners will be used during all activities involving POL transfer or replacement.
- Mess facilities will direct all wastewater through a grease trap prior to discharge to the soil or will use tray-packs, which do not generate any cooking waste.
- Medical waste will be contained and disposed of at an appropriate, licensed facility.
- Ships engaged in training activities will not discharge solid waste within 25 nautical miles (nm) of any island and will use all available means to cause unprocessed garbage to sink as rapidly as possible.

- All construction performed by the Seabees includes erosion controls to prevent sediment runoff into surface waters.[9]

1.3.3.3 Range Safety

Obvious hazards associated with live fire ranges will be managed in accordance with established range practices. Each range has an associated surface danger zone (SDZ) in which activities are stringently restricted. In cases in which SDZs extend into areas accessible by the public (including fishing vessels and aircraft), public notices are published (notices to airmen [NOTAMS] and notices to mariners [NOTMARS]). In addition, SDZs are guarded and access is limited, and each SDZ is surveyed and cleared of personnel and endangered marine animals (where relevant) prior to use.

Weapons activity with the potential to interfere with civilian aviation is required to occur within a defined Controlled Firing Area and to meet other requirements of FAA Order 7400.2D.[10]

1.3.3.4 Electromagnetic Radiation

Electromagnetic radiation (EMR) zones are generally found around transmitting antennas where high density electromagnetic fields may pose a hazard to personnel, ordnance, or fuels (HERP, HERO, and HERF, respectively), or where such fields may interfere with aviation electronics equipment. Each piece of equipment has a known hazard radius, and all portable transmitters will be sited to avoid such hazards. All field military communications equipment have been tested for HERP, HERF, and HERO and are operated only in modes that do not present a hazard. Standard communications equipment is operated in an authorized manner in frequency bands assigned for use in accordance with Federal Communication Commission (FCC) and military policy. During transmission periods, personnel manning the vehicles monitor the equipment and the surrounding area to insure that no one comes within hazardous range. These transmissions are not known to be of sufficient strength to pose a hazard to wildlife.

1.3.3.5 Aviation Safety

The FAA requires that it be notified of military aircraft and weapons fire with the potential to interfere with civilian air traffic. All military aircraft approaching, departing, or operating at Tinian notify the FAA in Guam and Saipan 72 hours prior to any exercise. Aircraft using established runways and LZs on Guam follow site-specific notification procedures and respond to all control tower orders.

[9]Seabees receive construction plans from staff civil engineers assigned to each command. Construction plans are reviewed by the Seabee Quality Control Department environmental engineer for potential environmental concerns, including erosion control, in accordance with NMCB-1 Instruction 4355.1D and COMCBPAC/COMCBLANT Instruction 4355.1C. Construction plans which raise environmental concerns are returned to the customer for clarification.

[10]Federal Aviation Administration, U.S. Department of Transportation (September 16, 1993) *7400.2D Procedures for Handling Airspace Matters.*

1.3.3.6 Hazardous Materials/Hazardous Waste Management

All military units follow unit- and site-specific SOPs[11] regarding hazardous materials and hazardous waste (HM/HW) management. These SOPs directly comply with federal regulations, including the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund), the Superfund Amendment and Reauthorization Act (SARA), the Toxic Substances Control Act (TSCA), the Clean Air Act (CAA), Department of Transportation (DOT) regulations covering transport of HM/HW, and territorial and commonwealth regulations on HM/HW management.

1.3.3.7 Construction Management Practices

No proposed construction is approved and initiated without complying with standard site management practices to prevent sediment runoff, fugitive dust, and erosion.

1.4 GOVERNMENT PERMITS AND APPROVALS

As part of the EIS process, consultations have been initiated with various government agencies to obtain their concurrence with the preferred alternative. The agencies may request modifications to the proposed action or proposed mitigation before providing their concurrence. The following approvals are required:

Section 106 Consultation. The National Historic Preservation Act requires consultation with the Guam and CNMI Historic Preservation Officers (HPOs) because the proposed action involves sites listed or eligible to be listed on the National Register of Historic Places. The final EIS (FEIS) will include the HPOs' concurrence that the proposed action will not adversely affect sites determined to be "significant" under National Register criteria.

Section 7 Consultation. The Endangered Species Act requires consultation with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) because the proposed action will occur at locations inhabited by endangered plant and animal species. The FEIS will include USFWS and NMFS concurrence that the proposed action will not adversely impact plants or animals listed as threatened or endangered under the act.

CZM Consistency Determinations. The Coastal Zone Management (CZM) Act requires a determination that the proposed action is consistent with local CZM programs, which regulate non-point source pollution and protect coastal resources. On Guam, CZM is administered by the Bureau of Planning; in the CNMI, CZM is administered by the Office of Coastal Resources Management. The FEIS will include concurrence by these agencies that the proposed action is consistent with their programs.

Land Use and Policies. The majority of lands to be affected by the proposed action are owned or leased by the Department of Defense for the purpose of military training and associated activities. Therefore, the proposed training activities on military-controlled lands are not inconsistent with

[11] e.g., COMNAVMARIANAS INST 5090.2 (16 February 1993) *Oil and Hazardous Substance (OHS) Pollution Contingency Plan;* NAVSTAGUINST 5090.2 50E (5 February 1993) *Oil and Hazardous Substance (OHS) Pollution Contingency Plan* ; and NASAGANAINST 5090.3 118 (1 March 990) *Hazardous Substance (HS) Contingency Plan and Emergency Procedures.*

federal or local land use planning and policy. Real estate agreements are generally required to authorize training when one DoD component uses the land and/or facilities of another DoD component, federal agency, local government agency, or a private owner. Such agreements are currently in place for all locations proposed for training.

Other permits and approvals are identified in the appropriate sections in Chapter Four and in related tables and appendices.

CHAPTER TWO
PROPOSED ACTION AND ALTERNATIVES

This chapter defines the proposed action and compares the alternatives. NEPA requires an EIS to evaluate a range of "reasonable" alternatives to the proposed action, including the "no action" alternative.

The proposed action consists of land-based training activities to augment existing training which has been conducted for many years at specific locations in the Marianas. As explained in Chapter One, new and ongoing training activities are currently required by military organizations (units of the Navy, Marine Corps, Army, Air Force, Guam Army Reserve, and Guam National Guard) stationed on Guam and other Pacific locales to fulfill their individual missions and to maintain personnel qualifications and certifications. The alternative of conducting training outside the Marianas was eliminated from consideration because it does not meet the stated purpose of providing training opportunities within the Marianas. Eliminating training altogether from the Marianas was not considered because it is not a reasonable alternative in light of the military services' need to maintain military readiness in the Pacific area.

The proposed action alternatives presented in this chapter consist of different sets of individual training activities. The alternatives represent the two extreme cases of the proposed action—(1) no new training activities and (2) all of the proposed new training activities—and (3) a "middle ground" alternative, which includes only the proposed new activities which are not expected to significantly impact the environment. Therefore, the alternatives are defined as follows:

1. **No Action:** This alternative consists of all ongoing training activities conducted on the islands of Guam, Tinian, Rota, and Farallon de Medinilla (FDM) in recent years. It includes all locations in which those activities have occurred.

2. **Augmented Set of Training Activities:** This alternative consists of augmenting ongoing training activities with all requested new training activities and locations.

3. **Mitigated Set of Training Activities:** This alternative consists of ongoing and selected new training activities and locations mitigated to avoid significant impacts on the environment.

Alternative locations on Guam, Tinian, Rota, and FDM are integrated within the three alternatives. Note that training locations are not necessarily mutually exclusive, i.e., a certain activity may occur or be proposed for several different sites and/or for more than one island. Most activities require a specific environment, e.g., forested land, nearshore or beach areas, buildings, or firing ranges. Many exercises (consisting of one or more activities) require a specified minimum land area in order to provide realistic training. The area required is a function of the number of personnel, the weapons and equipment used, and the exercise scenario.[1]

[1]For example, an infantry company of 150 persons requires between five and 20 square kilometers (km^2) to conduct various forms of offensive and defensive ground maneuvers. An airmobile operation using MC-130 transports needs an airfield at least 1,675 meters in length.

2.1 NO ACTION ALTERNATIVE

This alternative is the status quo or baseline condition. This section describes ongoing training activities in sufficient detail to provide readers with an understanding of training activity components which might have cumulative environmental impacts. Supplementary information on certain terms and items of equipment that may be unfamiliar to readers is provided in the Technical Descriptions in Appendix B.

The ongoing training activities are presented here in three parts:

- Section 2.1.1 describes activities which transport military forces to a training area.
- Section 2.1.2 describes training activities conducted by combat and combat support ground and aviation forces.
- Section 2.1.3 describes combat service support and logistic training activities provided during military exercises.

Locations already used for these training activities are identified in each section, as well as in Table 2-1 and Figures 2-1 through 2-6.

The most comprehensive ongoing combination of training activities occurs during the biennial Tandem Thrust exercise, which is occasionally held in the Marianas. This joint exercise trains USCINCPAC staff and elements of all U.S. military services on Guam, Tinian, and large expanses of the Pacific Ocean. Forces and equipment are staged on Guam and introduced to Tinian; field maneuvers and aviation support occur on Tinian; and logistics support is provided on and between both islands. Many of the activities described below have been components of past Tandem Thrust exercises and have been previously evaluated for potential environmental impacts.[2]

2.1.1 Introduction of Forces

The following training activities deliver troops and equipment to exercise areas (see Figures 2-1 through 2-6 for specific locations):

- **Airmobile Training**: Troop units and their equipment are inserted and extracted at airfields or landing zones (LZs) by fixed- and rotary-wing aircraft. In the Marianas, two types of USAF cargo/transport aircraft are used. The smaller C-130 is a four-turboprop aircraft capable of landing on short, unimproved runways. The larger C-141 is a four-turbojet aircraft that requires a larger landing field but is capable of carrying larger wheeled vehicles and additional personnel. Both are designed with large ramps at the rear that can be used to parachute cargo. The Navy's combat support squadron, HC-5, uses CH-46D medium lift helicopters to carry personnel. The Marines use either the medium-lift CH-46E or the larger heavy-lift CH-53D or E models. (The latter is capable of carrying about 7,300 kg externally, e.g., a 155 mm howitzer.)

[2]Belt Collins & Associates. (June 1993 and November 1994) *Environmental Assessments, Military Exercises, Island of Tinian, Commonwealth of the Northern Mariana Islands*. Prepared for Pacific Division, Naval Facilities Engineering Command.

Table 2-1
Existing and Proposed Training Activities and Locations

Location	Training Activity	No Action	Augmented Set of Training Activities	Mitigated Set of Training Activities
GUAM:				
NAVACTS Ordnance Annex	Bivouac	X	X	X
	Small unit patrolling	X	X	X
	Land navigation	X	X	X
	Field exercises	X	X	X
	Rappelling	X	X	X
	Helicopter landings, tactical unit insertions (rappel, fastrope)	X	X	X
	Helicopter insertions and extractions (SPIE)	X	X	X
	Command post exercises	X	X	X
	Water purification	X	X	X
	HC-5 firebucket training	X	X	X
	EOD and demolition training	X	X	X
	Sniper range (to be developed)		X	X
	Jungle shooting trail with pop-up targets		X	X
	Breaching house		X	X
	Urban training using simulated, non-lethal ammunition (at breaching house)		X	X
	Paradrops and drop zone (to be cleared)		X	X
NAVACTS Waterfront Annex Apra Harbor	Helicopter cast & recovery	X	X	X
	Combat swimmer training	X	X	X
	Swimmer insertions	X	X	X
	Water paradrops	X	X	X
	Riverine training (Atantano River)	X	X	X

Table 2-1 (continued):

Location	Training Activity	No Action	Augmented Set of Training Activities	Mitigated Set of Training Activities
NAVACTS Waterfront Annex Apra Harbor *(continued):*	IED training	X	X	X
	LCAC landings (Polaris Point, Drydock Island)	X	X	X
	Drownproofing	X	X	X
	Shallow water mine countermeasures (Breakwater Beach, Drydock Island, and Polaris Point)		X	X
	Shallow water mine countermeasures (Gabgab Beach)		X	
	Underwater demolition training in Outer Harbor:			
	10-lb. charges	X	X	X
	20 1-lb. charges	X	X	X
	20-lb. charges		X	X
	Underwater demolition training in Inner Harbor (up to 5 lb. charges)	X	X	X
	Helicopter search and rescue	X	X	X
	Helicopter paradrops	X	X	X
	Mine countermeasure training	X	X	X
	Helicopter fastrope training		X	X
	Heliborne firebucket training (offload)	X	X	X
	Floating mine neutralization (outside and north of harbor)		X	X
NAVACTS Waterfront Annex Orote Point	Helicopter insertions (rappel, fastrope)	X	X	X
	Helicopter insertions and extractions (SPIE)	X	X	X
	Chemical protective mask and NBC clothing training	X	X	X
	Bivouac	X	X	X
	Small arms live fire range training	X	X	X
	Field exercises	X	X	X
	Helicopter flight operations	X	X	X
	IED training	X	X	X
	Swimmer insertions	X	X	X
	Combat swimmer training	X	X	X

Location	Training Activity	No Action	Augmented Set of Training Activities	Mitigated Set of Training Activities
GUAM *(continued)*:				
NAVACTS Waterfront Annex Orote Point *(continued)*:	Stress course		X	X
	Heliborne firebucket training (offload)	X	X	X
	Close quarter battle house (shooting house)	X	X	X
	Seabee deployment training (Camp Covington)	X	X	X
	LCAC landings (Dadi Beach)		X	X
	Fixed-wing flight operations (MC-130 operations)	X	X	X
	Underwater demolition training with 10-pound charges (offshore of Dadi Beach)		X	X
	Shallow water mine countermeasures training (Dadi Beach)		X	X
	FARP		X	X
	Sniper range (extension of existing firing range)		X	X
	Fire and maneuver range		X	X
Andersen Air Force Base Main Base	Land navigation	X	X	X
	Bivouac	X	X	X
	Communications exercise	X	X	X
	TRUE training	X	X	X
	Small unit maneuvers	X	X	X
	Small boat operations	X	X	X
	EOD team training/use of tool sets and procedures	X	X	X
	Airfield defense exercises	X	X	X
	Combat arms training and maintenance	X	X	X
	Rapid runway repair	X	X	X
	Air base defense exercises	X	X	X
	Air assault operations (paradrops)	X	X	X
	Air crew proficiency	X	X	X
	Chemical protective mask and NBC clothing training	X	X	X
	FCLP	X	X	X
	Flight operations, fixed- and rotary-wing, day and night	X	X	X
	Rappelling	X	X	X
	Heliborne firebucket training (on active runways)		X	X

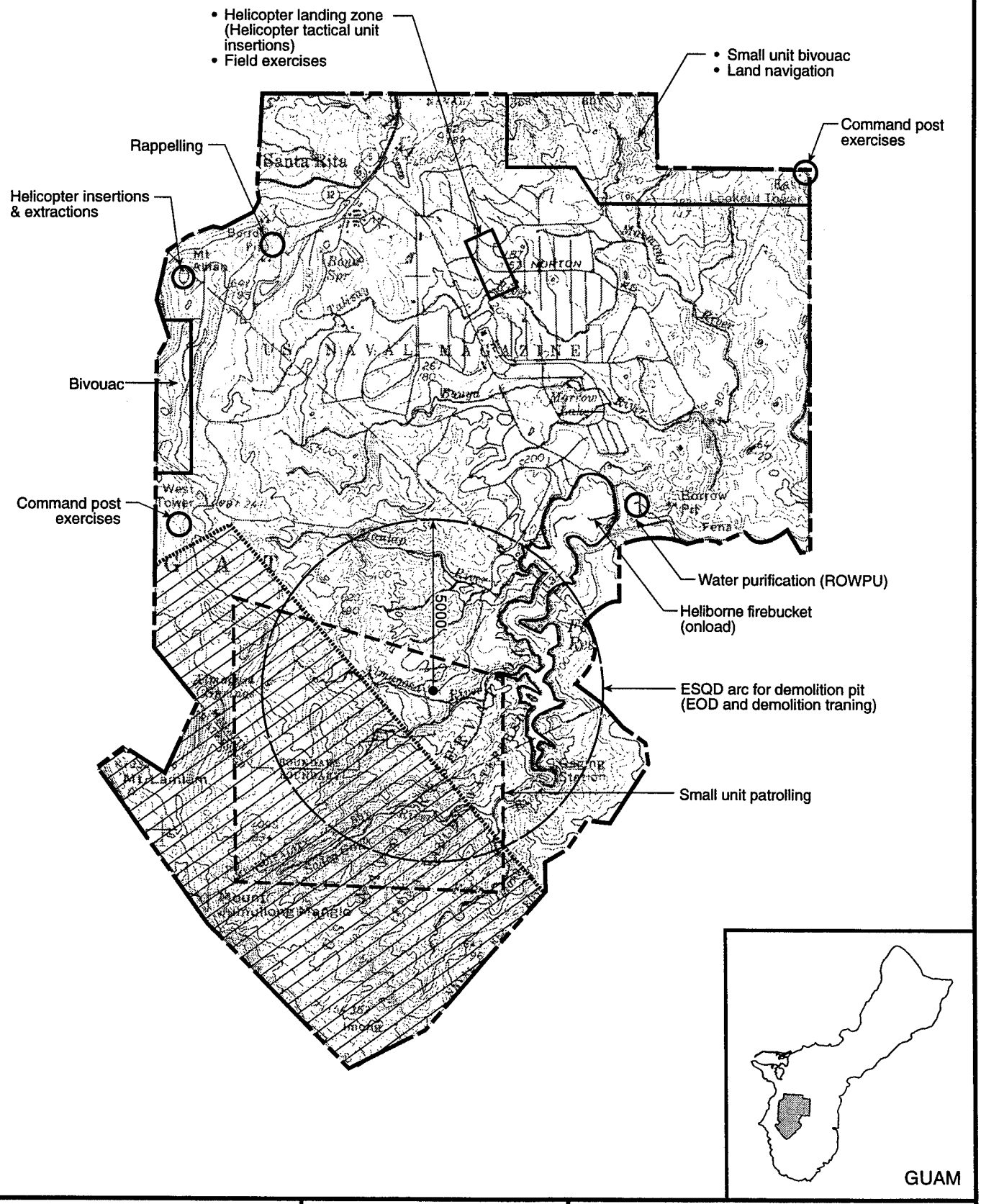
Table 2-1 (continued):

Location	Training Activity	No Action	Augmented Set of Training Activities	Mitigated Set of Training Activities
GUAM *(continued)*:				
Andersen Air Force Base Northwest Field	Airfield seizure	X	X	X
	MC-130 operations	X	X	X
	Helicopter NVG training	X	X	X
	Paradrops	X	X	X
	Rapid runway repair		X	X
	Security police training with military working dogs	X	X	X
	Bivouacs	X	X	X
	TRUE training	X	X	X
	Small unit maneuvers	X	X	X
	Land navigation	X	X	X
	Defensive tactics	X	X	X
	Confined area landing (CAL) training		X	X
	Jungle foot patrols	X	X	X
	Combat search and rescue	X	X	X
	Escape and evasion tactics	X	X	X
Andersen South	Bivouac	X	X	X
	Land navigation	X	X	X
	Small unit field maneuvers	X	X	X
	Defensive tactics (blank fire only)	X	X	X
	Contingency exercise support	X	X	X
NCTAMS Finegayan	Small boat/swimmer insertions	X	X	X
	Overland maneuvers	X	X	X
	Small arms training	X	X	X
NCTAMS Barrigada	Small unit bivouacs	X	X	X
	Small unit maneuvers	X	X	X

Location	Training Activity	No Action	Augmented Set of Training Activities	Mitigated Set of Training Activities
GUAM *(continued)*:				
Non-DoD Land	Helicopter insertion/extraction (Dandan LZ)	X	X	X
	Parachute drops (Dandan LZ)	X	X	X
	River insertion (Talofofo and Ylig River)		X	X
TINIAN:				
EMUA	Offensive and Defensive Tactics:			
	Combat and reconnaissance patrolling	X	X	X
	Force on force tactical maneuver exercises	X	X	X
	Communications and signal exercises	X	X	X
	Bivouac	X	X	X
	Rapid runway repair	X	X	X
	Helicopter insertions and extractions (rappel, fastrope, and SPIE)	X	X	X
	Parachute operations	X	X	X
	C-130 containerized aerial (cargo) deliveries (CADS)	X	X	X
	C-130 airmobile training	X	X	X
	Airfield seizure/defense	X	X	X
	FARP	X	X	X
	Swimmer insertion/extraction	X	X	X
	LCAC landings (Unai Dankulo, Unai Chulu)	X	X	X
	Logistic support	X	X	X
	Fire and maneuver range (to be developed)		X	X
	60 mm mortar range (to be developed)		X	
	Shooting house (to be constructed)		X	X
	TRUE training	X	X	X
	AAV landings (Unai Babui)		X	X
	Permanent base support camp (to be constructed)		X	X
	Security gates (to be constructed)		X	X

Table 2-1 (continued):

Location	Training Activity	No Action	Augmented Set of Training Activities	Mitigated Set of Training Activities
TINIAN *(continued)*:				
LBA	Paradrops	X	X	X
	Movement to contact (field maneuver)	X	X	X
	Airmobile training/personnel and cargo airlift (West Tinian Airport)	X	X	X
	NVG training	X	X	X
Non-DoD Land	Forward staging base	X	X	X
	Combat swimmer training	X	X	X
	Logistic support operations (San Jose, San Jose Harbor)	X	X	X
ROTA:				
Non-DoD land	Combat swimmer training (West Harbor/Songsong coastline)	X	X	X
	SEAL forward staging base (Angyuta Island)	X	X	X
	Medical evacuation flights (MEDEVAC)	X	X	X
	Helicopter NVG flight training (Rota International Airport)		X	X
FARALLON DE MEDINILLA:				
	Aerial bombardment	X	X	X
	Air to ground ordnance	X	X	X
	Naval gunfire	X	X	X
	Tactical air control party training	X	X	X
	.50 caliber weapons from raider craft to targets on land	X	X	X
	Sniper range/.50 caliber machine gun (ground mount)		X	
	Artillery		X	
	60 mm mortar (practice and illumination fire)		X	
	AT-4 Anti-tank missile		X	
	40 mm grenade launcher range (training projectiles)		X	



Source: Marianas Training Plan Briefing Booklet

NORTH

0 500 1000 (Meters)

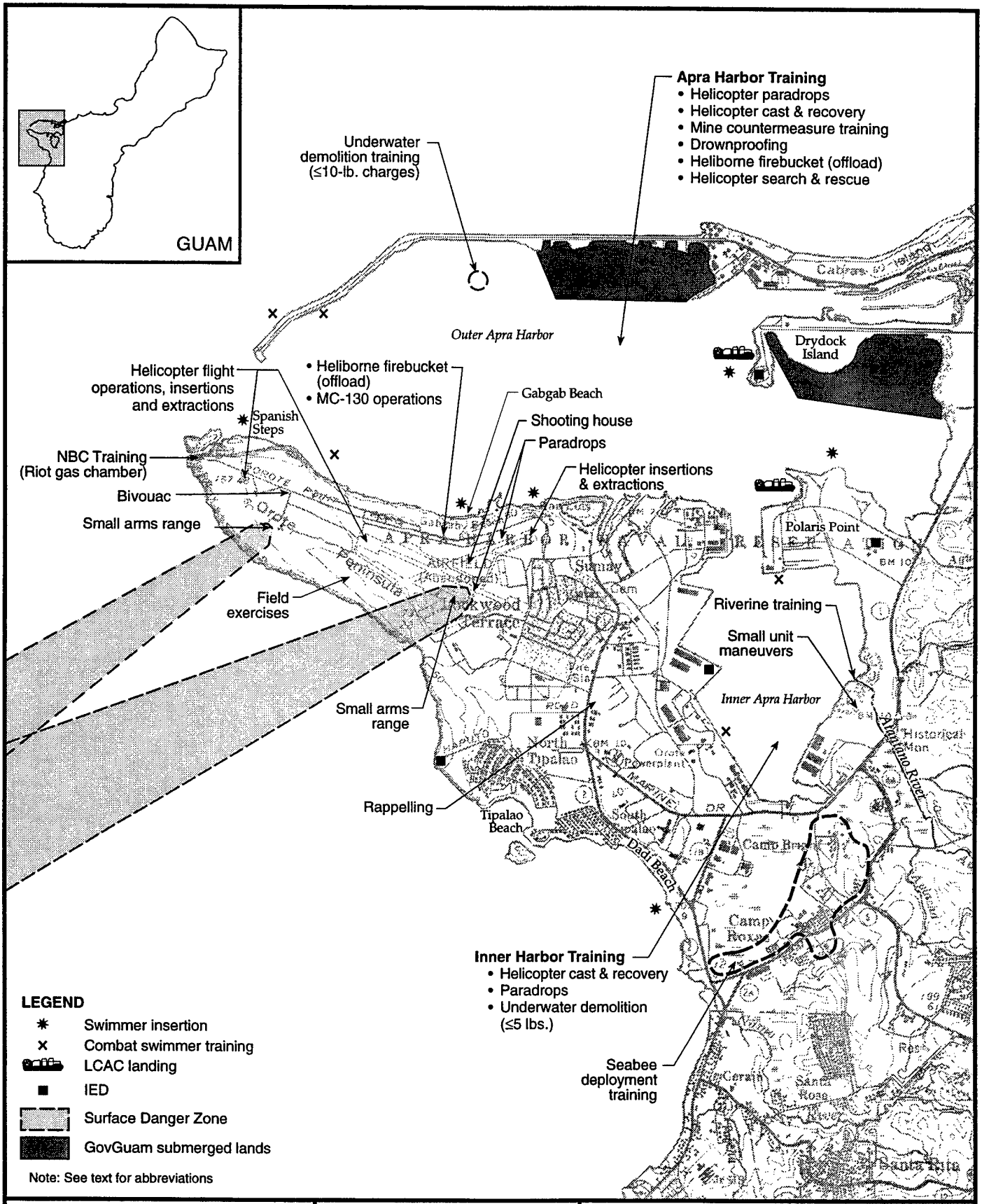
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LEGEND

Land navigation

Figure 2-1
ONGOING NAVACTS GUAM ORDNANCE ANNEX TRAINING
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

342.0414/013-1 r1.17.97



Source: Marianas Training Plan Briefing Booklet

NORTH

0 500 1000 (Meters)

0 2000 4000 (Feet)

Figure 2-2
ONGOING NAVACTS WATERFRONT ANNEX TRAINING
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

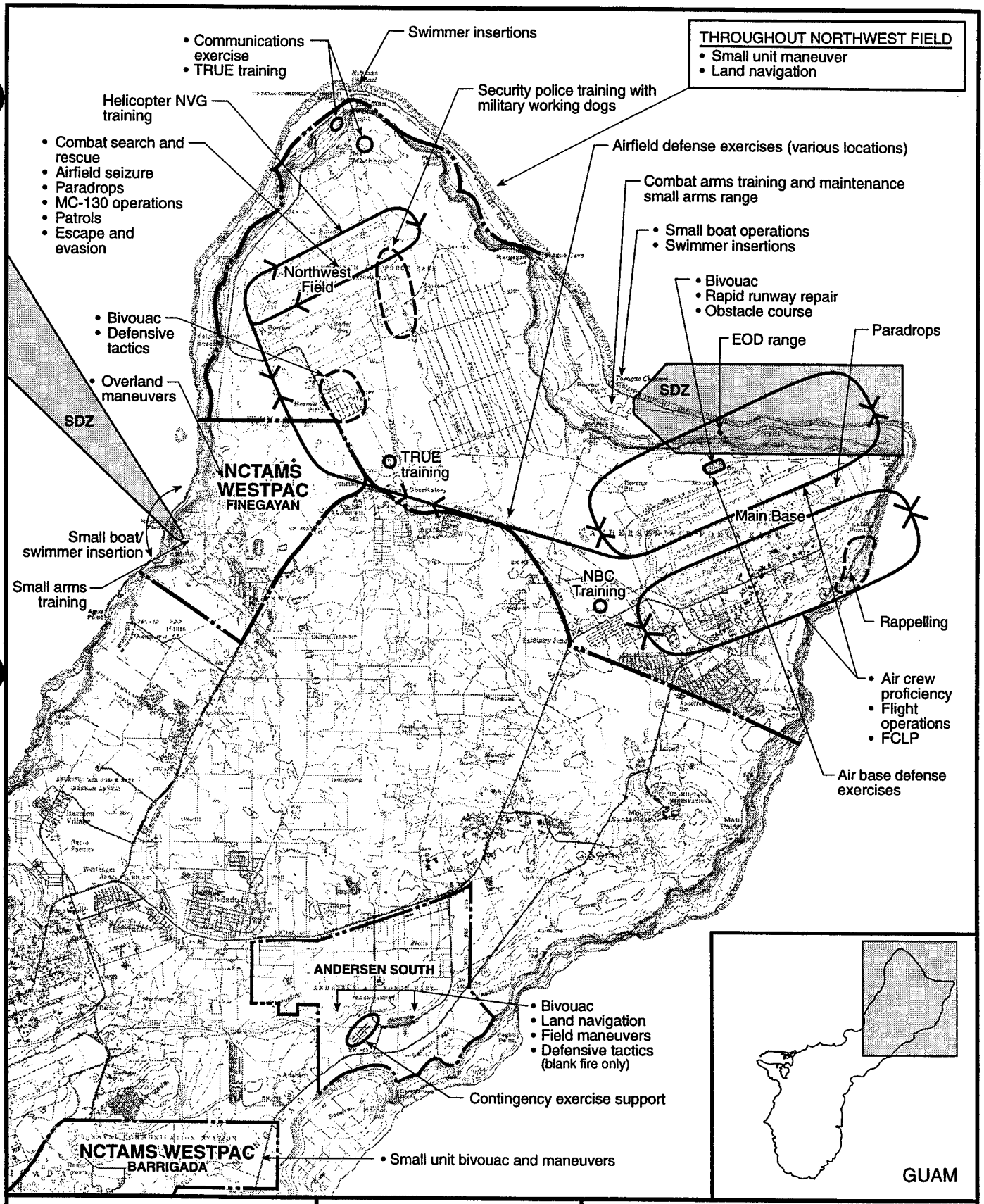


Figure 2-3
ONGOING ANDERSEN AIR FORCE BASE AND NCTAMS TRAINING
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

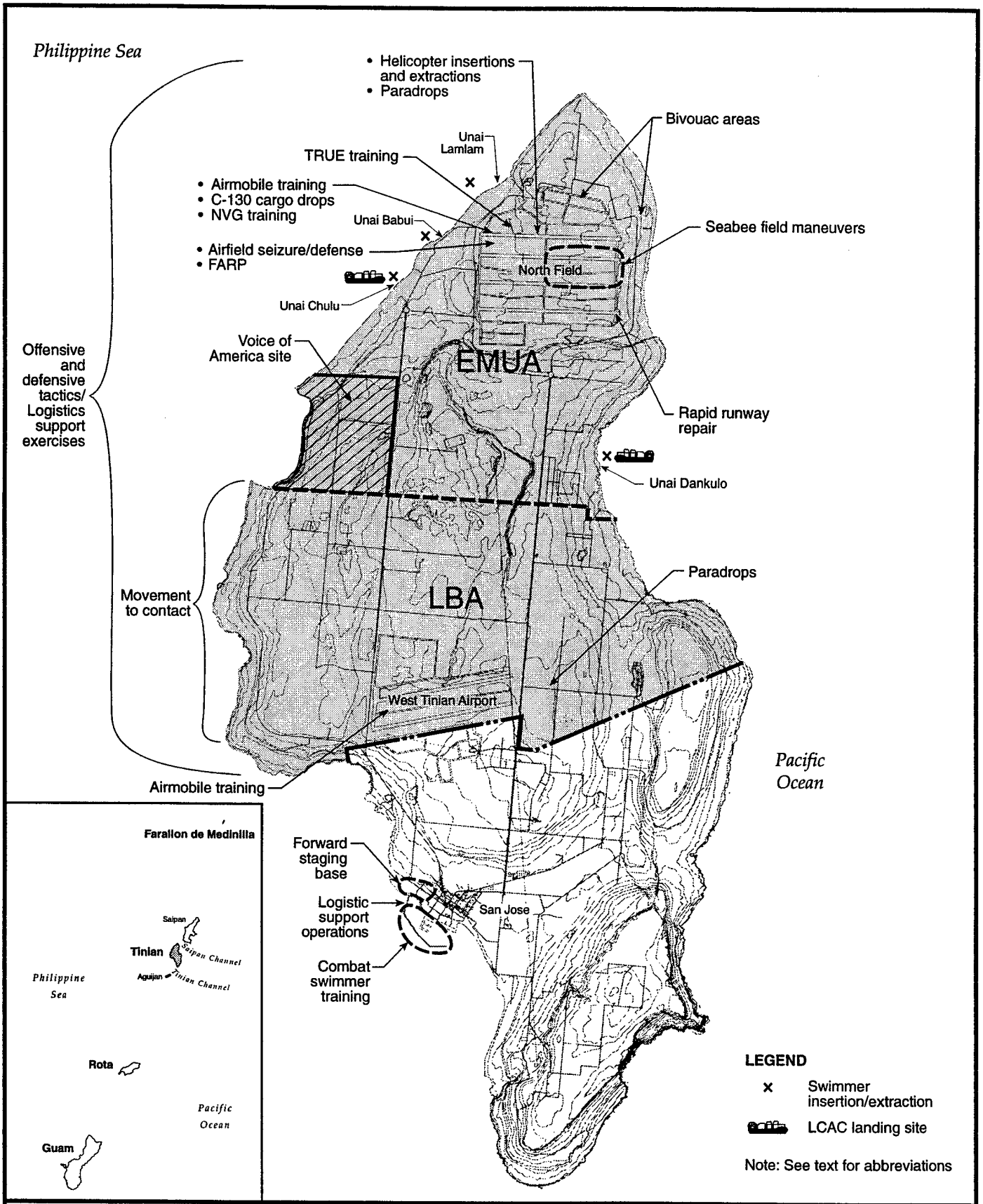
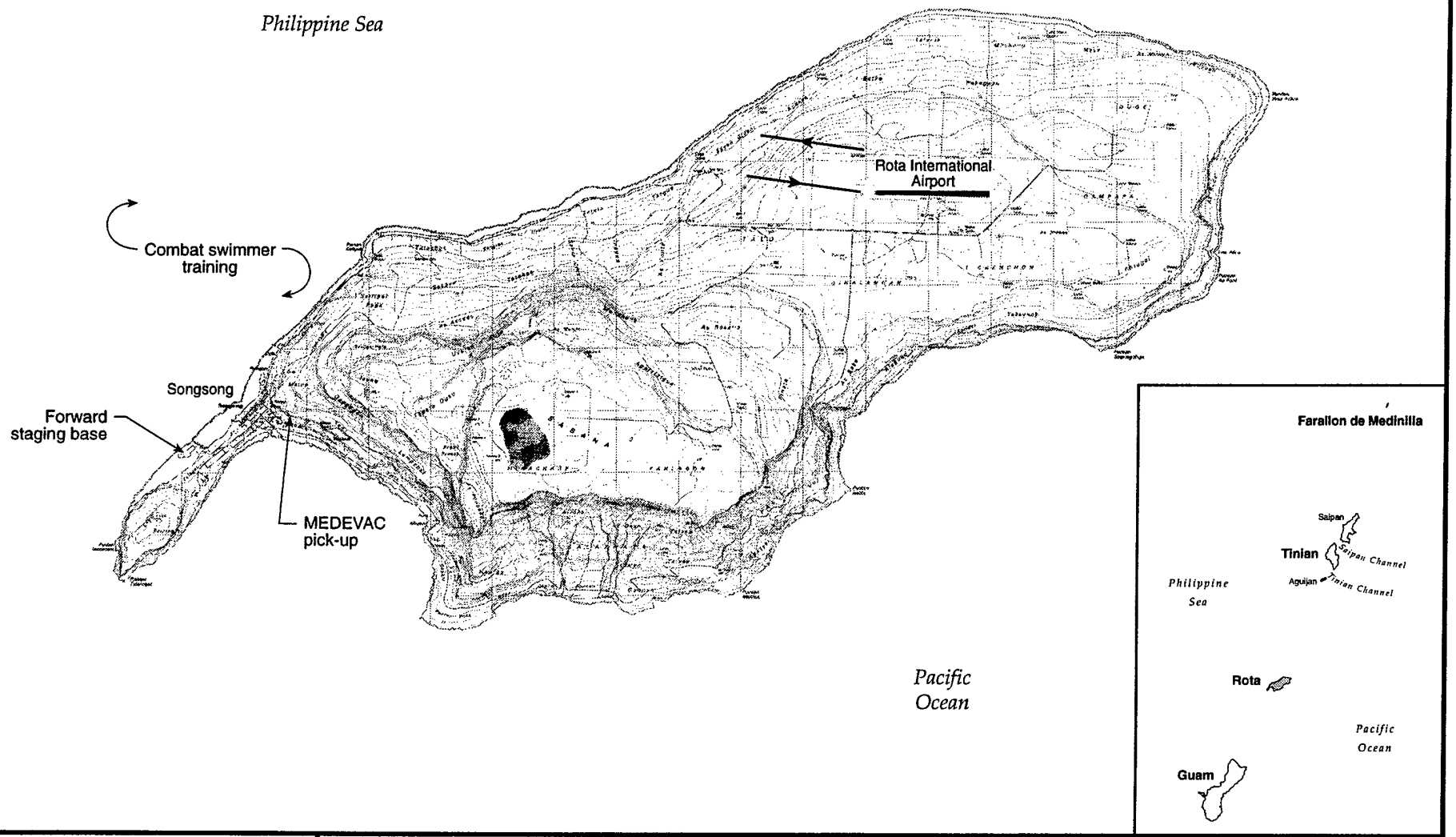


Figure 2-4
ONGOING TINIAN TRAINING

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997



Source: Marianas Training Plan Briefing Booklet

NORTH

0 1000 2000 (Meters)

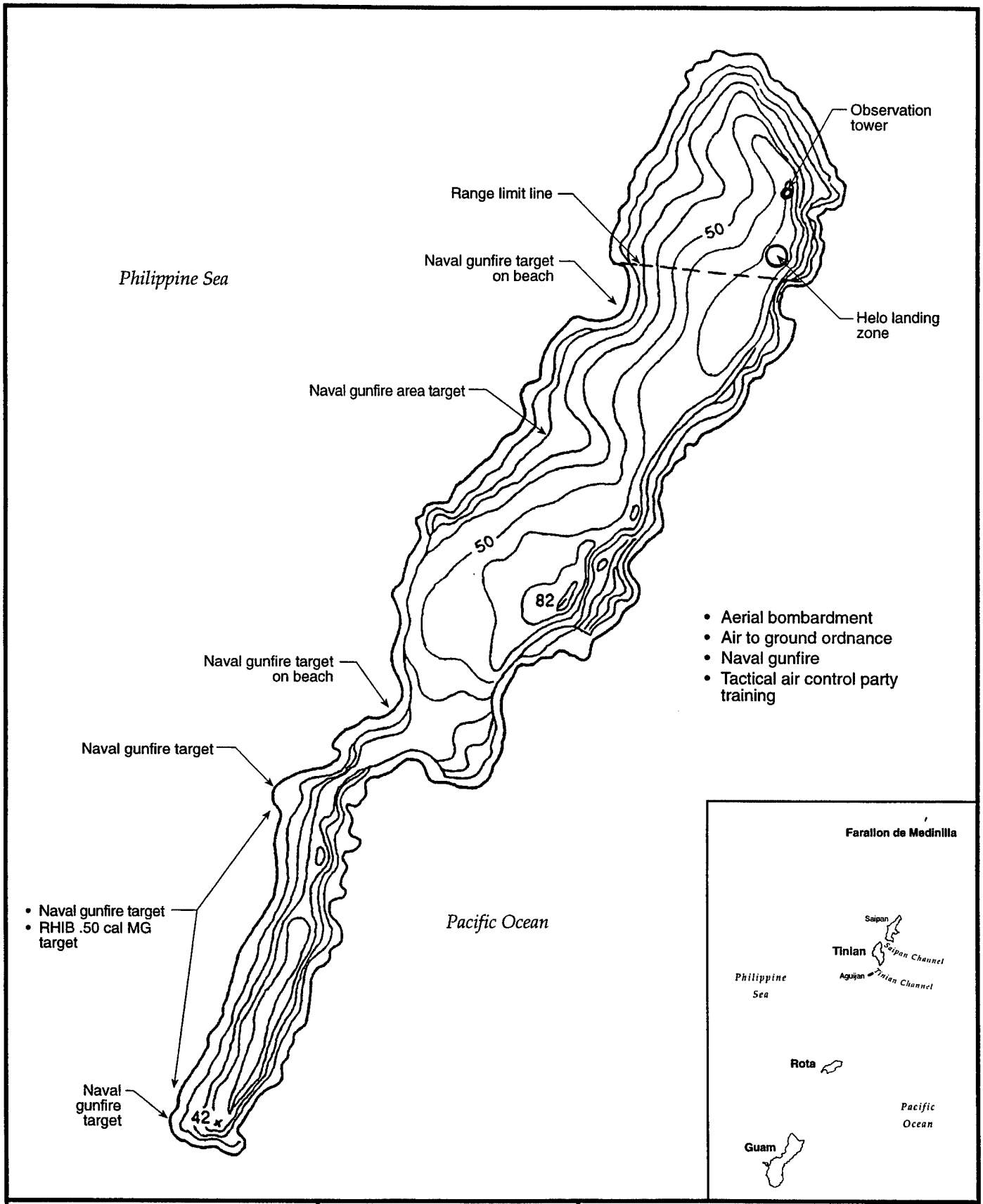
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LEGEND

Commercial aircraft flight tracks

Figure 2-5
ONGOING ROTA TRAINING

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997



Source: Marianas Training Plan Briefing Booklet

NORTH

0 100 200 300 (Meters)

0 500 1000 (Feet)

Figure 2-6
ONGOING FARALLON DE MEDINILLA TRAINING
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

Airfields and surveyed helicopter LZs currently used to deliver forces and cargo are located on Guam at AAFB (Main Base and Northwest Field), and on Tinian at North Field in the EMUA and the civilian West Tinian Airport. In addition, the Orote Point Runway is used for tactical MC-130 operations.

- **Airborne Training**: Each of the military services is required to deliver troops and cargo by parachute from fixed- and rotary-wing aircraft, using surveyed assault zones (LZs, drop zones [DZs], and extraction zones [EZs]) situated on landing fields, on cleared land, or in the water. Cargo delivery includes high and low-altitude, parachute-assisted delivery from fixed-wing aircraft.

  Surveyed DZs used for parachute delivery of personnel and cargo are located on the Orote Point runway, AAFB (including Northwest Field), Tinian's EMUA and LBA, and on non-military-controlled land in Dandan, Guam (see Figure 1-2). Helicopter swimmer insertions and recovery are conducted in the NAVACTS Waterfront Annex. Parachute drops are conducted in Inner and Outer Apra Harbor, at assorted open water parachute drop zones around Guam, and on AAFB Main Base DZs.

- **Helicopter Insertion (and Extraction)**: Small tactical units are delivered to a LZ or exit a hovering helicopter in a rapid descent by rappelling or using a fastrope. Over water, SCUBA equipped SEALs and Reconnaissance teams jump from hovering helicopters (helicast). An additional method of rapid troop insertion, as well as extraction, is by using the special purpose insertion and extraction (SPIE) rig—a suspended rope with hookups for four to five soldiers/Marines. The rope is not winched into the helicopter; the troops are transported quickly away as an external load. These systems eliminate the need for LZs and are suitable for tactical situations requiring surprise and speed.

  This training is currently conducted in the Ordnance Annex, the Waterfront Annex (Apra Harbor and Orote Point), the Dandan LZ in Southern Guam, and the EMUA on Tinian.

- **Amphibious Assaults**: Ship-to-shore tactical exercises are conducted by Marine Expeditionary Units (MEU). These assaults normally combine the use of helicopter insertion with the delivery of troops and equipment across the beach by tracked assault amphibian vehicles (AAV)[3] and landing craft. An AAV carries up to 23 combat equipped Marines or 10,000 pounds of cargo from ship to shore. In the Marianas, three types of landing craft have been used to transport troops and wheeled vehicles from ship to shore: the Landing Craft, Medium (LCM-8), Landing Craft, Utility (LCU), and Landing Craft, Air-Cushion (LCAC). The LCM-8 transports personnel, small and medium sized trucks, and cargo. The LCU is equipped with ramps both fore and aft and can deliver artillery, a 5-ton truck (4536 kg) prime mover, and combinations of smaller vehicles and trailers. The LCM and LCU can be beached at the shore to unload personnel, vehicles, and cargo. They are currently used in San Jose Harbor on Tinian.

  The largest landing craft in the inventory, the LCAC,[4] rides over land or water on a cushion of air; it is designed to transport 63,500 kg at high speed. As examples of the LCAC's capabilities, it can transport one USMC M1A1 tank, four Light Armored Vehicles (LAVs), or four AAVs.

[3]See Appendix B.Although the AAV is not currently used for training exercises in the Marianas, during World War II literally hundreds of tracked landing vehicles landed on the beaches of Guam, Tinian, and Saipan during assault and retaking of those islands from the Japanese.

[4]See Appendix B.

Since the LCAC rides above the surface on an air cushion, it is capable of crossing the high-water line and traversing relatively flat terrain before coming off-cushion (i.e., down onto the ground surface) and offloading cargo.

The LCAC requires a beach at least 46 meters wide and with a maximum gradient of six degrees for landing. An area of 30 m x 30 m is adequate for a spot turn. For landing multiple LCACs, a standard separation distance of 92 m is necessary between vehicles. LCAC landing training currently occurs at Polaris Point and Drydock Island in the Waterfront Annex and at Unai Dankulo and Unai Chulu in the EMUA.

- **Beach Insertion (and Extraction)**: Small special purpose forces and reconnaissance teams are inserted into an exercise area with a beachfront by using small assault boats and rigid-raider craft (zodiac-type boats). Teams may also be transported to an offshore area by submarine and then approach the beach using small inflatable craft or by swimming from the boat to the beach. Teams may also move up-river from a beach, using Rigid Hulled Inflatable Boats (RHIB) or Combat Rubber Raiding Craft (CRRC).

  Beach insertions currently occur at various Waterfront Annex beaches in Apra Harbor and south of Orote Point (see Figure 2-2), Ritidian Point, Tarague Beach at AAFB, Haputo and Doublereef Beaches at NCTAMS Finegayan, Angyuta Island in West Harbor, Songsong Village (Rota), and various beaches on Tinian (see Figure 2-4).

- **River Insertion:** Small teams travel upriver in CRRCs, disembark into water, and enter surrounding area for tactical operations against a defending force. This type of training is performed on the Atantano River and surrounding marshy area.

- **Motor March**: Resident Guam National Guard and Army Reserve forces use tactical motor vehicle convoys to move forces from home armories to Guam's training areas. Convoy control by the training unit and traffic control by military police are practiced on both public streets and highways to reach designated training areas and on military bases used for training.

- **Confined Area Landing** (CAL) training is conducted to practice the introduction of forces by helicopter to a confined LZ during day or night hours. CAL training for **medical evacuations** (MEDEVAC) are practiced by HC-5 from both military training areas and civilian property at designated LZs on Guam and Rota. These techniques are also used for actual response at Rota by HC-5.

2.1.2 Combat and Combat Support Training

This section describes the following: (1) field maneuvers—ground-related training activities; (2) aviation support of such maneuvers; and (3) ordnance training on existing firing ranges.

Field maneuver elements can range in size—e.g., a small team of one to four persons, 130-person infantry company, 560-person battalion, or 2,000-person reinforced brigade—based on the size and nature of available training areas. Ongoing field maneuver activities in the Marianas include the following:

- Maneuvers usually consist of **tactical operations** carried out by combat and combat support units such as infantry, engineers, artillery, and communications. Marianas maneuver training

may integrate the combined arms capabilities that reside within a given service (e.g., U.S. Army light division or the Marines' MEU) or join two or more uniformed services for a joint military exercise (e.g., Army division and USAF wing; Navy amphibious squadron and embarked MEU). These maneuvers may begin as a movement to contact against an opposing force, which develops into offensive action (attacks, raids, ambushes, and consolidation at the objective) and then becomes a fixed position or mobile defensive operation.

Field maneuvers are currently conducted in the Ordnance Annex, Orote Point (Waterfront Annex), AAFB (Main Base, Northwest Field, and Andersen South), NCTAMS Finegayan, NCTAMS Barrigada, and both the EMUA and LBA on Tinian. Blank fire training occurs in the EMUA, as well as AAFB Main Base, the Northwest Field bivouac area, Waterfront Annex (adjacent to Atantano River), and Andersen South.

- **Special operations** include clandestine reconnaissance and raids, training in an urban environment (TRUE), tactical recovery of aircraft and personnel (TRAP), in-extremis hostage rescues, and noncombatant evacuation operations (NEO). Special operations are conducted on Orote Point (Waterfront Annex), NCTAMS Finegayan, and AAFB (Main Base and Northwest Field). Some training operations require the use of blank or live 7.62 and 5.56 mm ammunition.

- **Command post exercises** (CPXs) are used to train and test headquarters elements given limited time or limited training areas. A CPX is often conducted prior to the execution of a major exercise as part of the planning and preparation phase. The **communications networks** (radio and radar) needed among adjacent, subordinate, and senior headquarters, including exercise supervisors and cognizant agencies, are exercised and refined prior to conducting a full-scale tactical maneuver. CPX and communications activities occur at the Ordnance Annex, AAFB (Main Base and Northwest Field), and the EMUA and LBA on Tinian.

- Similar to a CPX, a **tactical exercise without troops** (TEWT) is conducted by commanders and supporting staffs over exercise terrain, developing cohesion and coordination between maneuver elements, but at reduced monetary and manpower costs. TEWT exercises are conducted at any location where maneuvers or bivouacs are allowed.

- Extended field maneuvers may involve some degree of **site development**: preparing field fortifications, constructing fighting positions, clearing vegetation from lanes needed as fields of fire, laying and clearing simulated anti-personnel and anti-tank mines, constructing road blocks, practicing camouflage discipline, and clearing vegetation for LZs or DZs. These activities support exercises in the EMUA on Tinian.

- **Road and cross-country movement** is conducted on foot or by wheeled vehicles—High Mobility Multipurpose Wheeled Vehicle (HMMWV), LAV, or 5-ton truck—and by tracked vehicles—AAV, M1A1 Main Battle Tank, or the Army's Small Unit Support Vehicle (SUSV). These vehicles are used to support field maneuvers at various locations.

- **Seizing an airfield** and providing an immediate perimeter defense are practiced both on active fields and abandoned airstrips. Airfield seizure and defense training occurs at AAFB's Main Base and Northwest Field and at North Field in the EMUA on Tinian.

- Military police conduct **security training and military working dog training** at the Ordnance Annex and at AAFB's Northwest Field. This training essentially consists of **riot training and crowd control.**

Aviation training integrates aircrew and supported ground units to enhance their capabilities to function in a three-dimensional battlefield. Adjacent landing fields or LZs and DZs are required at maneuver training areas to support integrated training. In the Marianas, such training activities include the following examples:

- Air-to-surface and air-to-air **gunnery and strategic bombing** are practiced by fixed- and rotary-wing aircraft crews at FDM. Aerial observation and control of naval gunfire and artillery fire missions are conducted by aircrews and aerial observers at FDM and can be simulated at maneuver areas.

- Navy/Marine fighter aircraft simulate **close air support** to ground force maneuver, providing specialized training for ground units' Tactical Air Control Parties (TACP), command personnel, and aircrews.

- Navy aircraft carrier landings and takeoffs are simulated as **field carrier landing practices** (FCLP) at AAFB's Main Base airfield. Exercises consist of low-altitude oval patterns up to 183 m (600 feet) AGL and 1.5 to 2.0 km wide. It involves repeated approaches to an airfield and simulated landings aboard a shorter length aircraft carrier, followed by take-offs and tight turns to repeat the maneuver.

- **C-130 aircraft operations** in support of special operations are performed at the Orote Point runway, AAFB Main Base and Northwest Field.

- Using C-130 aircraft, the USAF **delivers cargo** directly to maneuver areas with shorter, primitive airfields. If insufficient runway distance is available or the situation does not support landing the aircraft, there are two methods used for parachuting cargo from C-130s. The first is the low-altitude, parachute extraction system (LAPES). Approaching a release point at tree-top level, a parachute attached to a skid-mounted cargo pallet is first released from the aircraft's rear cargo hatch; the parachute aids in extracting the pallet from the plane. As the pallet contacts the ground, the parachute serves as a brake to slow and stop the pallet's skid. The second method is the container delivery system (CDS)—a parachute release of a container of equipment from an altitude of about 300 meters above ground level. Both cargo delivery methods are practiced at AAFB and occasionally on Tinian's North Field Runway Two.

- Using C-141 aircraft, the USAF **delivers personnel** by parachutes or by landing at AAFB Main Base. These strategic lift exercises normally cover great distances, exercising airmobile force ability to deploy on short notice to various climes. A strategic flight of airborne infantry from Alaska to Guam is a typical example.

- **Heliborne firebucket training:** Helicopters train to lift water-filled buckets at Apra Harbor and Fena Reservoir, in response to potential fires in remote or seaside locations. Buckets are emptied on the Orote Point runway and in Outer Apra Harbor. The buckets are pre-staged for major exercises such as Tandem Thrust conducted in Tinian's EMUA.

- **Helicopter search and rescue** (SAR) missions in support of military ground forces and civilian authorities are practiced by HC-5, in preparation for response to actual emergencies in the Marianas. This training involves getting personnel into the water to assist victims into the helicopter for transport to medical assistance. It is practiced in Outer Apra Harbor.

- **Night vision goggle training:** Helicopter night-flying support missions using night vision goggles (NVG) must be practiced in remote airfields with little or no ambient light. The training involves flying multiple circular or oblong patterns in the vicinity of a designated airfield. It currently occurs on the southern runway of Northwest Field (AAFB) and at Tinian's North Field.

- **Parachute operations** occur from fixed- or rotary-wing aircraft at various altitudes and distances from the designated DZ. Group size depends on the size of the DZ and capacity of the aircraft; it may range from fewer than a dozen to as many as 110 personnel. Large and small groups may perform static-line jumps from low altitude aircraft (approximately 300 to 350 meters above ground surface). The aircraft makes one or more passes fairly directly over the DZ; jumpers exit the aircraft wearing round canopy parachutes which open upon leaving the aircraft.

  Small groups of parachute-qualified special operations personnel may conduct high altitude operations from fixed-wing aircraft. Jumpers are equipped with steerable canopies which they deploy at high or low altitudes (high altitude, high opening [HAHO] or high altitude, low opening [HALO], respectively). High altitude jumps are defined as those from 1,200 meters or higher; most HAHO and HALO operations commence at 3,000 to 6,000 m.

  HAHO and HALO operations allow clandestine entry into an area, since personnel exit the aircraft far from the target DZ. For HAHO operations, jumpers open parachutes 600 m below the aircraft and glide up to 40 km, arriving silently with no associated aircraft noise. HALO jumpers freefall to within 1,200 meters of the ground, then open their parachutes and steer silently to the DZ.

  DZs currently used are on the Orote Point runway, at AAFB's Northwest Field and Main Base airfield, in Tinian's EMUA and LBA, and on non-military-controlled land in Dandan (Guam).

- Navy and Marine helicopter support is provided to Army and Marine personnel, and to Navy SEALs to practice exiting a hovering helicopter using **rappelling techniques**, or to use a **SPIE rig** to insert or extract personnel suspended from a rope extended from a helicopter. This training is conducted at LZs and maneuver areas at AAFB, in the NAVACTS Ordnance Annex, and Waterfront Annex, at the Dandan LZ, and EMUA.

Ordnance training (individual and crew-served weapons and munitions) proficiency is maintained by all ground and aviation units using training simulators at armories and home bases, blank ammunition for added realism during field exercises, and live ammunition on known distance and fire-and-maneuver ranges located on military installations. Firing ranges are specifically designed for certain families of weapons to ensure proper distance, direction of fire, and safety margins (see Appendix B).

There are four small arms firing ranges and one shooting house currently used on Guam, and one closed firing range on Tinian.

- Orote Point (Waterfront Annex) has two small arms ranges, primarily used for rifle and pistol requalification.

  The shooting house,[5] adjacent to the old runway on Orote Point, has reinforced walls and a raised ceiling, designed to contain projectiles within the house and to allow observation from the upper level. The shooting house has an SDZ of 50 m at 360 degrees, which is kept clear of personnel during training. The shooting house is constructed to effectively contain all rounds of 9 mm pistols and submachine guns and 5.56 mm rifles used inside the house during training.

- The AAFB Main Base small arms range accommodates 9 mm pistols, 5.56 mm and 7.62 mm rifles, and light machine guns. The range is used by day for requalification and at night for special operations.

- The NCTAMS Finegayan known distance small arms range is used for weapons qualifications training with pistols and rifles.

- The firing range on the east coast of Tinian's EMUA has been closed, pending safety survey and recertification. It was previously used for training with 9 mm pistol and submachine guns, 5.56 mm and 7.62 mm rifles and light machine guns, 60 mm mortars, and 40 mm rifle grenades.

Pyrotechnics (trip flares, signal flares, signal smoke, and illumination grenades) are used in Tinian's EMUA during ground maneuvers. Signal smoke and flares are used for emergency signaling in all training areas, DZs, and LZs.

Demolition training occurs at two land-based demolition pits in Guam and in several locations in and near Apra Harbor (see Figures 2-1 through 2-3):

- The Ordnance Annex EOD pit is used for demolition training by Navy EOD and special operations personnel, and for detonation of actual live ordnance discovered on Guam. In many cases, the ordnance remains from World War II.

- The AAFB Main Base EOD range is used by USAF EOD personnel for proficiency training with up to 600 pound net explosive weight and for destruction of old ordnance.

- At the Waterfront Annex, underwater demolition training in the Inner Harbor involves charges of no more than 5 pounds. Shallow-water demolition training in the Outer Harbor includes mine countermeasures training and detonation of strings of up to 20 one-pound charges. Deep-water training involves detonation of 10-pound charges at depths of 40 m.

- Training with IEDs (improvised explosive devices) is part of special operations training conducted at Orote Point in the Waterfront Annex. An IED is similar to a .50 caliber machine gun round in power and sound.

In addition, the unoccupied island of FDM is used as a bombing range for naval gunfire, aerial bombardment, and air-to-ground ordnance delivery. The SEALs use the southern cliffline target area for .50 caliber live fire from RHIBs.

[5]See Appendix B.

2.1.3 Combat Service Support and Logistics Training

Combat service support (CSS) unit training often provides actual support to larger exercise forces.

During field maneuvers, Army, Air Force, Marine, and National Guard CSS units establish **bivouacs** (field camps) for housing, feeding, and supporting the exercise force. Training includes establishing and maintaining proper food preparation, unit supply and field warehousing, ammunition storage and issue, field medical and dental support, field sanitation, solid waste disposal, and fire prevention and response. Troops currently bivouac in the Ordnance Annex, at Orote Point (Waterfront Annex), at AAFB (Main Base, Northwest Field, Andersen South), at NCTAMS Barrigada, and in the EMUA on Tinian. Water purification using reverse osmosis water purification units [ROWPUs] is practiced in the Fena Reservoir spillway.

Naval Construction Battalion (Seabee) **logistics** support activities are subdivided into vertical construction (e.g., constructing temporary structures, hardbacking tents) and horizontal construction (rapid runway repair, constructing gun positions, constructing roadways). **Rapid runway repair** is practiced at AAFB (Northwest Field and Main Base airfield) and at North Field in the EMUA. Seabees perform most other training at Camp Covington, within the NAVACTS Waterfront Annex.

To support long range training between islands, NSWU establishes a forward staging base on Angyuta Island in Rota's West Harbor. The area is sufficient for a small base camp with an adjacent marina suitable for small boat repair, refueling, and mooring.

A major part of **logistics** support is **transportation** by land, sea, and air to unimproved locations as well as to established sea and air ports. Logistics personnel train in staging, maintaining, and inspecting equipment and cargo in transit. They also set up forward area refueling point (FARP) stations. Logistics over-the-shore training is conducted at landing beaches and more formal staging areas. This training familiarizes members of one service with the requirements of, and services provided by, others. In the Marianas, a major part of transportation logistics training is inspection for brown tree snakes and other noxious species, as well as customs inspections. Transportation training activities occur at AAFB and the Waterfront Annex on Guam and at San Jose Harbor, West Tinian Airport, and North Field on Tinian, particularly in support of Tandem Thrust exercises.

2.2 AUGMENTED SET OF TRAINING ACTIVITIES

The Augmented Alternative consists of all new proposed training activities and locations, in addition to ongoing training activities and locations described above (in Section 2.1).

The new activities and locations include:

- beach landings by tracked assault amphibian vehicles (AAVs)
- a variety of new locations for ongoing introduction of forces, combat, and combat support training activities
- configuring three new firing ranges (including a mortar range) and extending an existing range
- constructing a shooting house and breaching house
- constructing a small base support camp and security gates on Tinian
- constructing a fence around the former firing range on Tinian

- expanding activities on FDM to include land-based sniper training, anti-tank missile, mortar and artillery fire.
- conducting floating mine neutralization training outside of Apra Harbor

The new activities (including small construction projects) and locations are described below, listed on Table 2-1, and illustrated on Figures 2-7 through 2-15. (Note that no new activities or construction are proposed for NCTAMS Finegayan or NCTAMS Barrigada.) This section is organized to parallel the No Action Alternative description: Introduction of Forces, Combat and Combat Support Training, and Combat Service Support and Logistics Training.

2.2.1 Introduction of Forces

- **Establish a parachute training DZ** in the north central area of the Ordnance Annex on Guam. This would require clearing approximately 125,000 m^2 of vegetation and formally surveying the area (see Figure 2-7).

- **Establish additional CAL** sites at Northwest Field including simulated shipboard helicopter landing spots (see Figure 2-9).

- Conduct **LCAC landings** at Dadi Beach (Waterfront Annex); no construction or modification of the beach is required (see Figure 2-8).

- Conduct **river insertions** on the Talofofo and Ylig Rivers in southeast Guam (see Figure 1-2). Training would consist of very small units moving upriver in small boats or raider craft under stealth conditions. Personnel would not disembark or enter civilian land areas without prior arrangements with landowners.

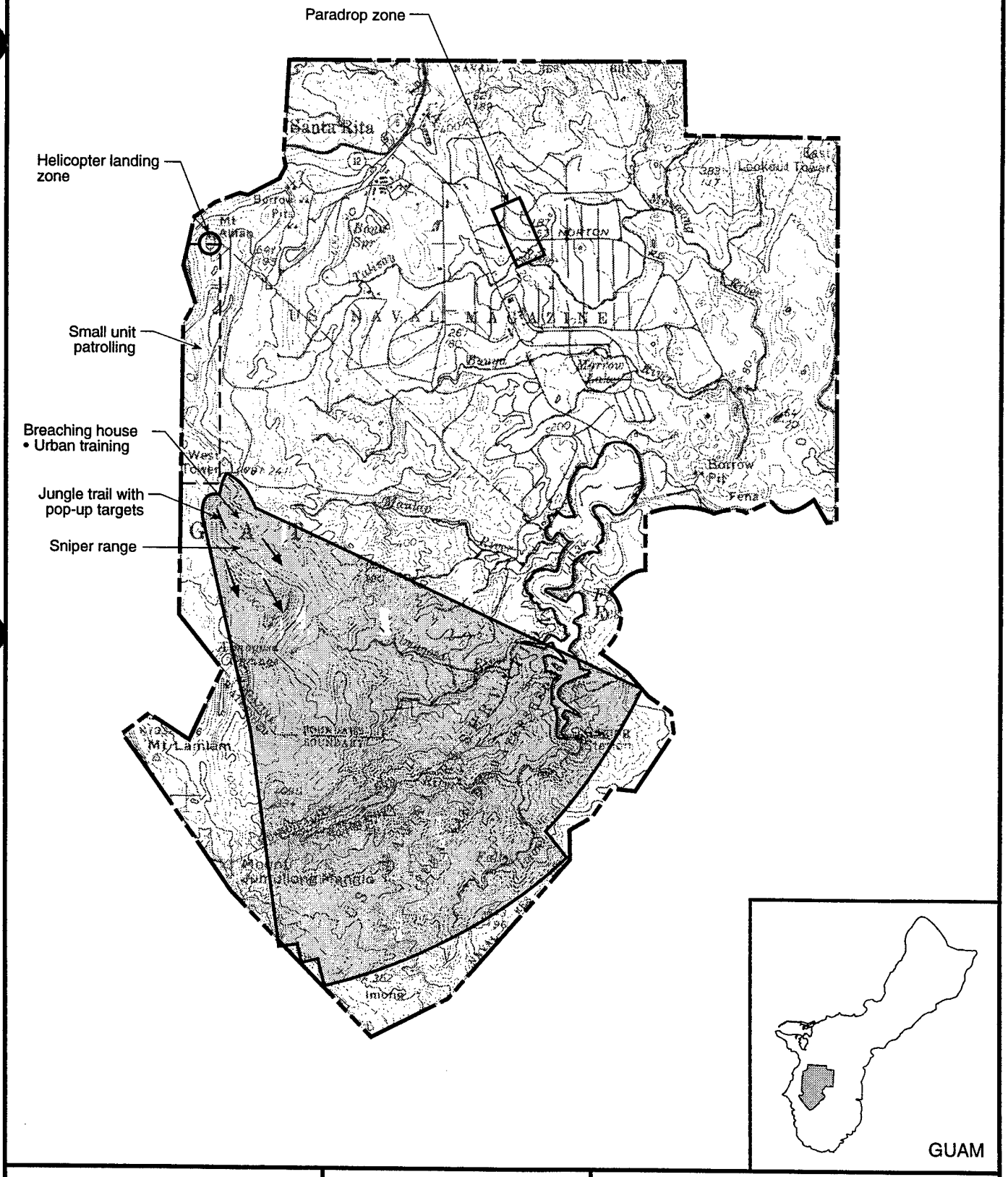
- Conduct **AAV beach landings** at Tinian's Unai Babui, one of the classic World War II amphibious landing sites (see Appendix B).

2.2.2 Combat and Combat Support Training

The Augmented Alternative proposes aviation training activities at AAFB, on Rota, and a number of new ordnance training locations and capabilities on Guam, Tinian, and FDM.

- Allow **helicopter insertions and extractions** to the existing Dandan LZ and to the rappelling tower area at Orote Point.

- Develop a **new sniper range** in the Ordnance Annex on Guam (see Figure 2-7). Only minimal ground disturbance would be required to develop the range for 7.62 mm sniper weapons. The range area would remain in its natural state, with firing positions designated in the vicinity of the West Tower lookout. Targets would be of simple metal and lumber construction, hand carried in from existing roads. Areas for target placement will be designated so as to not disturb archaeological and natural resources. Minimal vegetation would be cleared, since training is conducted by only three to five snipers operating under stealth conditions and firing on a limited number of targets that are designed to blend into the surroundings. A heavy day of shooting would put approximately 100 rounds down range. The conceptual SDZ is illustrated in Figure 2-7.



Source: Marianas Training Plan Briefing Booklet

NORTH

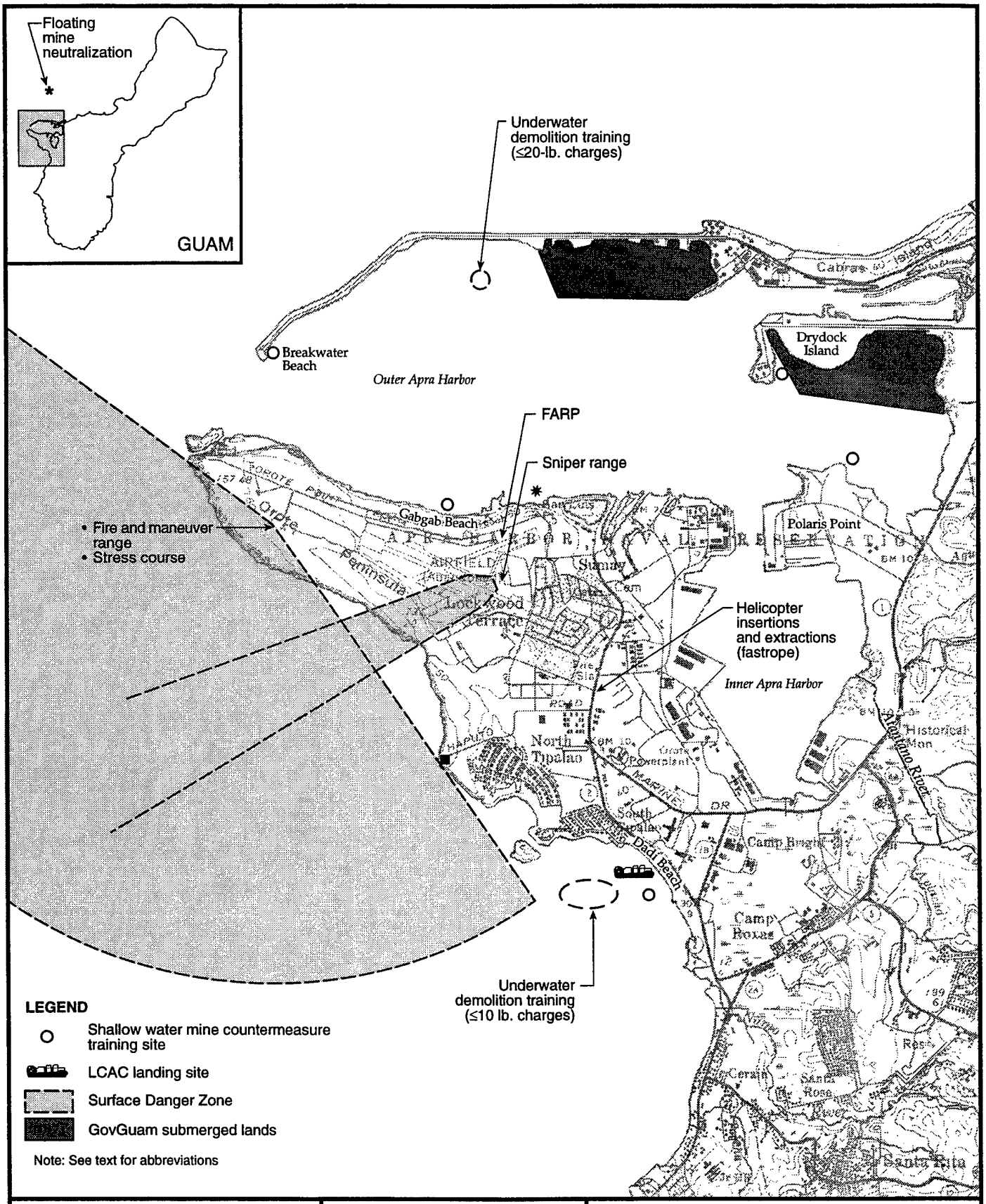
0 500 1000 (Meters)

0 2000 4000 (Feet)

LEGEND

Proposed Surface Danger Zone

Figure 2-7
PROPOSED NAVACTS GUAM ORDNANCE ANNEX TRAINING
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

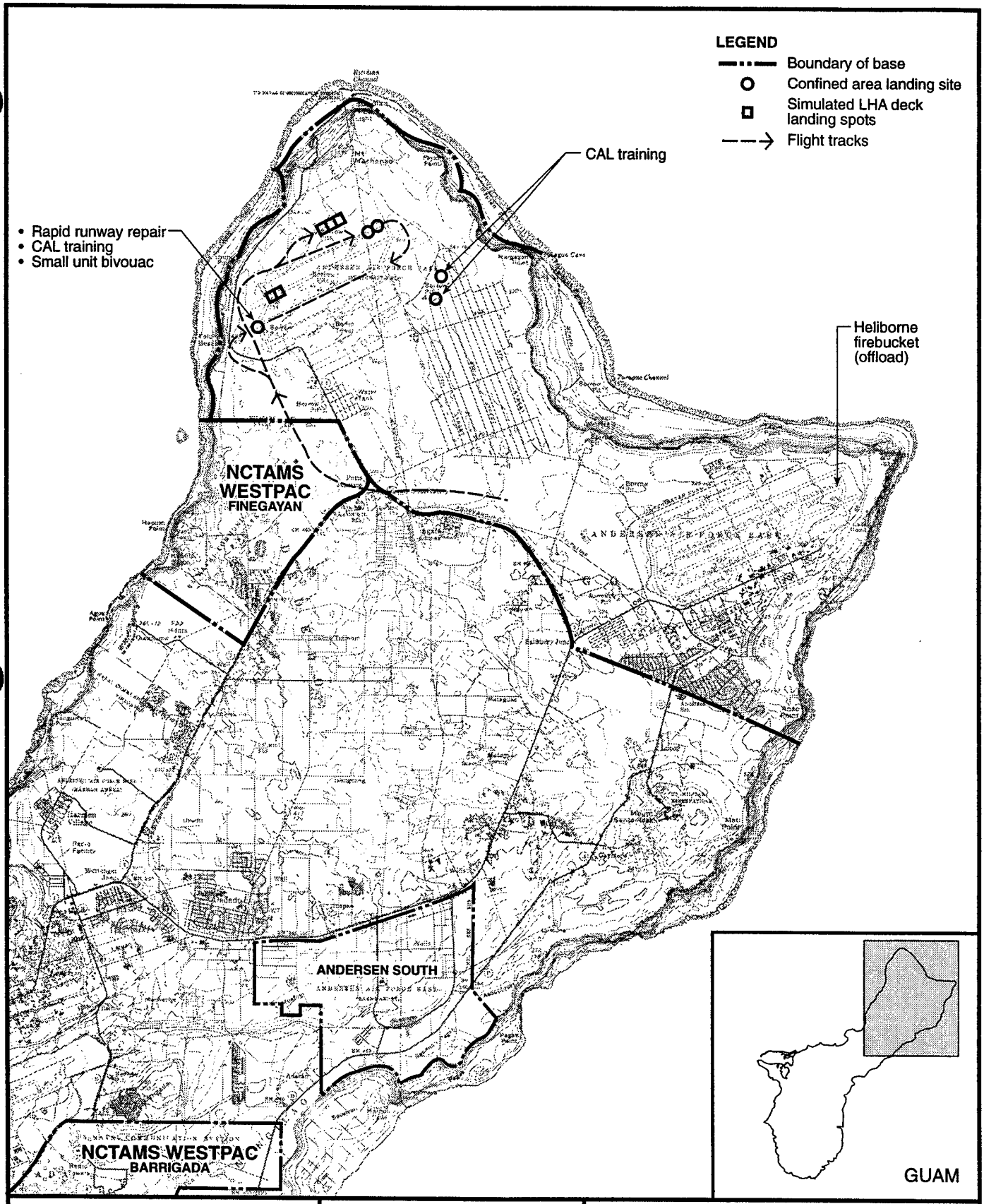


Source: Marianas Training Plan Briefing Booklet

0 500 1000 (Meters)

NORTH 0 2000 4000 (Feet)

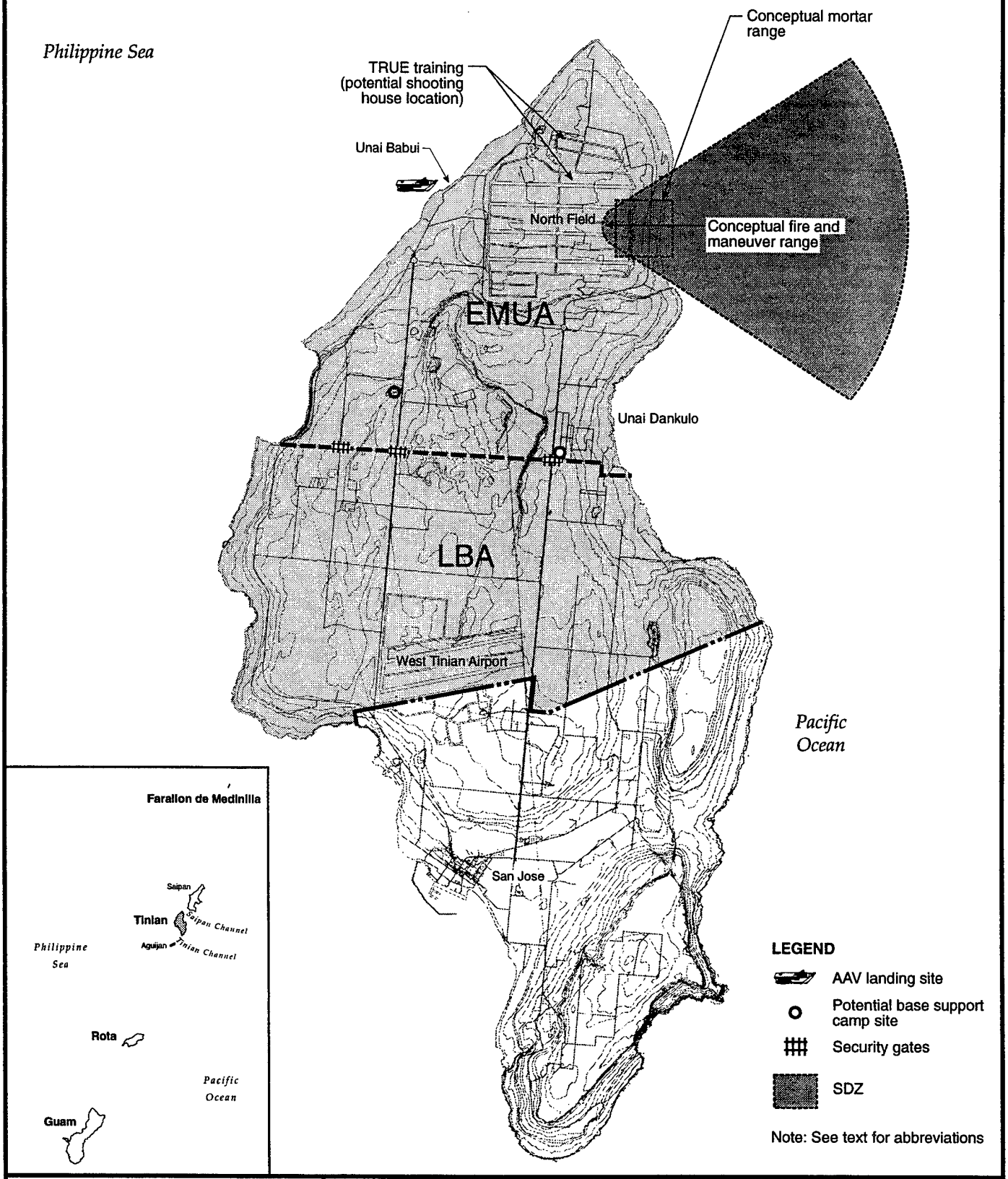
Figure 2-8
PROPOSED NAVACTS WATERFRONT ANNEX TRAINING
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997



Source: 360SS and HC5 LTR of Agreement ATC Procedures HC-5 Ops NW Field

Note: See text for abbreviations

Figure 2-9
PROPOSED ANDERSEN AIR FORCE BASE AND NCTAMS TRAINING
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997



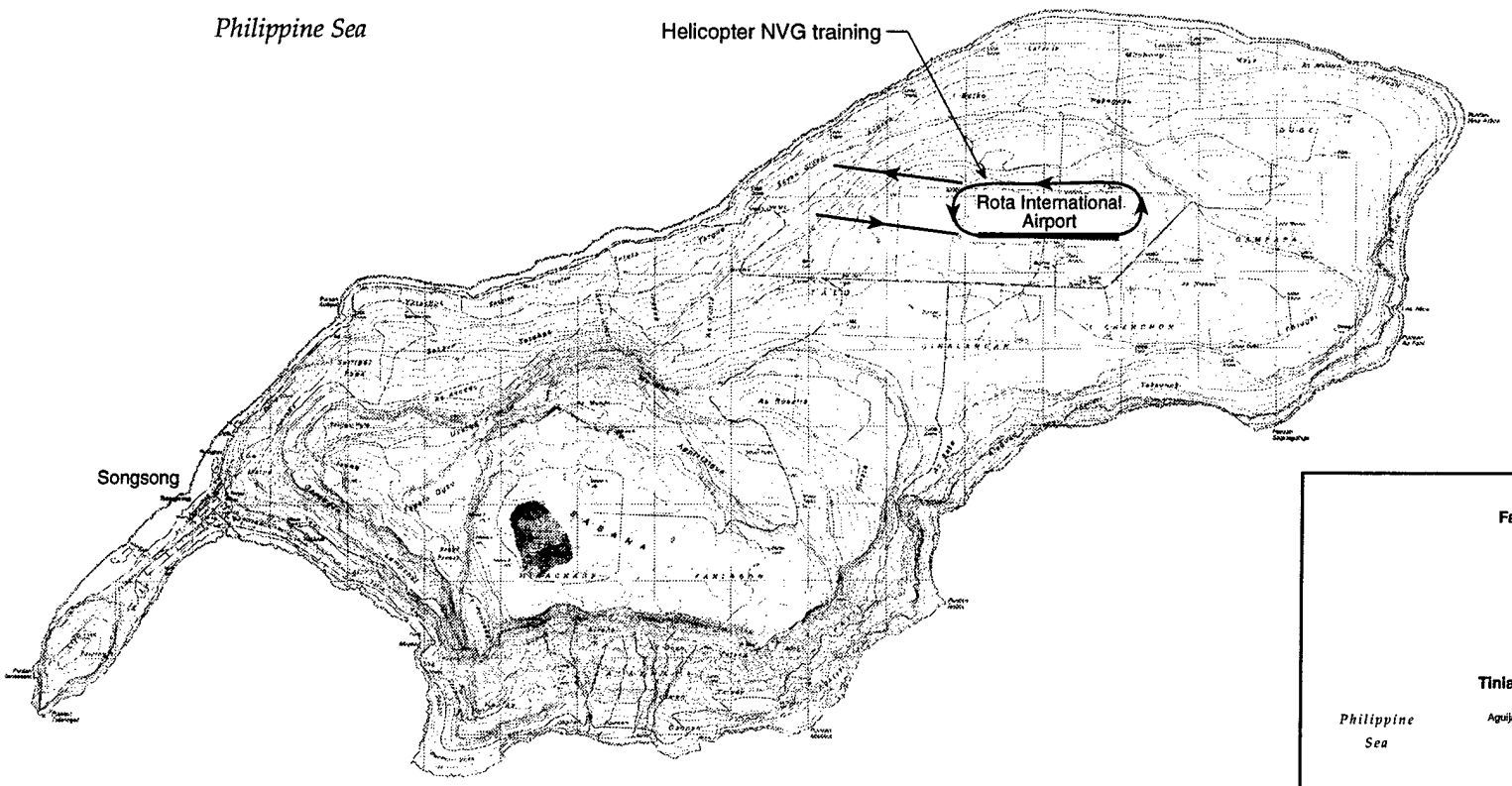
Source: Marianas Training Plan Briefing Booklet

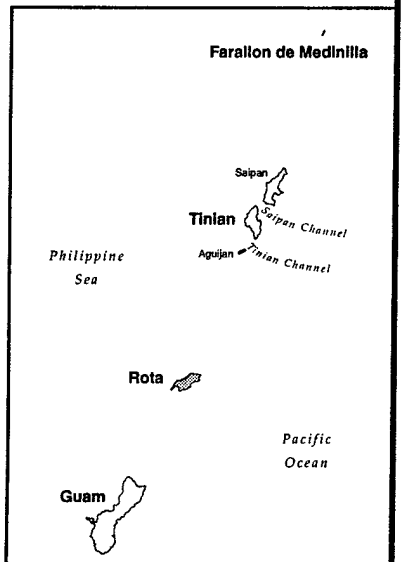
0 1000 2000 (Meters)

NORTH 0 4000 8000 (Feet)

Figure 2-10
PROPOSED TINIAN TRAINING

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997





Source: Marianas Training Plan Briefing Booklet

NORTH

0 1000 2000 (Meters)

0 4000 8000 (Feet)

LEGEND

Proposed helicopter flight track

NVG Night vision goggles

Commercial aircraft flight tracks

Figure 2-11
PROPOSED ROTA TRAINING

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

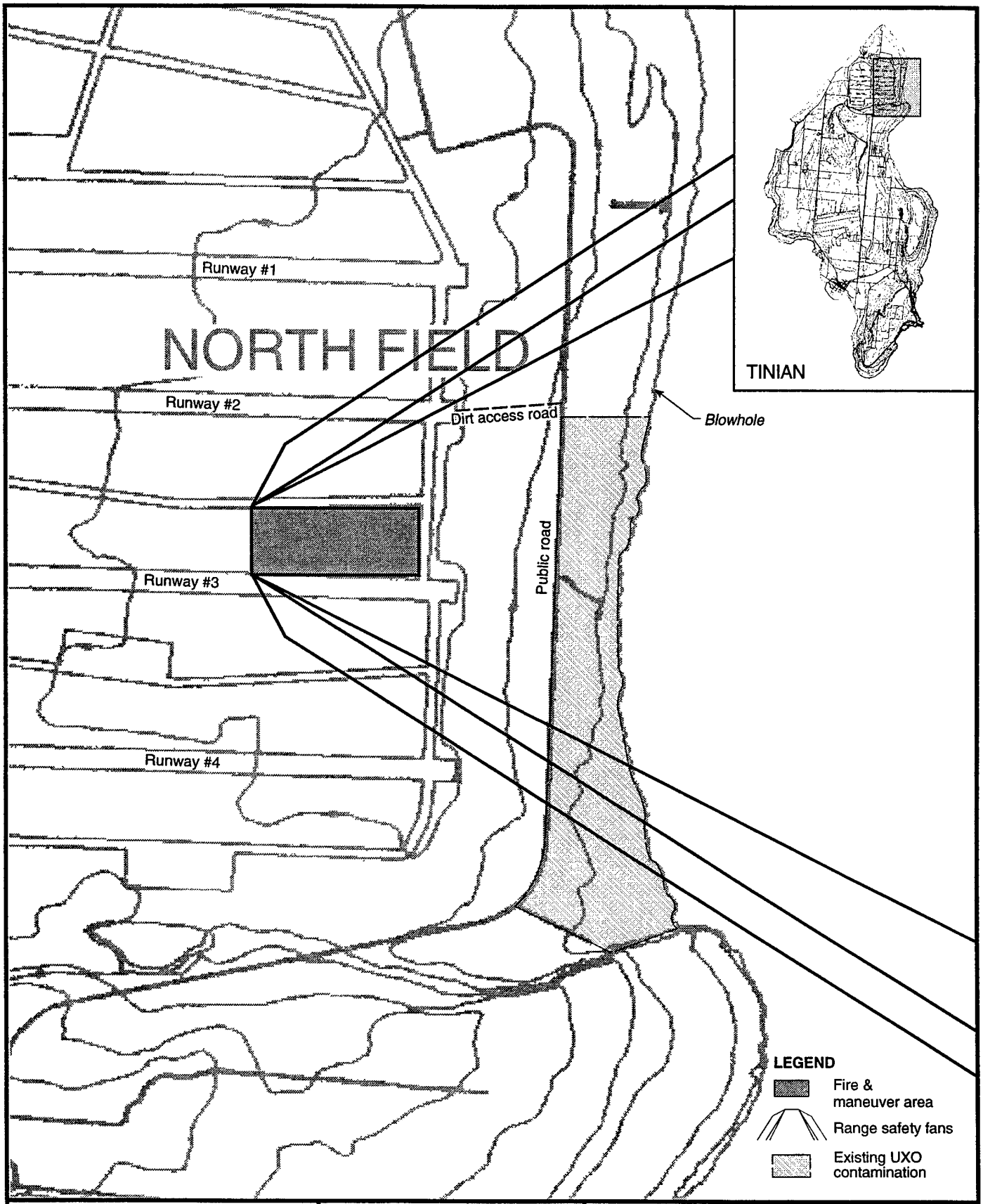
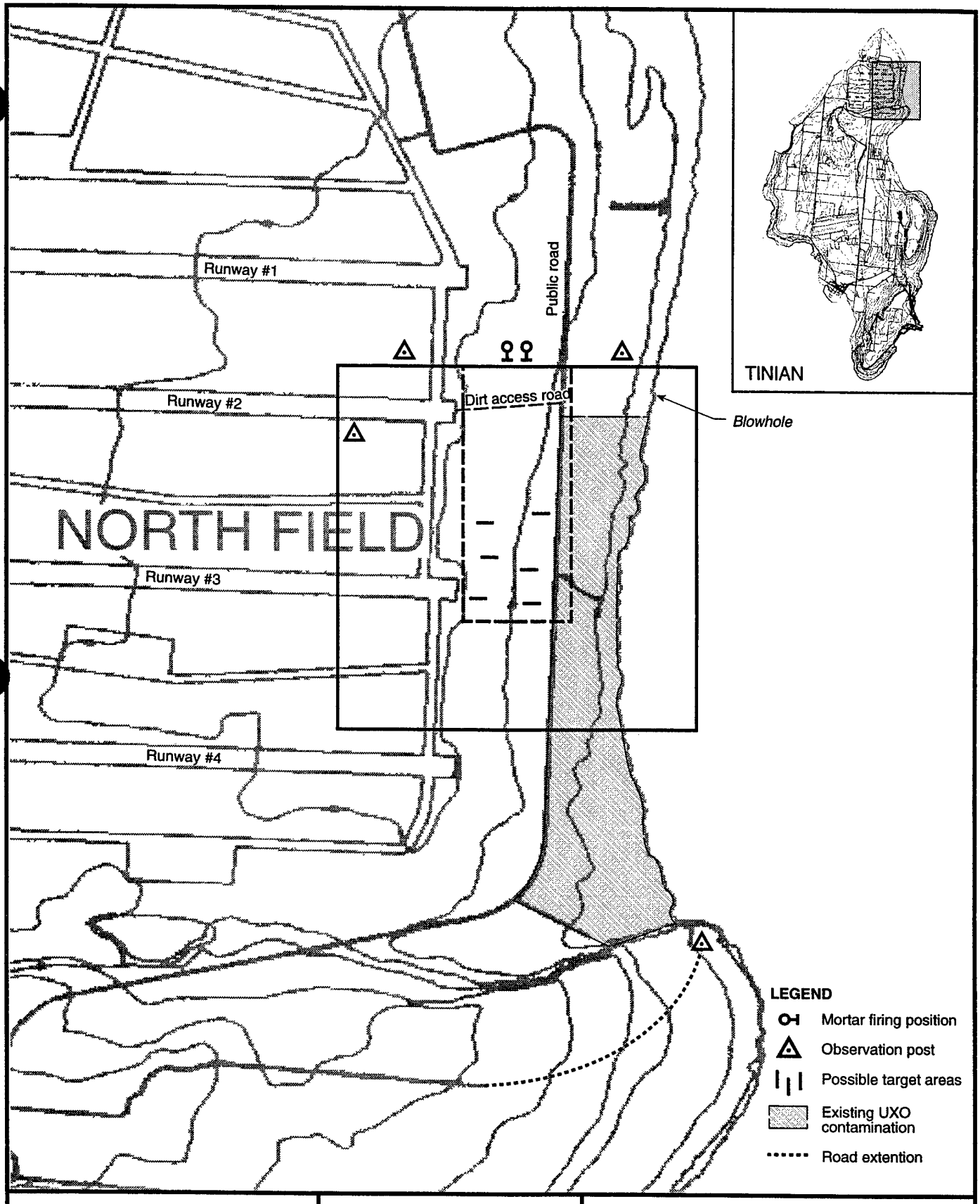


Figure 2-12
CONCEPTUAL FIRE AND MANEUVER RANGE ON TINIAN
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

342.0414/010-4 r1.3.97



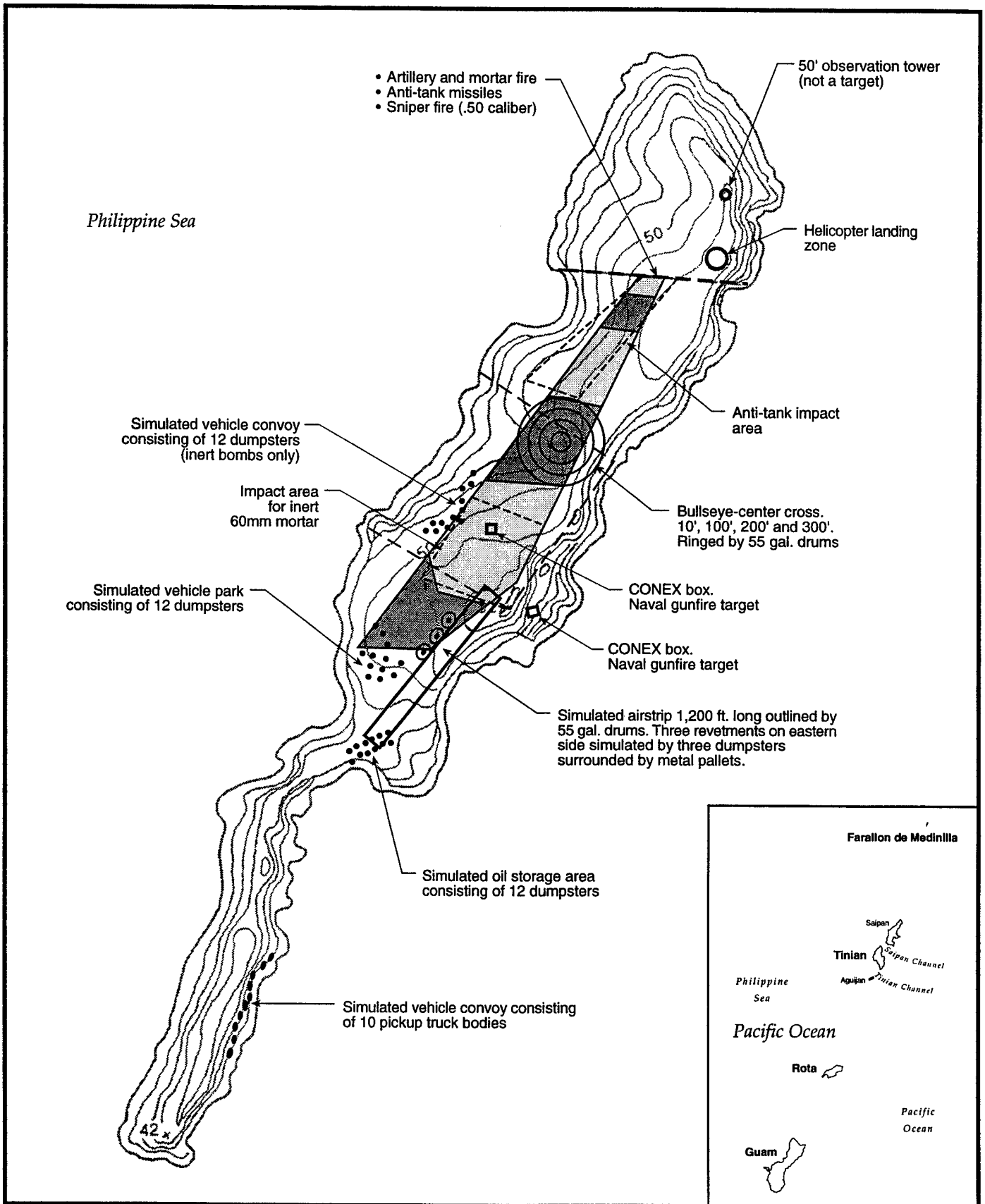
Sources: AR 385-63, MCO P3570.1A

NORTH

0 200 400 (Meters)

0 600 1200 (Feet)

Figure 2-13
CONCEPTUAL MORTAR RANGE ON TINIAN
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997



Source: Marianas Training Plan Briefing Booklet

NORTH

0 100 200 300 (Meters)

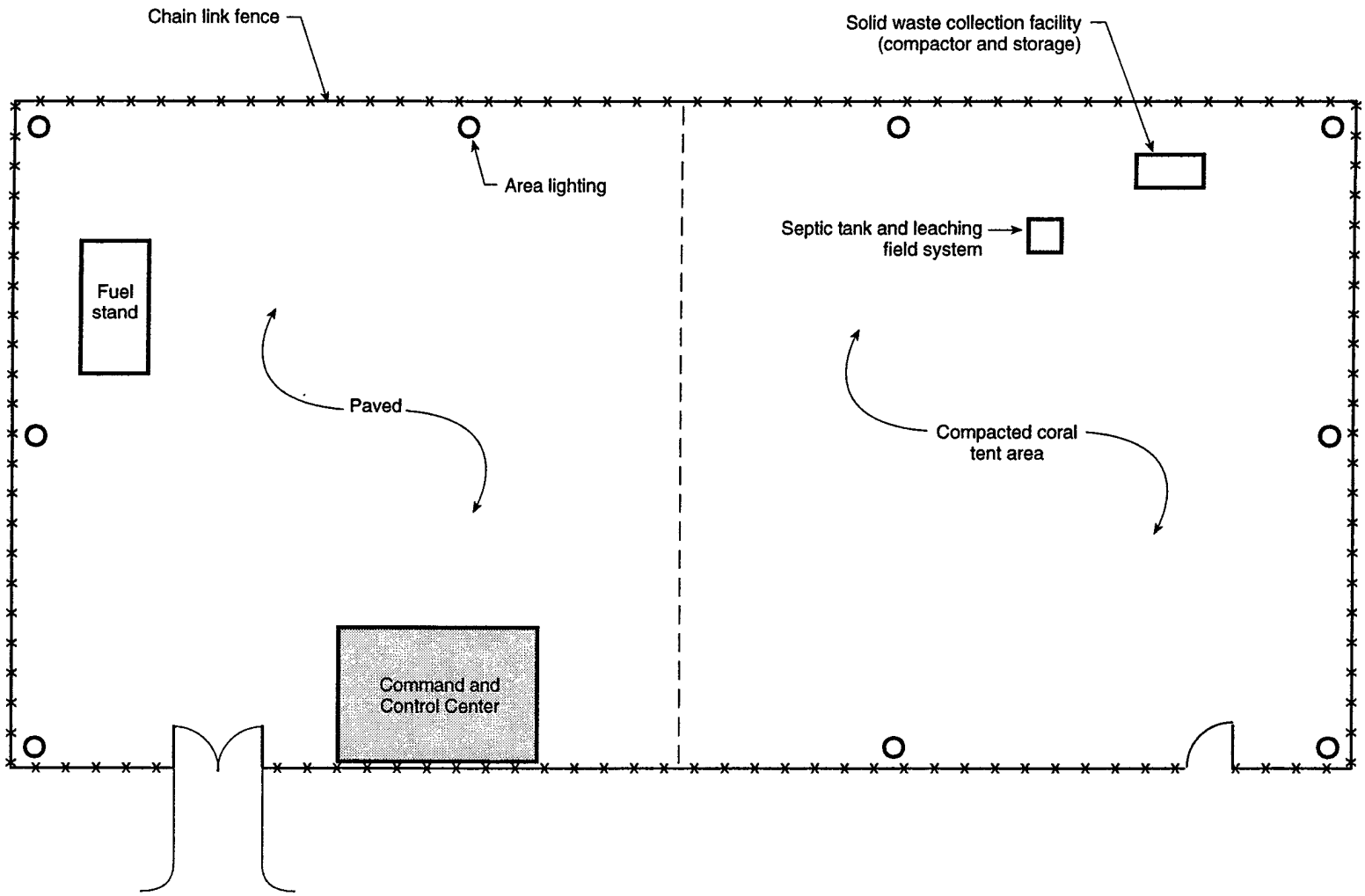
0 500 1000 (Feet)

LEGEND

Sniper targets area

Area not visible from firing line

Figure 2-14
PROPOSED FARALLON DE MEDINILLA TRAINING
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997



0 5 10 15 20 25 (Meters)

0 25 50 (Feet)

Note: See Figure 2-10 for proposed locations.

Figure 2-15
CONCEPTUAL BASE SUPPORT CAMP

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

- **Construct a breaching house** in the Ordnance Annex, inside the SDZ of the sniper range (see Figure 2-7). This would require clearing approximately 900 m^2 of vegetation and construction of a 196 m^2 concrete, covered structure. Forced entry techniques consist of using explosive breaching shape-charges or detonation cord to blast doors and windows inward. Instead of the armed trainees using live ammunition inside the structure, they will use non-lethal, simulated ammunition made of plastic (SIMUNITIONS). A minimal SDZ will be established for breaching operations employing the six-pound or smaller charges; no SDZ is required for the use of the simulated ammunition.

- Expand the existing Orote Point small arms range to include **fire and maneuver capabilities** (see Figure 2-8). This would require construction of a low earthen berm on the northeast side of the runway at a distance of 800 m from the target area. The new range would combine a stress course and obstacles with small arms (rifle and pistol) live fire.

- Provide for **additional underwater demolition training** in the Waterfront Annex (see Figure 2-8). Shallow water mine countermeasure training is proposed for five new locations within Apra Harbor and for locations offshore of Tipalao Beach and Dadi Beach south of Orote Point. Deep water demolition of charges up to 20 pounds is proposed for a location 750 m offshore of Dadi Beach, in approximately 100 m of water. Training with charges of up to 20 pounds is proposed for the existing deepwater demolition site in Apra Harbor (currently used with charges up to 10 pounds).

- Establish a **floating mine neutralization training area in open seas** northwest of Apra Harbor. The operating area would be approximately one square mile.[6] Floating mine neutralization is proposed by detonating a 10-pound explosive charge within 3 meters (10 feet) of the surface.

- On Tinian, **reconfigure the closed firing range** on the eastern coast of the EMUA to include a fire and maneuver range for small arms (up to 5.56 mm) and machine guns, and a mortar range for 60 mm mortars. The fire and maneuver range conceptually illustrated in Figure 2-12 would require constructing an earthen backstop berm west of the public road and limited removal of tangantangan brush.

  The mortar range would consist of an impact area extending approximately 700 m from the firing line, within a one km^2 safety box. It would include locations for observers and an additional 300 m-deep area for overshots. The mortar range illustrated in Figure 2-13 would not require any vegetation clearing or construction. Installation of either range would require certification (including plotting actual SDZs) by Navy Facilities Engineering Command, as well as notification of the FAA and U.S. Coast Guard (USCG).

- **Sweep** the north end of the impact area of the closed Tinian range for UFO. **Fence off** the remainder of this area, extending from approximately 100 m south of the blowhole to the access road to Unai Chiget. Post signs warning of the UXO hazard in this area.

- Conduct **live fire TRUE training** at the former Japanese air administration staff building northwest of Tinian's North Field in the EMUA. Small teams of special forces would set up temporary bullet traps in the northernmost room and along the western exterior wall and would conduct urban training, including live fire with 5.56 mm and 9 mm small arms.

[6]Operating area boundaries 13-30'N, 13-31'N, 144-39' E and 144-40' E.

- **Construct a shooting house** in the vicinity of North Field in the EMUA (see Figure 2-10). The construction activities and SDZ would be the same as those accomplished for construction of the Orote Point shooting house. The shooting house would be used for urban (TRUE) training.

- **Establish firing positions** at the north end of FDM for AT-4 anti-tank missile launchers, 60 mm mortars, artillery weapons, and .50 caliber heavy machine guns to fire down the length of the island (see Figure 2-14). This would require a thorough sweep of the area north of the firing line for UXO. Mortar and machine gun targets would be constructed of wood and designed to withstand typhoon winds. Antitank targets would be vehicle bodies or other low maintenance items which would not be destroyed by an AT-4 round. The weapons and their crews would be delivered and extracted by helicopter. (At present, there are no anti-tank (AT) missile, mortar, or artillery ranges in the Marianas.)

- **Establish sniper firing positions** north of the firing line on FDM. At present, no one goes ashore for firing of any weapon system.

- **Upgrade targets on FDM** to provide realistic sights to air crew from tactical altitudes. Target materials would consist of painted tires, vehicle carcasses with all drive train components and glass removed, shipping containers, and sandbags. A small bunker would be constructed on FDM to shield personnel conducting the laser target designation.

- Use the Rota International Airport for night helicopter training using **night vision goggles** (see Figure 2-11).

2.2.3 Combat Service Support and Logistics Training

- **Conduct rapid runway repair** and **bivouac exercises** at Northwest Field (see Figure 2-9).

- **Construct security gates** at the Broadway and 8th Avenue entrances to the EMUA to temporarily control public access during range use (see Figure 2-10).

- Because there is no permanent military facility and no personnel stationed on Tinian, the Augmented Alternative proposes **construction of a small base support camp** to facilitate logistics support of training units (see Figure 2-15). Proposed locations are at the two main roadway entrances to the EMUA (see Figure 2-10). One of the two locations is within the site recently assigned to the Voice of America (VOA) program for installation of a transmitting station. The camp would be manned only during exercises and would be available as a small unit command and control center. It would include showers, toilets, a septic tank and leaching field system, gas and diesel fuels stand with aboveground fuel tanks, a small electrical generator, and utilities. The camp would be surrounded by a chain-link security fence. The other location is an undeveloped site on Broadway at the EMUA boundary.

- **Conduct heliborne firebucket training** on AAFB Main Base runways.

2.3 MITIGATED SET OF TRAINING ACTIVITIES

The Mitigated Alternative consists of many but not all proposed new training and locations, somewhat modified to avoid causing significant impacts on the environment. This alternative was

developed in response to potential impacts identified for the Augmented Alternative. Most of the modifications limit the locations in which certain types of activity can occur. Three types of constraint have been defined and applied to specific locations (Figures 2-16 through 2-21):

- NGD (no ground disturbance): No excavation permitted and no vehicles allowed offroad
- NWD (no wildlife disturbance): No pyrotechnics, no live ammunition or demolition, no motor vehicles offroad, no mechanical vegetation clearing, no helicopter hovering, no helicopter LZs
- OL (off limits): No training activities allowed, except troop and vehicle movement along established roads

Modifications to activities proposed in the Augmented Alterative are described below under the headings of Introduction of Forces, Combat and Combat Support Training, and Combat Service Support. The Mitigated Alternative activities are identified in Table 2-1.

2.3.1 Introduction of Forces

This alternative proposes all means of force introduction included in the Augmented Alternative, except for the following restrictions:

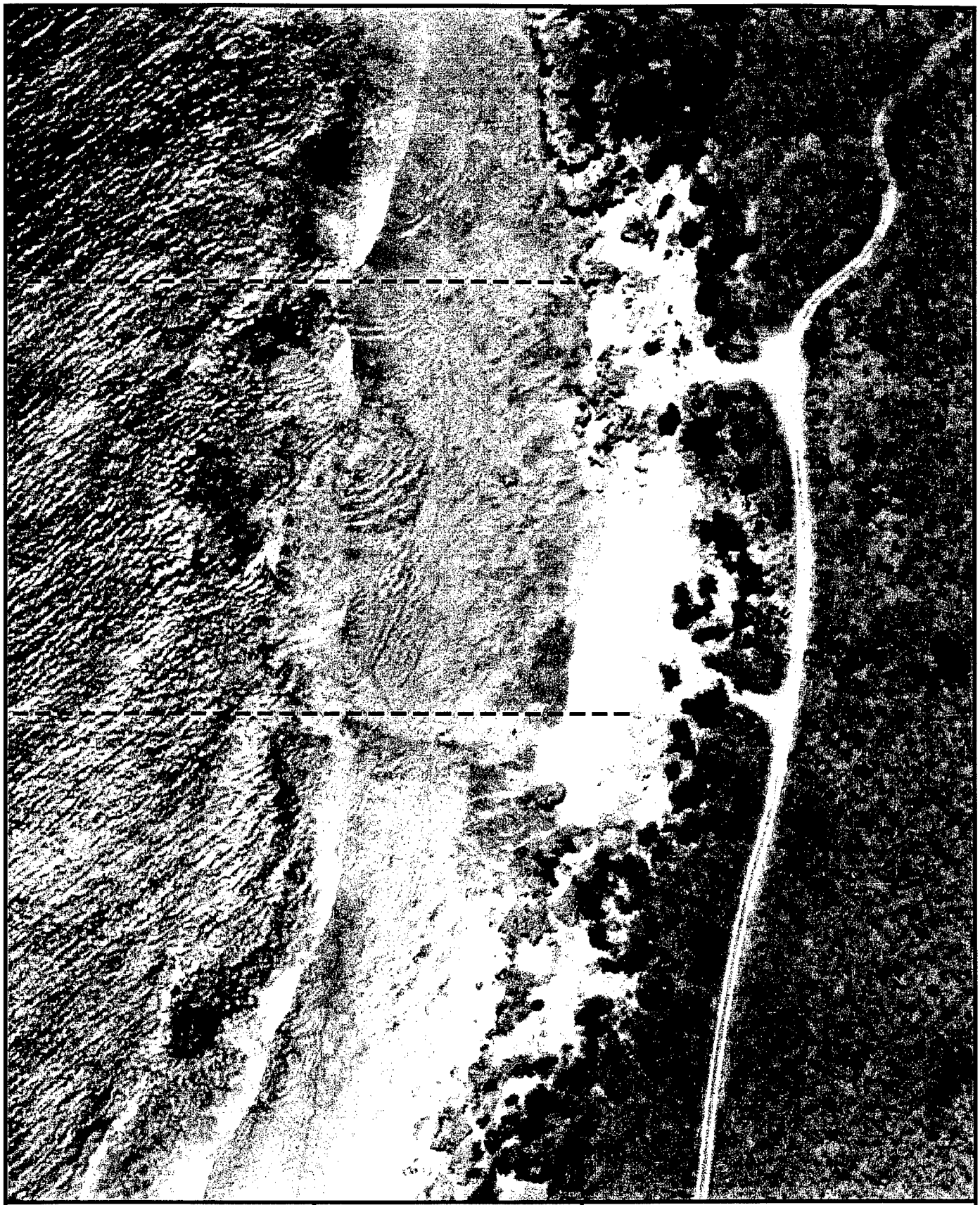
- AAVs landing at Unai Babui (Tinian, EMUA) will be restricted to a single file approach within the approximate area shown on Figure 2-16. Upon reaching the beach, vehicles will be restricted to unvegetated areas and existing roadways.
- LCAC landings at Dadi Beach (Waterfront Annex, Guam) will be permitted only after an archaeological survey of the proposed landing area.

2.3.2 Combat and Combat Support Training

In addition to the constrained areas (NGD, NWD, and OL) defined in Figures 2-17 through 2-21, the following modifications of new combat and combat support activities are proposed in this alternative:

- Northwest Field aviation training (FCLPs, CALs, LHA helicopter spot landings, and paradrops) must avoid an area 1.85 km (one nautical mile) in diameter around all known Mariana crow nesting areas during breeding season (approximately October 15-April 15). The same restriction will apply to overflights of the Tarague cliffline. Actual nesting sites will be identified by DAWR.
- Paradrops at AAFB's Northwest Field will occur from aircraft flying no less than 305 m AGL during crow nesting season.
- No shallow water mine countermeasures training will be conducted offshore of Gabgab Beach.
- No ground-based weapons training will be conducted on FDM.

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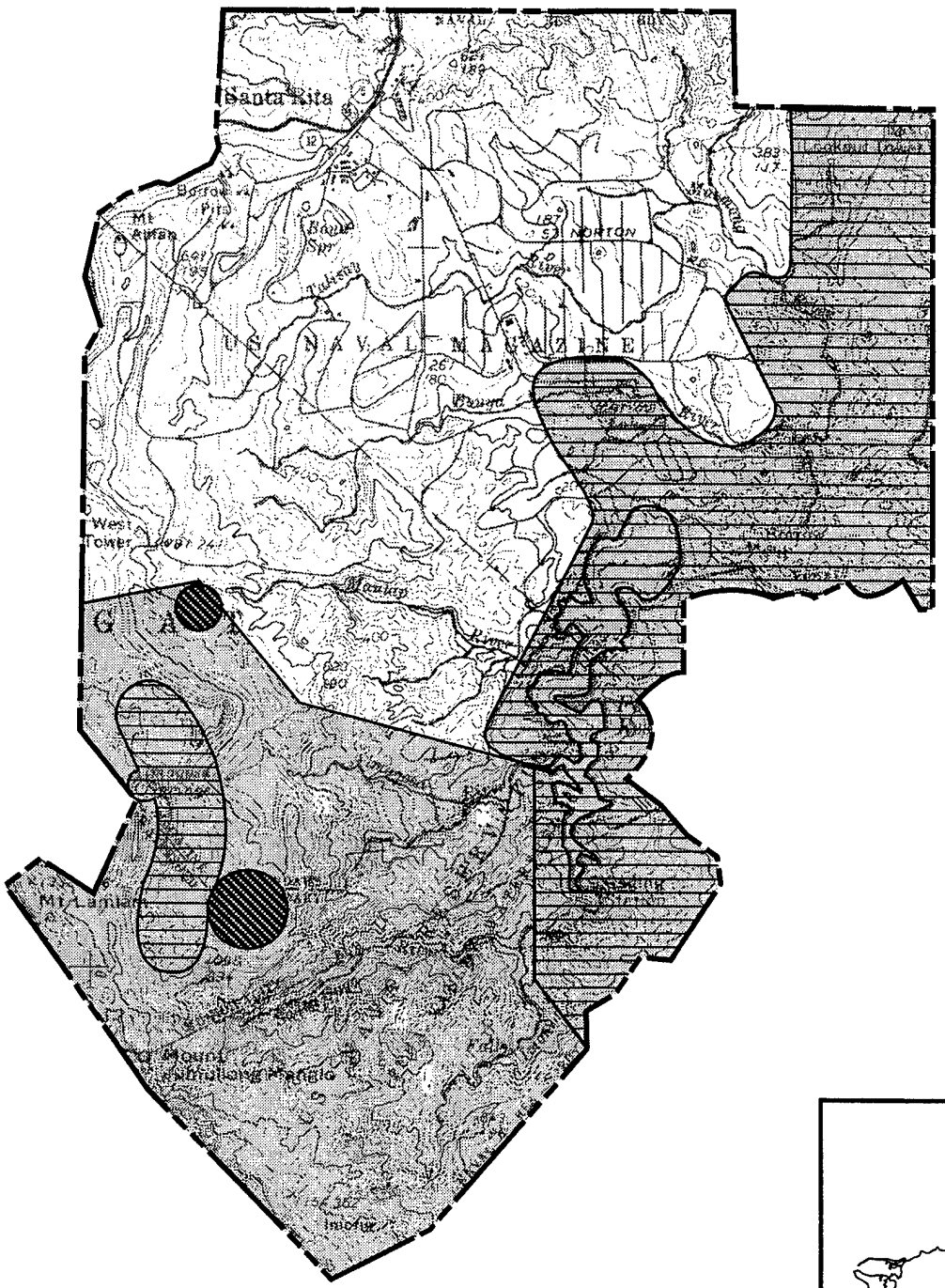
NORTH

0 10 20 (Meters)

0 40 80 (Feet)

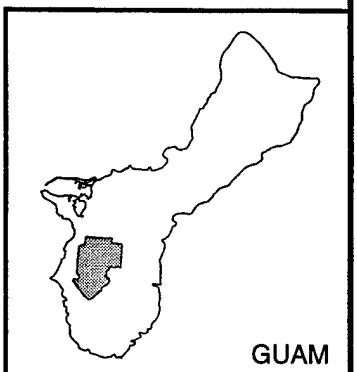
AAV approach lane 15m wide to be surveyed and permanently designated between dashed lines.

Figure 2-16
APPROXIMATE AAV LANDING AREA, UNAI BABUI
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997



LEGEND

- No offroad ground disturbance (NGD)
- Off limits (OL)
- No wildlife disturbance (NWD)



NORTH

0 500 1000 (Meters)

0 2000 4000 (Feet)

Figure 2-17
NAVACTS ORDNANCE ANNEX CONSTRAINED AREAS
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

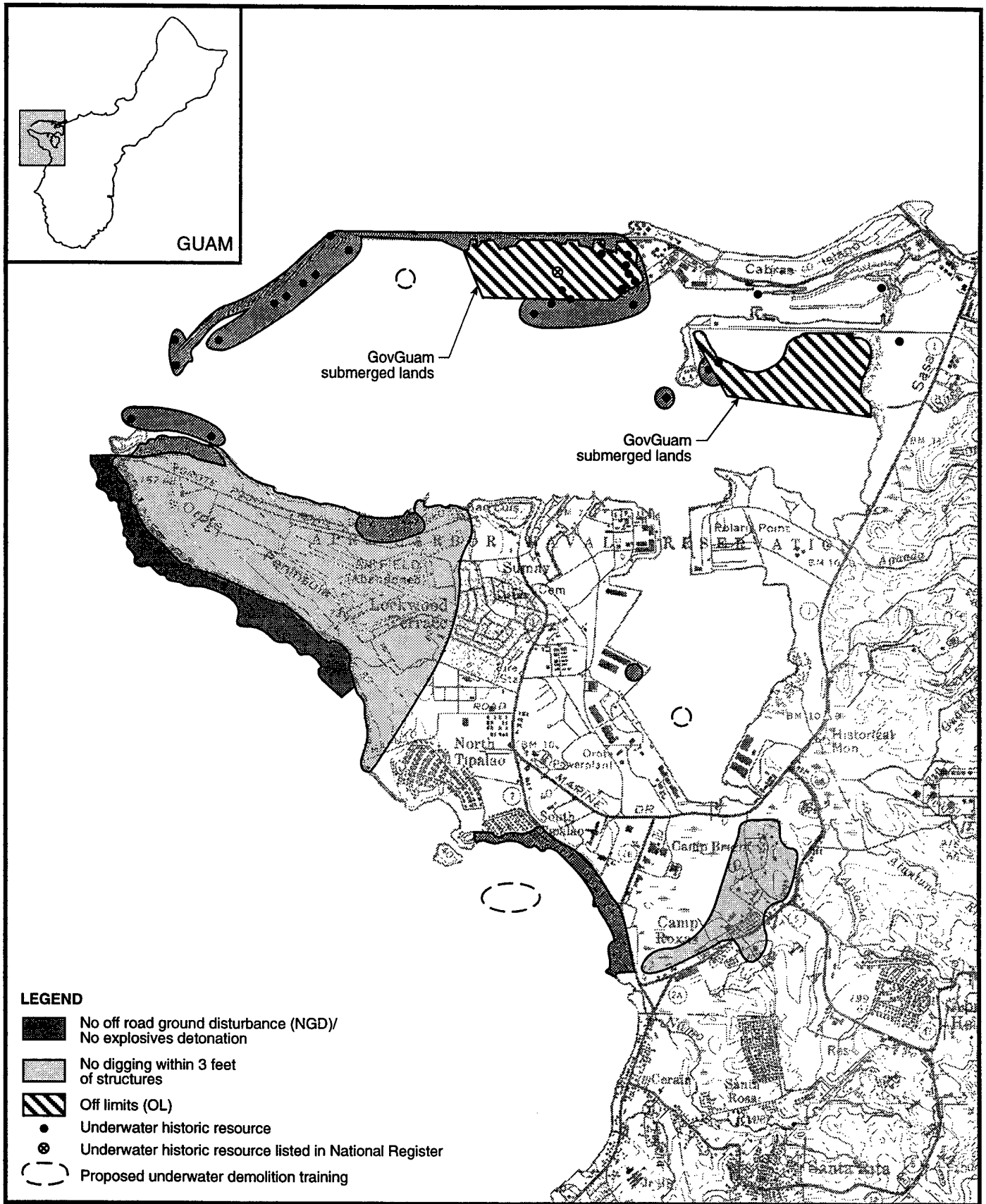


Figure 2-18
NAVACTS WATERFRONT ANNEX
CONSTRAINED AREAS
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

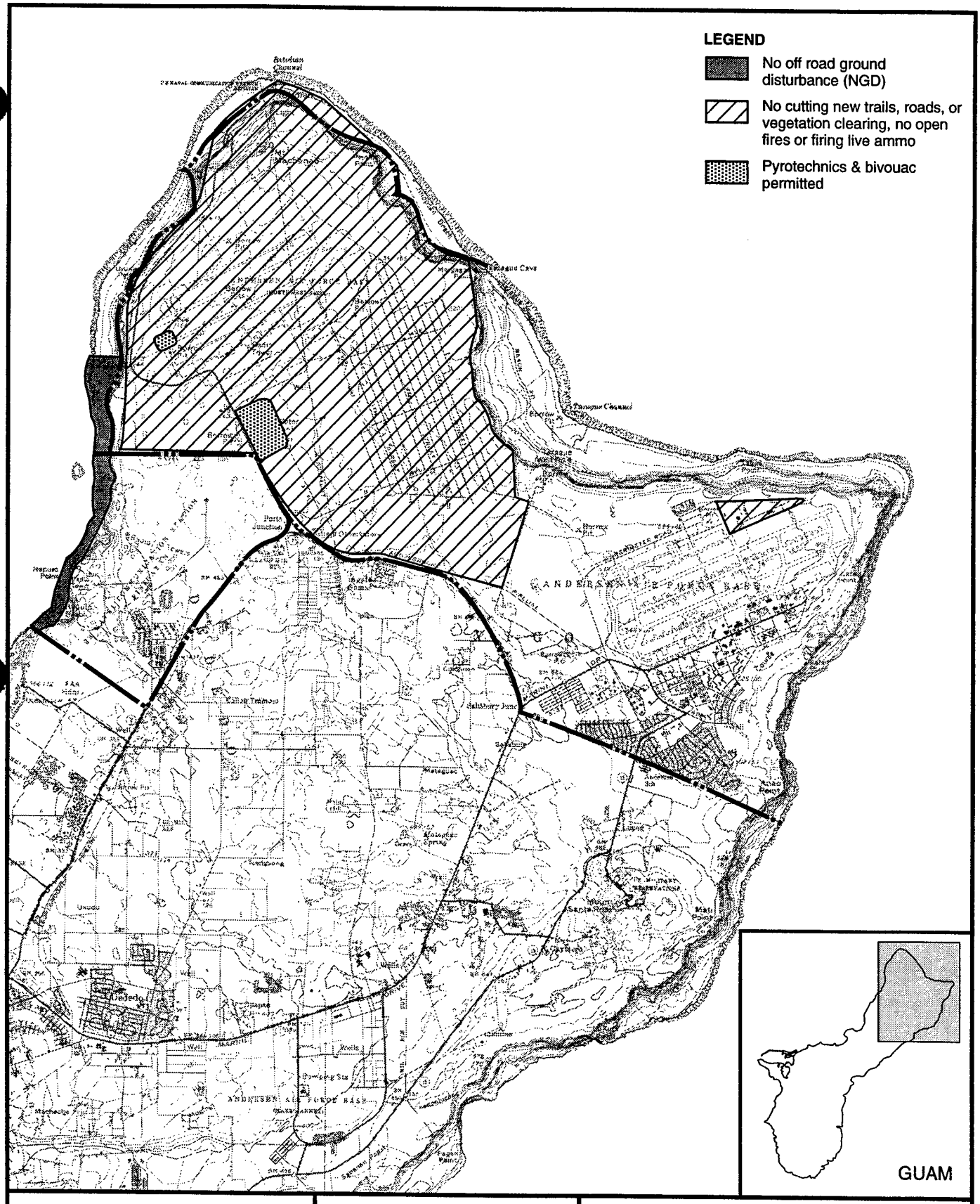
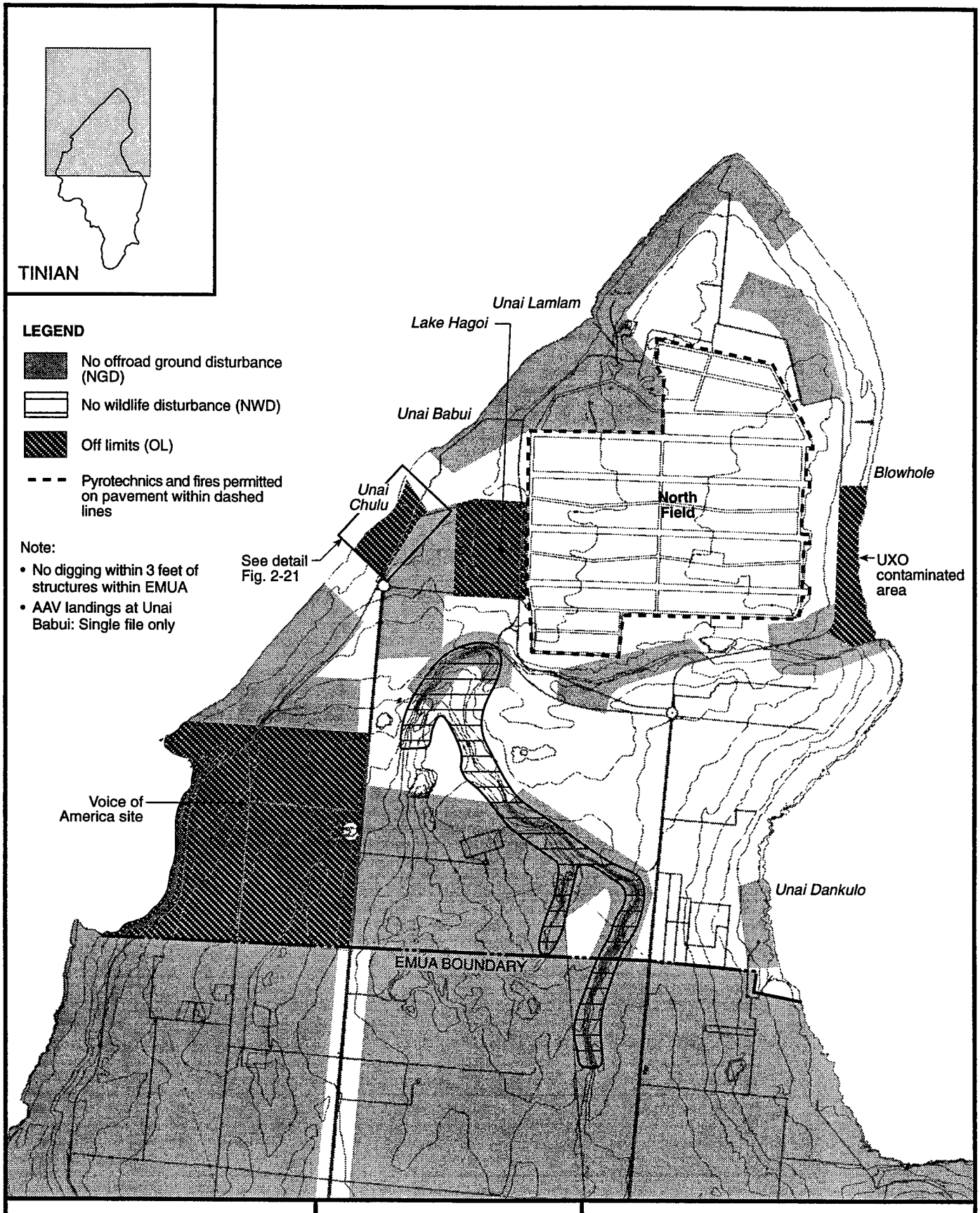


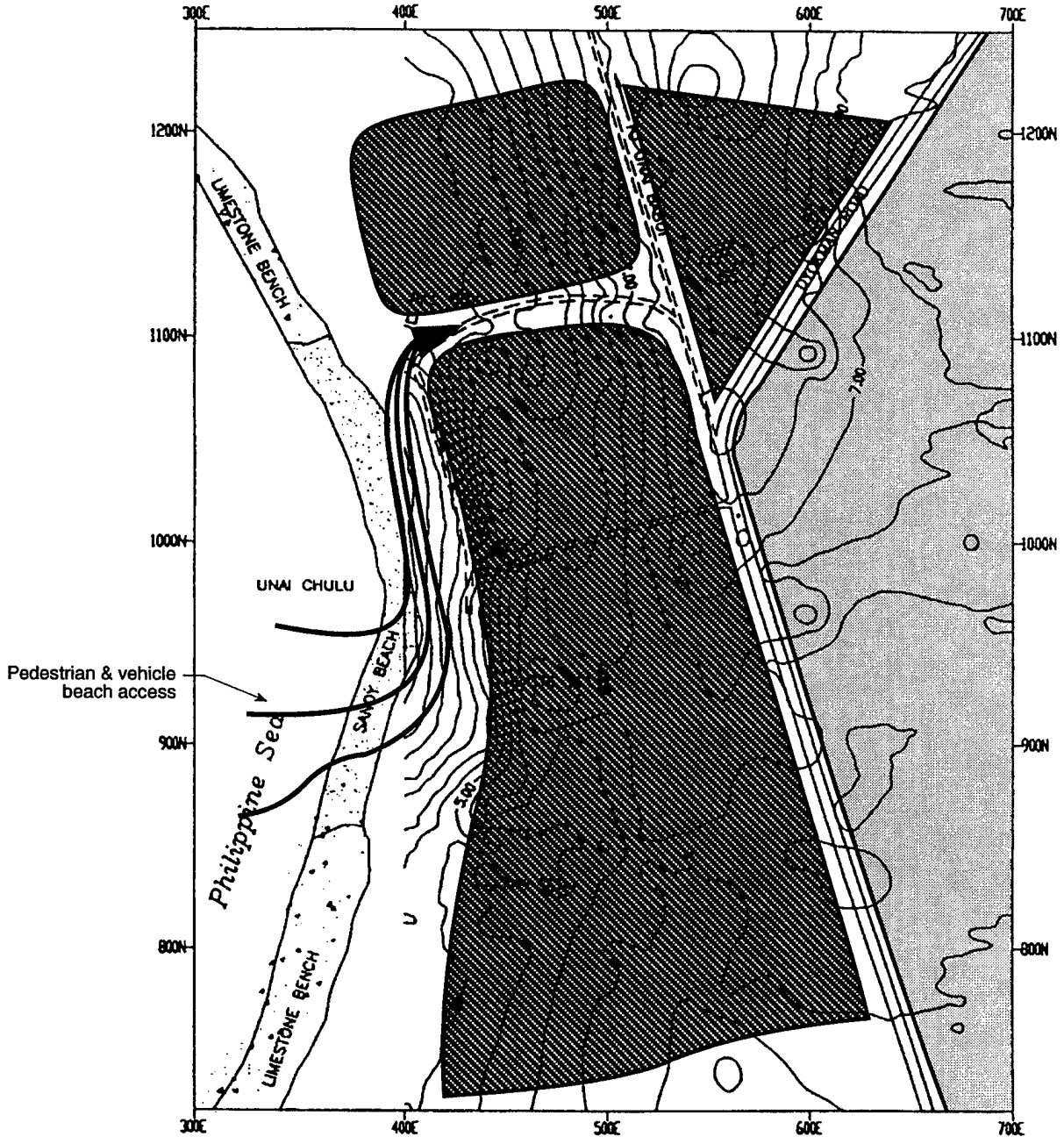
Figure 2-19
ANDERSEN AIR FORCE BASE, NCTAMS CONSTRAINED AREAS
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997



Note: See text for details of constraints.

Figure 2-20
TINIAN CONSTRAINED AREAS

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997



LEGEND

- Permissible vehicle traffic areas
- No offroad ground disturbance
- Off limits

Source: IARII (Sept. 1996) *Prefinal Military Excercises and Historic Sites in the Military Lease Area of the Island of Tinian, CNMI: An Archaeological Assessment*

NORTH

0 25 50 75 100 (m)

0 50 100 150 200 (ft)

Note: Contour lines at 0.5m intervals.

Figure 2-21
DETAILED CONSTRAINTS AT UNAI CHULU
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

2.3.3 Combat Service Support and Logistics Training

There are no modifications of the construction projects proposed for Tinian in the Augmented Alternative, i.e., security gates, a small base support camp, and fencing the UXO-contaminated area south of the blowhole. There are no modifications for additional support training at Northwest Field.

2.4 COMPARISON OF ALTERNATIVES

This section compares the training results and impacts of the three alternatives.

2.4.1 Proposed Activities and Locations of Three Alternatives

There are very few differences in the training activities included in each of the three alternatives. Most activities and supporting facilities (i.e., live fire ranges and logistics support areas) already occur or are present at one or more of the DoD-controlled land areas addressed in this study. The Augmented and Mitigated Alternatives include only four activities not already ongoing at some location in the Marianas (Table 2-2). The first three items in the table are included in both action alternatives, but are somewhat modified under the Mitigated Alternative.[7] Fire and maneuver training, sniper fire, and mortar fire are included in both action alternatives, but live fire of artillery and antitank missiles is included only in the Augmented Alternative.

The primary difference among the alternatives is in the locations proposed for both new and ongoing activities (Table 2-3; see also Figures 2-1 through 2-15).

Table 2-2
Newly Proposed Activities

Proposed Activity	Augmented Alternative	Mitigated Alternative
Amphibious assault vehicles (AAV) landings (Unai Babui)	yes	yes
Underwater demolition of 20-pound changes (Apra Harbor)	yes	yes
Shallow water mine countermeasures training (Apra Harbor)	yes	yes
Live fire of certain weapons (mortars, .50 caliber sniper rifles, machine guns, artillery, and anti-tank missiles) and fire/maneuver training (Tinian, FDM)	yes	No machine guns, artillery, or anti-tank missiles

[7] In each case, activities are severely constrained by location.

Table 2-3
Newly Proposed Locations for Ongoing Activities

Proposed Location	Augmented Alternative	Mitigated Alternative
Ordnance Annex: live fire, urban training, and paradrops	yes	yes
Waterfront Annex: additional underwater demolition location, LCAC landings	yes	yes
Rota: helicopter NVG training	yes	yes

2.4.2 Training Results of Three Alternatives

The three alternatives do not all meet the purpose and need for training in the Marianas, i.e., the need for units to conduct all required certification and qualifications training without traveling to Hawaii or the continental U.S. Table 2-4 identifies training needs not met by some or all of the alternatives; numbers in parentheses indicate the number of locations proposed.

Table 2-4
Differences Among Alternatives: Meeting Training Needs

Training Needs	No Action	Augmented Set of Training Activities	Mitigated Set of Training Activities
Provides 60 mm mortar range for Guam National Guard and Army Reserve certification training?	no	yes (2)	yes (1)
Provides sniper ranges for special operations?	no	yes (2)	yes (2)
Provides fire and maneuver ranges?	no	yes (2)	yes (2)
Provides shooting and/or breaching house(s) for urban training?	yes (1)	yes (3)	yes (3)
Provides AAV landing training for Marines?	no	yes (1)	yes (1)
Provides realistic AAV landing scenario?	no	yes (1)	no
Provides combined arms training?	no	no	no
Provides artillery and anti-tank missile fire?	no	yes (1)	no
Provides shallow water mine countermeasures training?	no	yes (7)	yes (6)
Provides area for logistics support on Tinian?	no	yes (1)	yes (1)

Note: Number in parentheses identifies number of different locations.

2.4.3 Impacts of the Three Alternatives

In general, the Augmented Alternative would be likely to generate significant impacts which cannot be mitigated, while the other two alternatives are more likely to generate non-significant impacts. The differences are made explicit in the description of the Mitigated Alternative (Section 2.3),

which was designed specifically to avoid or reduce all significant potential impacts of the Augmented Alternative. For example, the AAV landings proposed in the Mitigated Alternative are limited to a narrow lane of approach to mitigate damage to coral offshore of Unai Babui. Another example is that the Mitigated Alternative prohibits LCAC landings at Dadi Beach until such time as the beach has been surveyed for possible archaeological resources. In addition to such activity-specific mitigations, the various land use constraints included in the Mitigated Alternative are designed to mitigate impacts which would otherwise result from training on the affected lands.

Another way of comparing the alternatives is to consider short-term, long-term, and cumulative impacts, all of which are discussed and itemized in Chapter Four. In terms of short-term and cumulative impacts, the three alternatives are virtually identical. The Augmented Alternative would generate the most long-term (significant) impacts.

Most **short-term impacts** (which were determined to be non-significant) are common to many training activities. They include temporary disturbance of wildlife, rare or occasional inconvenience to tour operators and tourists, rerouting requirements and/or delays for traffic (land, air, and sea), temporary damage to road surfaces, temporary shortage of store supplies (Tinian), and littering.[8] The newly proposed activities (see Table 2-2) do not add to the list of short-term impacts, so there is no difference among the alternatives.

Long-term impacts, essentially permanent, are greatest under the Augmented Alternative. These impacts consist primarily of disturbance of an endangered species population, or destruction of significant archaeologic or historic resources. The Mitigated Alternative is intended to avoid most long-term impacts. The exception is long-term UXO contamination in the impact area of the proposed mortar range, which will be mitigated by sweeping the area for UXO and fencing it off to prevent public safety hazards. Note that, in contrast to the No Action Alternative, both the Augmented and Mitigated Alternatives would mitigate potential long-term public safety impacts generated by past use of the former live-fire range on Tinian.

Cumulative impacts, which are caused by repetition of otherwise non-significant impacts from the proposed action and from interaction of the proposed action with unrelated projects, are somewhat greater under the No Action Alternative than under the two action alternatives. Both action alternatives provide relief from cumulative impacts on Tinian's infrastructure. The land use constraints included in the Mitigated Alternative—i.e., NGD, NWD, and OL—mitigate potential cumulative as well as long-term impacts to archaeological and historic resources, as well as to threatened and endangered species.

[8]All of these impacts were analyzed and associated mitigation was proposed for the two most recent Tandem Thrust exercises on Tinian. Belt Collins & Associates (June 1993 and November 1994).

CHAPTER THREE
ENVIRONMENTAL SETTING

The purpose of this chapter is to provide adequate background for the reader to understand the potentially significant impacts of alternatives compared in Chapter Two. Chapter Four provides a more detailed discussion of conditions relevant to the significant issues identified.

3.1 REGIONS OF INFLUENCE

The Mariana Islands are a chain of 15 volcanic islands located in the western Pacific Ocean, roughly 5,790 kilometers (km) west of Hawaii and 2,250 km south of Japan. The island chain extends approximately 800 km, from Guam in the south to the uninhabited active volcano of Farallon de Pajeros in the north. Guam is approximately 52 km long with a land area of 542 square km; Tinian is about 20 km long and has a total land area of 105 square km; Rota is 19 km long and has a land area of about 83 square km; and Farallon de Medinilla (FDM) is approximately 1.6 km long and has a land area of 0.9 square km.

The primary regions of influence are the military lands on each of these islands or areas that will be directly affected by military training activities (see Figures 1-2, 2-4, and 2-6). Secondary regions of influence include community or habitat areas surrounding the primary regions.

3.2 PHYSICAL ENVIRONMENT OF THE MARIANA ISLANDS

This section presents a general overview of the physical environment of the Mariana Islands, including climate, geology, hydrology, water quality, air quality, noise, visual setting/aesthetics, and natural hazards and constraints. Some details specific to each island of concern are also presented when appropriate.

3.2.1 Climate

The Mariana climate is generally warm and humid throughout the year, although rainfall and wind conditions vary with the seasons. Average temperatures range from 29 to 32°C during the day and 21 to 24°C in the evenings. Relative humidity is about 65 to 75 percent in the afternoons and 85 to 100 percent at night. Two primary seasons, the dry and wet seasons, are separated by periods of transitional weather. The dry season (mid-January through July) is characterized by very little rainfall and consistent tradewinds blowing from the east to northeast at 24 to 40 km per hour (kph). May, June, and July are the driest months of the year. The rainy season (August through mid-January) features heavy winds and rains with occasional typhoons and tropical storms.[1]

3.2.2 Geology and Hydrology

The Marianas are volcanic islands developed west of the Mariana Trench, an active subduction zone where one section of the ocean crust is pushed beneath another. Coralline limestone covers much of each island, in some cases in a layer several hundred meters thick. Soils developed on volcanic rock tend to be poorly drained clays, while soils developed on limestone are usually

[1]Personal communication with Gil Borja, CNMI Department of Public Safety, May 21, 1996.

shallow and highly porous. Surface water bodies and streams can only exist in regions with enough clay to prevent water from draining through to the porous rock below.

Guam. The northern half of Guam is covered by a limestone plateau. The plateau elevation ranges from 90 to 180 meters (m) above mean sea level (MSL) and drops to the shoreline in steep cliffs. Rainwater easily percolates through the limestone, recharging Guam's only drinking water aquifer, the Northern Lens Aquifer. In the southern portion of Guam, bedrock is mostly volcanic rock with clay soils on top. Streams have carved this half of the island into a rugged mountainous region; its highest peak is Mount Lamlam (407 m MSL) near the southwest coast. No significant groundwater aquifer has been identified here. The two halves of the island are joined by a transition region of hilly terrain and mixed limestone and volcanic rock.

Tinian. Almost no volcanic rock is exposed on Tinian; its topography consists of a series of limestone plateaus and rocky shoreline cliffs. The highest point on the island is 178 m above mean sea level. There are no streams and only a few small surface water bodies on Tinian. Tinian has an aquifer of fresh water in the older limestone unit in the south-central portion of the island and may have a smaller aquifer in the north.[2]

Rota. Rota is best depicted as a series of limestone terraces surrounding a volcanic core which protrudes slightly above the top terrace as Mount Manira (496 m MSL). Volcanic rock is also exposed along the south and southeast slopes of the island, an area known as the Talakhaya, where all the surface drainageways are located. A perched aquifer appears to be located under the Talakhaya which gives rise to Rota's two main water sources, the Matanhanom and As Onaan springs.[3] A basal lens of fresh to brackish water is also known to exist on the central north coast.[4]

FDM. Although there is no published information on FDM's geology or hydrology, the island is expected to be similar to Guam, Tinian, and Rota. Because FDM has no surface water bodies, it is suspected to be completely covered by limestone and related porous soils. The existence or extent of any freshwater aquifer is unknown.

3.2.3 Water Quality

Marine Waters. Marine water quality around the Mariana Islands is good. Guam's ocean water quality is relatively good, with the exception of locations close to river mouths or sewage treatment outfalls. Guam beaches are tested weekly using biological parameters.[5] Various locations in Tinian Harbor are tested monthly for fecal coliform. There have been five incidents of coliform violations due to fishing boat discharges into the harbor in the past two years. Several beach and harbor areas

[2]David B. Doan, Harold W. Burke, Harold G. May, and Carl H. Stensland (1960) *Military Geology of Tinian Mariana Islands.* Prepared under direction of the Chief of Engineers, U.S. Army.

[3]Juan C. Tenorio & Associates, Inc. (December 1995) *Physical and Economic Master Plan for Rota.* Prepared for The First Senatorial District of Rota and the Department of Public Works.

[4]Tom Nance Water Resource Engineering and Belt Collins Hawaii (June 1994) *Groundwater Monitoring Plan SNM Rota Island Resort.* Prepared for SNM Corporation.

[5]Personal communication with H. Victor Wuerch, GEPA, March 4, 1996.

on Rota are tested quarterly for fecal coliform. There have been seven incidents of coliform violations recorded in the past two years. These violations are due to town drainage system discharges into the ocean. No testing is done on FDM, which is uninhabitated.[6]

Ground and Surface Waters. Ground and surface water quality in the Marianas, in general, is good. Guam's groundwater is relatively free from point source pollutant discharges that are usually associated with larger land masses. This results in water quality remaining at a consistently high level island-wide. Groundwater in the northern aquifer is protected from surface contamination by natural filtration through hundreds of feet of coralline limestone. On the other hand, groundwater aquifers on Tinian and Rota are vulnerable to contamination by substances introduced onto the soil surface because the porous soil and underlying limestone do not significantly impede the passage of contaminants to the water body.

Guam's surface waters are vulnerable to contamination from sewage disposal overflows and animal wastes carried into streams during periods of heavy rainfall. Inland surface water bodies are of highest quality, whereas coastal regions contain surface water bodies of medium to low quality.[7] The surface water bodies on Tinian and Rota are similarly vulnerable to contamination.

3.2.4 Air Quality

Favorable meteorological conditions, i.e., the nearly constant tradewinds, maintain generally good air quality on all islands. Guam is generally free from serious air pollution; tradewinds prevent accumulation of a significant amount of pollutants in Agana-Tamuning metropolitan area and the airport. However, there are non-attainment areas associated with power plant operation at Piti, Cabras, and Tanguisson.[8] Tinian and Rota have no significant sources of atmospheric emissions at this time.

3.2.5 Noise

The primary sources of noise in the Marianas are aircraft, traffic, and industry. Noise on Guam is generated by aircraft and generic traffic and industrial noise sources in the Agana-Tamuning metropolitan area. The sources of noise on Tinian are aircraft and vehicular traffic. The north end of the island, including the EMUA, is in the landing approach for Saipan's airport and is subject to periodic elevated noise levels from low-altitude jet aircraft throughout the day. Noise from aircraft, power plant, and vehicular traffic on Rota is limited. The only source of noise on the uninhabitated FDM is periodic military bombardment and aircraft overflights.

3.2.6 Visual Setting/Aesthetics

The islands' visual settings are defined by the ocean and local topographic features. Various hills and cliffs provide vantage points of the ocean and coastline areas. On Guam, large expanses of

[6]Personal communication with Edna Buchan, CNMI DEQ, March 5, 1996.

[7]GEPA (January 1992) *Revised Guam Water Quality Standards.*

[8]The U.S. EPA has designated the areas within a two-mile radius of the Piti, Cabras, and Tanguisson Power Plants as a non-attainment area for SO_2, and therefore, is subject to more stringent emission control requirements. The Orote Power Plant is not located in a non-attainment.

undeveloped land exist in the northern and southern regions, while the built environment tends to dominate the visual setting in urban and suburban areas in the central part of the island. Steep cliffs edge the northern half of the island, while mountains and hills serve as backdrop to the central and southern areas.

Tinian's built environment is sparse and is concentrated in the southwestern portion of the island. In most areas, the visual setting consists of fields and wooded areas covering the relatively gentle topography. Small beaches occur intermittently around the island, and several ridges provide a backdrop to many views. Tinian's most notable physical attraction is a blowhole on the northeast coast.

On Rota, beaches line the northern coast of the island, and coral reefs can be found just off shore on the southwestern coast. Steep cliffs define the southern coast while gentle hills connect the southern plateau, known as the Sabana, to the northern plateau. Much of Rota is covered with vegetation and rural/agricultural land. Except for a few towns, the airport, and the increasing resort development in the northern region, very little urbanization has occurred. Most of Rota's built environment is concentrated in Songsong Village on the narrow isthmus connecting Mount Taipingot to the rest of the island.

The outline of FDM is defined by steep cliffs that drop off into the ocean. The base area of these cliffs have eroded in several places leaving behind large caverns. The northern half of the island is relatively flat and covered with vegetation. The southern portion is rocky with some vegetation. FDM has few beach areas and is completely undeveloped.

3.2.7 Natural Hazards and Constraints

The primary natural hazards are typhoons and earthquakes. The Marianas are in a typhoon belt and are frequently subjected to the powerful winds and heavy rains that characterize these storms. The typhoons are most common during the rainy season, with high winds in excess of 39 km per hour extending out more than 160 km from the center of a storm.

The Marianas are also located in a seismically active area. The nearby Mariana Trench is a low point in the ocean floor where two sections of the ocean floor collide and one slides beneath the other, causing periodic earthquakes. Earthquakes of low magnitude occur throughout the year.

3.3 BIOLOGICAL ENVIRONMENT OF THE MARIANA ISLANDS

Several endangered species and their primary habitats occur in the Mariana Islands at or near the proposed training sites. Native species of concern on the islands of Guam, Tinian, and Rota include several endangered birds, an endangered bat, threatened and endangered sea turtles, and endangered plants. There are no designated critical habitat areas in the Mariana Islands. Primary habitats for these endangered species include wetlands, native limestone forests, coral reefs, and beaches. In some cases, primary habitat for an endangered species may occur on more than one island, since some species occasionally migrate or recruit between islands.

The major terrestrial habitat types common to the Mariana Islands include limestone and ravine forests, secondary growth forest, savanna, tangantangan stands, open weedy areas, wetlands, and

strand vegetation. The major marine habitat types include shoreline and strand vegetation, beaches, coral reef, and benthic communities.

Native species are those which occur naturally in a defined area. They are either endemic, meaning they are found only in one locale (such as on one island), or indigenous, meaning they are found in more than one geographic location (such as throughout the Pacific). Populations of various native species have declined or become extinct on these islands for many reasons, including historical poaching pressure, the loss and modification of habitat, noise disturbance, and predation, all of which have resulted in mortality, decreased nesting success, and reduced reproductive success. The greatest threat to terrestrial endangered species on the Mariana Islands is the brown tree snake (BTS) (*Boiga irregularis*). The BTS has reached very high densities on Guam and caused the population decline and, in some cases, extinction of many of Guam's birds, lizards, and bats. The potential for this snake to be introduced to other islands, including Tinian, Rota, and Hawaii, is high and would have catastrophic results. The BTS is discussed in more detail in Section 3.3.1.4.

An overview of biological resources of the islands of Guam, Tinian, Rota, and FDM is given below. Appendix C contains maps of sensitive habitat areas on the islands of Guam, Tinian, and Rota and tables listing habitats on Guam, native species found in the Marianas, and introduced species found in the Marianas. The potential impacts of the proposed action on these biological resources are discussed in detail in Section 4.1.

3.3.1 Guam

Guam is distinct from Tinian, Rota, and FDM in being very intensively developed in some areas. Despite this development, habitat for both birds and mammals is still extensive on the island, especially in areas under protection by the Navy and Air Force. Protected areas on the island include the Guam National Wildlife Refuge areas, Government of Guam Conservation Areas, and military overlay units. Floral, faunal, and wetland surveys in the NAVACTS Ordnance Annex were completed by the Fish and Wildlife Service (FWS) in September 1996. The faunal survey is incorporated below.

3.3.1.1 Habitat

Today only 38 percent of Guam is forested. Much of the limestone forest acreage has been reduced by a variety of human and natural influences and converted to brush and grassland. Erosion is now a major problem in some areas.[9] A long history of island settlement, combined with more recent urbanization, fire, agricultural development, and the impacts of World War II, have all contributed to the alteration of Guam's forests, so they now contain various proportions of introduced species, mostly naturalized cultivars. The most suitable habitats for native fauna are native limestone and ravine forests. Wetlands also provide important habitat for native and migratory bird species. More disturbed areas, such as tangantangan stands or weedy fields, are less suitable as habitat for native fauna.

Limestone forests occur most frequently on the limestone plateau of northern Guam, which includes AAFB, Andersen South, the two NCTAMS sites, and the limestone of Orote Point.

[9]The Guam EPA developed the *Guam Soil Erosion and Sedimentation Control Manual* in 1986, and is currently spending $750,000 on erosion control in the NAVACTS Ordnance Annex, in part to prevent the siltation of Fena Reservoir.

Relatively well preserved and pristine native limestone forest growth occurs at AAFB and Orote Point; it contains 27 endemic and seven rare plant species,[10] including the last individual fire tree on Guam (*Serianthes nelsonii*) at Ritidian Point. Limestone forest is an important refuge for endangered birds and bats (see Section 3.3.1.3). Southern Guam also contains areas of limited ravine forest and extensive open grasslands (savanna).

The dominant introduced weedy species is tangantangan (*Leucaena leucocephala*), which is rumored to have been seeded from the air to revegetate the island after the U.S. invasion during World War II.

Aquatic habitats include rivers, freshwater wetlands, estuarine wetlands, and marine waters. Freshwater wetlands offer potential habitat for the endangered Mariana common moorhen *(Gallinula chloropus guami)* and for non-endangered native and migratory waterbirds. Estuarine wetlands, including mangrove swamps, provide nursery grounds for numerous marine and estuarine animals. The protection they provide is essential to the continued survival of many marine organisms.

Coastal vegetation on Guam includes coastal strand, which borders flat sandy beaches and contains sand-binding herbs and salt-tolerant vegetation. Coastal strand is found at the Waterfront Annex, in a thin band in Apra Harbor near the high tide line. Deep, sandy beaches (important for the successful nesting of sea turtles) are located at Ritidian Point, in the Marine Resources Preserve Shoreline at AAFB, and in Apra Harbor. The shallow coastal areas, reefs, and lagoons in these areas are frequented by sea turtles.

Conservation areas include the Guam National Wildlife Refuge areas at Ritidian Point, NCTAMS Finegayan, AAFB, Apra Harbor, and the Ordnance Annex; the Anao, Cotal, Bolanos, and proposed Falcona Beach Conservation Areas; and the Haputo and Orote Ecological Reserve Areas (ERAs).

3.3.1.2 Marine Environment

Approximately 220 species of marine benthic algae, three species of seagrasses, 267 species of stoney corals, and 800 fishes inhabit the coastal waters of Guam.[11] Coral reef surrounds at least three-quarters of the island, including several areas in the Waterfront Annex vicinity.

3.3.1.3 Rare, Threatened, and Endangered Species

Currently, three plant, three mammal, ten reptile, four invertebrates, and 18 bird species are listed as threatened or endangered by the federal and Guam territorial governments, although some of these are extinct on Guam (see Table C-2 in Appendix C). These threatened and endangered species have benefitted from inhabitating military land which indirectly serves as a wildlife preserve because it has remained relatively undeveloped and has restricted access.

The three plant species listed as endangered on Guam are the fire tree (*Serianthes nelsonii*), the ufa tree (*Heritiera longipetiolata*), and the tree fern (*Cyanthea lunulata*).

[10]Personal communication with Gary Wiles, Guam DAWR, July 1996.

[11]University of Guam Marine Laboratory (1981) *A Working List of Marine Organisms from Guam. Technical Report No. 70.*

The only known adult endangered fire tree is found in the limestone forest at AAFB. Threats to the survival of this tree include typhoons, herbivory by feral ungulates, insect infestations, loss of genetic diversity, wildland fires, and damage from other wildlife.[12] A recovery program is currently in effect for this species. The ufa plant is a rare endemic limestone forest plant, also found at AAFB and Orote Point. *Drypetese dolichocarpa*, another rare plant, has only eight individuals remaining, all at AAFB.

Guam has or had two endangered bat species and one bat that is a species of concern (SOC). The endangered little Mariana fruit bat (*Pteropus tokudae*) and the SOC sheath-tailed bat *(Emballonura semicaudata)* have not been sighted in approximately 20 years and are thought to be extinct on the island. If any colonies of these bats exist on Guam, it is likely that they would be in the limestone forest areas of the NAVACTS Ordnance Annex.[13]

The remaining extant species, the endangered Mariana fruit bat (*Pteropus mariannus*), number fewer than 400 individuals. Most of these bats aggregate at a roost site on Pati Point.[14] Other smaller roosts have been recorded in recent years along the northern cliffline between Ritidian and Pati Points. A small number of bats (10-25 individuals) occur in the Ordnance Annex, foraging at night between Mount Almagosa and East Tower. The preferred habitats for the bat include inaccessible cliffline and native limestone and ravine forests.[15] They are extremely sensitive to human disturbance and have been known to abandon their roosts at the slightest interference. Two of the most important reasons for the decline of these fruit bats have been poaching and predation by the BTS. Fruit bats are considered a gastronomic delicacy by the Chamorros, and although these bats are protected by law, illegal poaching still occurs. A 1991 poaching event at the last remaining bat roost on Guam reduced the population by 30 percent.[16] BTS are capable of preying on young bats, which are particularly vulnerable to predation because they are not yet able to fly and are too large to be carried by their mothers during nighttime foraging.[17] Several snakes have been captured or seen within 100 m of the colony at Pati Point.

Endangered and threatened reptile species on Guam include two sea turtles, three geckos, and five skinks (see Table C-2). Threatened green sea turtles use the beaches at the Waterfront Annex and AAFB for nesting. The green sea turtle nesting season is generally April through August. The hawksbill sea turtle nests only sporadically in Guam, between the months of May and October.[18] Currently, the primary threat to green sea turtles is habitat destruction, followed by poaching and

[12]USFWS and USAF with Guam DAWR (November 1995) *Integrated Natural Resources Management Plan for Andersen Air Force Base, Guam.*

[13]Personal communication with Gary Wiles, Guam DAWR, May 16, 1996.

[14]Wiles, et al. (1995) *The status and distribution of endangered animals and plants in northern Guam.* Micronesia 28:31-49.

[15]BioSystems Analysis, Inc. (September 1990) *Natural Resources Management Plan: Naval Station, Guam.* Prepared for the Department of the Navy, Pacific Division, Naval Facilities Engineering Command.

[16]USFWS and USAF with Guam DAWR (November 1995).

[17]Gary Wiles, DAWR (November 1990) *Mariana Fruit Bat and Little Mariana Fruit Bat Recovery Plan.*

[18]Karen L. Eckert, Ph.D. (September 1991) *The Biology and Population Status of Marine Turtles in the North Pacific Ocean.*

nest predation by feral dogs and pigs. AAFB beaches and offshore areas have been protected from large scale development and human activity. Current management programs include law enforcement, population surveys, tagging, and nesting studies. In the Ordnance Annex, the Pacific slender-toed geckos (*Nactus pelagicus*) and moth skink (*Lipinia noctua*) have been recently located by the National Biological Survey (NBS) and the USFWS.[19] Both occur in substantial numbers (500-2000/ha). The same survey also located the endangered Mariana Islands fragile tree snail (*Samoana fragilis*), threatened Pacific tree snail (*Partula radiolata*), and the Marianas euploea butterfly, a candidate for federal listing.

The avifauna of Guam once included many native forest birds, waterbirds, seabirds, and numerous migrant species. Today, however, many of the native birds are experiencing severe population declines due to both human activities, such as habitat destruction, and brown tree snake predation. Native birds listed by the territory as endangered are the rufous fantail (*Rhipidura rufifrons*), Mariana fruit-dove (*Ptilinopus roseicapilla*), cardinial honeyeater (*Myzomela rubrata saffordi*), Micronesian starling (*Aplonis opacus guami*), white-throated ground-dove (*Gallicolumba x. Xanthonura*), wedge-tailed shearwater (*Puffinus pacificus*), and white-browed crake (*Porzana cinerea*). All of these species are presumed to be extinct on Guam with the exception of the Micronesian starling, which is found on AAFB in the southeastern section near the base housing, and is also found in the Anao Conservation Area to the south.

Federally listed endangered native birds presumed to be extinct on Guam include the bridled white-eye (*Zosterops conspicillatus conspicillatus*), Micronesian megapode (Megapodius laperous), Guam broadbill (*Myiagra freycineti*), nightingale red-warbler (*Acrocephalus luscinia*), and Mariana mallard (*Anas oustaleti*). The Micronesian kingfisher (*Halcyon cinnamomina*) and Guam rail (*Rallus owstoni*) are probably extirpated from the wild but are the subject of captive breeding programs.[20]

Federally listed native birds still known to occur on the island are the endangered Mariana crow (*Corvus kubaryi*), island swiftlet (*Aerodramus vanikorensis bartschi*), and Mariana common moorhen. The endemic Mariana crow is estimated to have a current population of ≤40 individuals restricted in distribution to AAFB, mostly occurring in the northern cliffline forests.[21] The island swiftlet occupies limestone caves in the NAVACTS Ordnance Annex, located northeast of Fena Reservoir near the Bonya River and the Maemong River drainage area. The Mahlac Cave harbors the most significant colony of swiftlets on Guam. Approximately 300-350 individuals remain on the island.[22]

The complex of marshes, ponds, and mangrove swamps near the entrance to Apra Harbor provides breeding, nesting, and foraging habitat for the Mariana common moorhen, the only remaining wetland-dependent, non-migratory bird species on Guam. No moorhens are found on the Atantano

[19]Personal communication with USFWS, December 10, 1996.

[20]BioSystems Analysis, Inc. (September 1990) *NRMP: Naval Station, Guam.*

[21]USFWS (July 1996) *Final Report: The Effects of Aircraft Overflights on Endangered Mariana Crows and Mariana Fruit Bats at Andersen Air Force Base, Guam.* Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command.

[22]Personal communication with Gary Wiles, Guam DAWR, July 1996.

River, but approximately one-quarter mile due east of Atantano River and Marine Drive,[23] they are found in manmade wetlands at the Shell and Island Equipment businesses. This area, one of Guam's three primary habitats for the Mariana common moorhen, is considered to have the highest habitat quality of the primary moorhen sites.[24] However, these wetlands dry out seasonally, forcing the birds to move to permanent water sources, such as Fena Reservoir, the largest of four moorhen-supporting wetlands in the NAVACTS Ordnance Annex. The southern half of the reservoir is a moorhen sanctuary, and is also used by several species of migratory shorebirds and waterbirds. Both the Fena Reservoir and the Waterfront Annex marsh were identified in the 1992 Mariana common moorhen recovery plan as areas that should be secured and managed as primary moorhen habitat.

3.3.1.4 Brown Tree Snake

The introduced brown tree snake (BTS) has become a serious pest species on Guam. Native to the Solomon Islands, Papua New Guinea, and the northern coast of Australia, it is believed to have been introduced in the post-war years in cargo shipped from Papua New Guinea. Snakes became conspicuous throughout central Guam by the 1960s, and by 1968, they had probably dispersed throughout the island. Today, up to 12,000 snakes per square mile occur in some forested areas of Guam. In the absence of natural predators and other population controls, the snake population has reached very high densities, causing the decline, and in some cases, extinction, of many of the island's birds, lizards, and bats. The snake is nocturnal and cryptic. Difficulty of detection is compounded by the snake's slimness, exceptional climbing ability, potential to survive for weeks without food, and propensity to seek dark, cool hiding places during the heat of the day. Due to their nocturnal habits and hiding ability, the snakes are frequently accidental stowaways in cargo leaving Guam. Unless intercepted, the BTS could become established on Tinian, Rota, or Hawaii, causing ecological and economic problems similar to those found on Guam. The BTS has already been sighted on Oahu,[25] Saipan, and Rota, but is not thought to be established on those islands.

3.3.2 Tinian

3.3.2.1 Habitat

The terrestrial vegetation community of Tinian has been disturbed during the last 300 years by both man-made and natural forces. Although historical evidence is sparse, it appears that in the late 1700s and 1800s, Tinian was densely covered with "thicket." In the 1920s, the Japanese cleared most of Tinian to plant sugarcane. The cane plantations were abandoned during the intense military actions of World War II. Aerial photographs reveal that World War II bombing, fires, and military reconstruction reduced the amount of native limestone forest on Tinian so that by 1945 it represented less than four percent of the total vegetation cover. The most conspicuous change between 1946 and 1980 was the enormous increase in the introduced weedy tangantangan.

[23]Personal communication with Mike Ritter, Guam FWS, August 22, 1996.

[24]USFWS (September 1992) *Recovery Plan: Mariana Common Moorhen (Gallinula chloropus guami).*

[25]T. H. Fritts, G. H. Rodda, and E. F. Kosaka. *Brown Tree Snake Update.* Memorandum to Brown Tree Snake Cooperators dated July 1, 1995.

Fire is an existing periodic threat to habitat on Tinian. In addition to being a direct threat to individuals of protected species, fire has the potential to destroy vegetation and expose soil, making areas vulnerable to encroachment by undesirable species and reducing their usefulness as wildlife habitat. Since active fire fighting is not practiced in all areas due to limited accessibility and few municipal fire fighting resources, some fires are allowed to just burn out, which can take three to four days. Fires on Tinian sometimes appear to be the result of the local method of clearing forested land for grazing (i.e., burning with inadequate controls), or of careless use of campfires or cigarettes, or of military use of pyrotechnics. The worst fire hazard occurs during the driest months (May through July) of the dry season, when one km^2 or more may be burned each year.

Vegetation on Tinian today is predominantly disturbed secondary growth. Secondary growth forests presently cover 19 percent of the island, in areas where primary vegetation has been disturbed. Tangantangan in solid, practically pure closed stands dominate most of the level and moderately sloping area of the island. Within the EMUA the predominantly tangantangan forest is interspersed with six-foot-tall Guinea grass (*Panicum maximum*). Small areas of primary habitat, such as wetlands, limestone forest, beaches, seagrass beds, and coral reefs, also occur in the EMUA and LBA. No federally listed endangered plant species were identified in a thorough survey of the MLA in 1984,[26] but there are many plants scattered throughout the island that have medicinal use, such as the Polynesian arrowroot or gap-gap (*Tacca leontopetaloisa*).[27]

Native limestone forest patches are restricted to cliff lines and escarpments around the plateaus on the southeast side of Tinian, and a narrow corridor on the escarpment that connects Mount Lasso with Maga (see Figure C-2 in Appendix C). The remaining limestone forest on Tinian is an important refuge for endangered species.

There are three terrestrial wetland areas within the MLA.[28] The largest is Lake Hagoi, a freshwater marsh about 0.15 km^2 in extent, and the surrounding 0.18 km^2 depression, which is seasonally immersed and dried out (see Figure C-2 in Appendix C). Lake Hagoi, the only major body of open water on Tinian, is an important habitat for the endangered Mariana common moorhen, especially during the wet season.[29] It provides seasonally abundant food sources (e.g., invertebrates, seeds) for migratory and resident waterbirds, and nesting and foraging habitat for moorhens and native forest birds. There are also two much smaller wetlands, Mahalang and Bateha (see Figure C-2 in Appendix C), that are used by a small number of moorhens.[30]

Tinian has several beaches supporting shoreline and strand vegetation, and the waters around Tinian support sea grasses. Chaguan-tasi (*Enhalus acoroides*), a large seagrass, is found at Unai

[26]Belt Collins Hawaii (November 1994) *Environmental Assessment Military Exercise, Island of Tinian: Tandem Thrust 95*. Prepared for Commander, Pacific Division, Naval Facilities Engineering Command.

[27]Personal communication with Historic Preservation Office Personnel, Tinian, February 8, 1996.

[28]Belt Collins Hawaii (November 1994).

[29]When surface water disappears from Lake Hagoi during dry years or during the dry season, the number of moorhens on Tinian is significantly reduced, sometimes to zero.

[30]USFWS (February 1996) *Characteristics of Mariana Common Moorhens and Wetland Habitats within U.S. Department of the Navy's Military Lease Area and Exclusive Military Use Area on the Island of Tinian, Commonwealth of the Northern Mariana Islands, July 1994-August 1995*. Prepared for the U.S. Department of the Navy, Pacific Division, Naval Facilities Engineering Command.

Chiget (which has a marine wetlands system of less than 0.004 km^2), Puntan Lamanibot Sanhilo, and possibly Tachogna Beach. Most beaches serve as green sea turtle nesting areas. Seagrass beds are preferred feeding sites for sea turtles (see Figure C-2 in Appendix C).

3.3.2.2 Marine Environment

Marine fauna on Tinian includes 129 coral species, 84 species of marine benthic algae, other benthic species such as the spiny lobster (*Panulirus*) and the larvae of the coconut crab (*Birgus latro*),[31] as well as 246 species of fish.[32] Coral reef is developed around much of Tinian. In general, reefs on the eastern (leeward) coastline are better developed and have greater species diversity than those on the western coast. Local regulations prohibit harvesting of corals.

3.3.2.3 Rare, Threatened, and Endangered Species

The terrestrial fauna on Tinian includes birds, mammals, amphibians, and reptiles, some of which are indigenous or endemic to the island (see Table C-2 in Appendix C). Tinian has five federally protected (threatened or endangered) bird species and two protected sea turtles. The coconut crab is locally protected from harvesting by non-residents, and the island is sometimes frequented by the Mariana fruit bat, which is on the CNMI Endangered Species List. There have been five unconfirmed brown tree snake sightings on Tinian; one snake was spotted in February 1990, and four were spotted during one sighting in November 1995.[33]

The five protected bird species that have been identified on Tinian are the endangered Mariana mallard, Mariana common moorhen, Micronesian megapode, and island swiftlet, and the threatened Tinian monarch. The Mariana mallard is believed to be extinct due to overhunting and loss of wetland habitat. Populations of the Mariana common moorhen have declined due to mortality and decreased nesting success caused by historical poaching pressure, the loss and modification of wetland habitat, the presence of humans, and predation.[34] The Micronesian megapode was confirmed in 1995 as still occurring on Tinian but is quite rare.[35] The island swiftlet has not been seen on Tinian since 1976 and may be extinct on the island. The only endemic

[31]Marine Research Consultants and Pacific Basin Environmental Consultants (1994) *Preliminary Assessment of the Nearshore Marine Environments Off Of Beaches on the Island of Tinian, CNMI.* Prepared for Belt Collins Hawaii.

[32]Jones, R.S., R.H. Randall, and R.T. Tsuda (1974) *A candidate marine environmental impact survey for potential U.S. military projects on Tinian Island, Mariana Islands. Univ. of Guam Marine Lab. Technical Report.9.*

[33]Fritts, T.H., M.J. McCoid, and D. Gomez (January 1997) Assessing *the Risk of Brown Tree Snakes On Saipan: Incidents of the Brown Tree Snake, Boigus irregularis, Dispersing to Saipan and Other Islands in the Commonwealth of the Northern Mariana Islands.*

[34]USFWS (April 1996) *U.S. Fish and Wildlife Service Wildlife Research Report for Navy-leased Lands on the Island of Tinian, Commonwealth of the Northern Mariana Islands.* Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command.

[35]USFWS (April 1996).

species on the island, the Tinian monarch, is quite common despite its threatened status.[36] An August/September 1996 USFWS survey tallied approximately 70,000 individuals on Tinian.[37]

No permanent fruit bat colony is believed to exist on Tinian, but the neighboring island of Aguijan has a small, resident population. Notable numbers of fruit bats fly between islands in the southern Marianas on an irregular basis.[38] These interisland movements may represent dispersing juveniles or migrants responding to roost disturbances (such as poaching) or limited food availability. The fruit bat is reported to roost in large trees surrounding Lake Hagoi and along the clifflines and forest plateau south of Lake Hagoi near Mount Lasso (see Figure C-2 in Appendix C). It is also known in limited numbers elsewhere, including areas near the West Tinian Airport and the Carolinas Ridge.

The threatened green sea turtle and the endangered hawksbill sea turtle have been observed in the vicinity of Tinian. The green sea turtle nests on Tinian's beaches. Successful nesting requires a deep sand beach with open ocean exposure and minimal disturbance. Green sea turtle nesting activity occurs as early as late January and ends in mid-July on most of Tinian's beaches. The hawksbill sea turtle is known to occur in offshore waters, but is not known to nest on the island. Although poaching of sea turtles and their nests has been and is still an ongoing problem on Tinian (half of all green sea turtle nests were thought to have been poached during the 1994 nesting season),[39] public education programs, better enforcement by local officials, and continuous monitoring of beaches during nesting periods has substantially reduced poaching of green sea turtle eggs. Sea turtle nesting beaches are protected and periodically surveyed by the CNMI Division of Fish and Wildlife.

3.3.3 Rota

3.3.3.1 Habitat

Although some areas were cleared by the Japanese for sugar cane, Rota was much less disturbed during the war than the other islands, and no military bases were established there. Vegetation consists primarily of native forest with some secondary vegetation and minor stands of tangantangan.

The largest remaining limestone forest in the Marianas is found on Rota, where it covers 60 percent of the island. These areas are important refuges for endangered species, such as the Mariana fruit bat and the Mariana crow. Nine percent of the land area on Rota is covered by secondary vegetation, characterized as mixed brush and weeds which developed after the removal of native forest. The secondary vegetation scattered throughout the island is mostly a remnant of formerly cultivated fields and coconut groves. Rota supports only minor stands of tangantangan, which are relatively homogeneous and make up less than one percent of the island's land area.

[36]USFWS (April 1996).

[37]Personal communication with Michael Lusk, USFWS, December 9, 1996.

[38]Gary J. Wiles and P.O. Glass (September 1990) *Interisland Movements of Fruit Bats (Pteropus Mariannus) in the Mariana Islands*. Atoll Research Bulletin No. 343.

[39]USFWS (April 1996).

Three conservation areas were established on Rota in 1994: the Sasanhaya Marine Reserve, Puntan Taipingot (Wedding Cake) Conservation Area, and Sabana Heights Wildlife Conservation Area (Figure C-3 in Appendix C). Additional conservation areas are proposed, including the Sasanlagu Marine Preserve, Pali'i Medicinal Plant Reserve, Kantan Aftao Commonwealth Forest, and a conservation area between Saguagaga and Puntan Fina Atkos.[40]

3.3.3.2 Marine Environment

Coral reefs are found offshore on Rota's north and west sides (see Figure C-3 in Appendix C). The seagrass *Enhalus acoroides* has limited distribution, occurring in a narrow band along the shore between West Dock and Anjota Island near Songsong Village.

3.3.3.3 Rare, Threatened, and Endangered Species

Rota still has many native species, including the endangered Mariana crow, threatened green sea turtle, Mariana fruit bat (a species of concern on Rota), and the Rota bridled white-eye, which is a candidate for listing as a federally endangered species. The endangered Mariana crow is endemic to Rota and Guam. According to a 1996 study,[41] the population of the Mariana crow on Rota has decreased 56 percent between 1982 and 1995, likely due to habitat loss. The remaining approximately 600 crows are widely distributed throughout the island, both in mature and secondary forests and coastal strand vegetation.[42] There is also a fairly large roost of Mariana fruit bats that depend on the native forest in the Sabana Heights area for habitat. Some of these bats migrate from Rota to Guam.

Brown tree snakes are not established on the island. The only confirmed siting of a brown tree snake was in October 1991 at a seaport: two dead brown tree snakes were found inside a cargo container that had been shipped from Guam.[43] Presumably the snakes died of dehydration or high temperatures from being in the container during hot weather.

3.3.4 Farallon de Medinilla

3.3.4.1 Habitat

Farallon de Medinilla (FDM) is an uninhabited island that has historically been used by the military as a bombing site. Steep, eroding sea cliffs make it virtually inaccessible except by helicopter. With the exception of sharp, irregular limestone outcroppings, the entire top of the island is vegetated, mostly by herbaceous and shrubby vegetation, dominated by littoral species.[44] While the vegetation

[40]Juan C. Tenorio & Associates, Inc. (December 1995).

[41]Grout, Daniel J., Michael Lusk, and Steven Fancy (FWS)(June 1996) *Results of the 1996 Mariana Crow Survey on Rota.*

[42]USFWS (July 1996).

[43]T. H. Fritts (May 1996).

[44]Whistler, Art (December 1996) *Botanical Survey of Farallon de Medinilla, CNMI.* Prepared for Belt Collins Hawaii.

is damaged by bombardment, no plant species appears to be seriously affected. Birds nest, forage, and shelter in the dense vegetation.

There are no threatened or endangered plant species on the island. Nearly all the species encountered on the island are widespread, littoral plants. However, there are two plant species that are considered rare or uncommon: the bunch grass *Digitaria gaudichaudii* (the only endemic species recorded from the island), and the seaside cotton (*Gossypium hirsutum* var. *taitense*).

There are apparently no sensitive types of vegetation on the island. The one wetland area observed was too small and lacked some of the prerequisites to be considered an official wetland. However, these areas may be vital to the presence of land birds on the island that need fresh water, such as the endangered Micronesian megapode.

Eleven of the 40 plant species identified in a half day botanical survey (Appendix H) were introduced. Two of these species, tangantangan (*Leucaena leucocephala*) and morning glory vine (*Operculina ventricosa*) pose a potential threat to the environment. Once established they are difficult to eradicate.

3.3.4.2 Marine Environment

There is no fringing reef or shallow coastal zone at FDM. The shoreline consists primarily of large boulders and rock outcrops with little beach formation. There is little shoal area around most of the island, with the exception of the northern and southern ends. Deep water surrounds much of the island, and the submarine slope of the island appears to be very steep. The combination of steep vertical profiles of the submarine shoreline and the massive physical forces from breaking waves on the windward side of the island likely results in a limited assemblage of benthic biota, at least to the depth of wave base.

Marine resources are primarily concentrated on the leeward side of the island, where substrate drops gradually seaward; coral growth of *Pocillopora, Acropora, Porites, Montiport* and *Millepora* is good, with approximately 50 percent coverage of the available substratum. Coconut *crabs (Birgus latro)* inhabit cracks in the rocks near the shoreline, and green sea turtles have been observed in the nearshore waters.

Approximately a mile due north of the island is the most extensive shoal area in the Mariana Islands. This shallow shoal (approximately 18 m deep) provides a suitable habitat for pelagic fish species, which are harvested by Tinian commercial and subsistence fishermen.[45]

3.3.4.3 Rare, Threatened, and Endangered Species

A brief daytime avifaunal survey of FDM (Appendix H) recorded a total of 17 avian species, including seabirds, migratory birds, and resident land birds. All of the avian species observed are native to the Marianas except for the Eurasian tree sparrow. Several species were found nesting on the island. The most widespread species, with populations ranging from 200 to 750 individuals,

[45]U.S. Department of the Navy (February 1975) *Final Environmental Impact Statement Farallon de Medinilla Bombardment Range, Marianas Islands.*

were seabirds: three species of boobies (masked [*Sula dactylatra*], red-footed [*Sula sula*], and brown [*Sula peucogaster plotus*]) and the common fairy tern.

The only endangered species recorded was the Micronesian megapode. Although only four megapodes were observed, a more thorough search of the island would likely reveal more megapodes. Three bristle-thighed curlews (*Numenius tahitiensis*), listed by the USFWS as a species of concern, were observed on FDM.

Birds are distributed throughout the island. Masked and brown boobies nest along the eastern (windward) side where they can more easily take flight from their ground nests. Red-footed boobies and great frigatebirds breed on the western side of the island where there is less wind and higher brush to support their nests. Terns and noddies nest primarily in the limestone sea caves at the base of the island. Megapodes and doves inhabit densely vegetated areas where shelter and food are more readily available. Shorebirds, such as the plover, curlew, and turnstone, require open habitat and are found in barren or sparsely vegetated areas.

3.4 ARCHAEOLOGICAL AND HISTORIC RESOURCES

The history and cultural resources of Guam, Tinian, Rota, and FDM are discussed in this section. This historical overview spans from the time of initial human settlement to the present day and includes information on Chamorro, Spanish, German, Japanese, and U.S. influences. As each of these cultures took turns "controlling" the Marianas, they left behind many cultural artifacts that can still be seen today.

3.4.1 Brief History

The Mariana Islands are historically part of Micronesia and have been controlled by many different nations since their "discovery" by Magellan in 1521. The oldest dated archaeological remains indicate that humans first settled the Mariana Islands about 1500 B.C. Early historic documents indicate that at the time of first European contact, the Chamorro people in the Mariana islands exhibited a typical Oceanic economy, consisting of farming and exploitation of marine resources.

The Chamorros had their first contact with European explorers in 1521. The Spanish claimed the islands in 1565 and left them undisturbed until they established a Jesuit mission on Guam in 1668, significantly changing the lives of the Marianas Chamorros. By 1698, the Spanish resettled most of the Chamorros, except for those hiding on Rota, into "church towns" on Guam, leaving the northern Marianas virtually uninhabited. Religious activities were not Spain's only concern. The islands also served as a valuable port for the golden galleons and other Spanish merchantmen. Tinian was used by the Spanish as a store for supplying the Guam garrison, as noted in British reports from their first visit in 1742.

Guam became a possession of the United States in 1898 as a result of the Spanish-American War. Under the administration of the U.S. Navy, Guam became a coaling station and later a naval base for the western Pacific. Spain sold the other (northern) Mariana Islands to the Germans in 1899. The short-lived (1899–1914) German administration was marked by little change, except for the reorganization of the Tinian cattle ranch established by the Spaniards. Tinian was leased by the Germans in 1904, primarily to the Japanese for the purpose of copra cultivation.

The northern Mariana Islands came under control of the Japanese at the outbreak of World War I and became a Japanese League of Nations mandate in 1920. The Japanese then began economic exploitation of the Marianas. In 1926, Tinian was leased by Nan'yo Kohatsu Kaisha (NKK or South Seas Development Company), which established sugar cane plantations and developed Tinian Town. Most of the indigenous forests and local vegetation on Tinian were bulldozed to make way for sugarcane and other crops.

Rota became the focus of the Japanese in 1930. NKK started its agricultural efforts in the Sinapalo area. Once the land was cleared of vegetation, sugar plantations were laid out and infrastructure was constructed. A refining mill was built on the west side of Songsong village, and a railroad was built to connect Songsong and Sinapalo. The Japanese also undertook small-scale mining on Rota. In 1939, the Japanese constructed an airfield at the north end of Tinian, using Korean slave labor.

The Japanese military government took control of Tinian in 1940. Guam was occupied by the Japanese shortly after the beginning of World War II. As discussed in Section 1.1.3.1, the Mariana Islands became a major focus of World War II in 1944. Tinian and Guam were eventually invaded and occupied by U.S. troops toward the end of World War II. Rota and FDM were not occupied by the U.S. The B-29s carrying the atomic bombs dropped on Hiroshima and Nagasaki departed from Tinian's North Field, which was designated a National Historic Landmark in 1987.

Tinian was essentially abandoned by the U.S. military within a year of the end of the war, and in 1947, the U.S. and the United Nations reached a trusteeship agreement for the Trust Territory of the Pacific Islands. Guam remained under the jurisdiction of the U.S. Navy until 1950, when President Harry Truman signed the Organic Act which ended military control and made Guam a U.S. territory. Negotiations in the 1970s resulted in the signing of a Covenant to Establish a Commonwealth of the Northern Mariana Islands in Political Union with the United States of America. The covenant included an agreement to lease approximately 71 percent (72 km^2) of Tinian's land area to the Department of Defense for military training use and as a contingency base should future conditions require significant forward deployment in the western Pacific. The amount of land leased has since been reduced to approximately 60 percent of the island.

3.4.2 Cultural Resources

Significant historic and prehistoric sites remain from the different cultures which have occupied the Mariana Islands. The most notable artifacts of the ancient Chamorro culture are sets of "latte stones." These are upright pyramidal stone pillars topped by semispherical capstones, set in two parallel rows in groups of 6 to 12. Numerous latte sites, complexes, and remnants can be found throughout Guam and Tinian. In fact, latte sets are still being identified and discovered. Other artifacts that can be found on Guam and Tinian include pottery scatters and stone adzes. Because access to areas under DoD control, such as the Ordnance Annex, is restricted, the cultural resources have been left undisturbed and are well-preserved. Detailed information on sites within military lands is provided in Section 4.2.

3.4.2.1 Guam

Guam's oldest archaeological sites are from the Chamorro period, prior to Western contact in 1521. Other sites show evidence of Guam's status as a possession of Spain, while numerous structures and relics attest to the island's major role in World War II. Many of the known historically

significant sites are located on DoD land. Several resources on DoD land are listed on either the Guam or National Register of Historic Places, or both. These listed resources include sites at Pati Point and Tarague (AAFB), Orote Airfield, the latte complex at Haputo Beach, and the Tokai Maru and S.M.S Cormoran, which are underwater resources in Apra Harbor. AAFB sites associated with World War II and the Vietnam conflict include primarily the runways at AAFB's Northwest Field, for which nominations to the Guam and National Registers are pending.

3.4.2.2 Tinian

Tinian's cultural resources include pre-contact Chamorro sites, primarily in the EMUA, and many World War II-era sites and artifacts associated with Japanese and U.S. invasion of the island. The latter includes the pits where two atomic bombs were loaded in the *Enola Gay* and *Bock's Car* for employment against Japan. The U.S. World War II airfields and support facilities, including the two atomic bomb pits, are part of the North Field National Historic Landmark, designated by the National Park Service in 1987.

The presence of numerous cultural resources in military training areas motivated the Navy to implement various protective measures, such as a Memorandum of Agreement signed in 1994 prior to the Tandem Thrust 95 training exercise. To supplement these agreements, the Navy also developed an interpretive program for north Tinian, the purpose of which is to inform the public of Tinian's cultural and natural resources and to instill an ethic that emphasizes preservation and protection.

3.5 INFRASTRUCTURE, UTILITIES, AND PUBLIC SERVICES

Guam, Tinian, and Rota all have infrastructure, utilities, and public services in place. Each island has its own roads, airports, drinking water systems, municipal solid waste landfills, electrical power plants, fire departments, and telecommunications systems.

In the case of telecommunications, the islands have both individual systems and a shared system. Public telecommunications is operated by the Guam Telephone Authority (GTA) on Guam and the Marianas Telecommunications Corporation (MTC) in the CNMI. The telephones on each island are also connected to each other by a microwave system. Presently, plans are being made to install an undersea fiber-optic cable between the islands to make telecommunications more efficient and cost effective. Although the resources available on each island are similar, they have developed at very different rates and will be discussed separately. Guam is the most developed of the islands addressed by this DEIS, whereas FDM is not discussed below because it is presently undeveloped.

3.5.1 Guam

Roads. Guam's public road network consists of over 650 km of paved roads which range from two-lane rural to seven-lane urban arterial roads. The roads are managed by the Government of Guam Department of Public Works. Most of the highway infrastructure was built by the U.S. military following the end of World War II and is a reflection of the desire for efficient connections between various military installations. After a vigorous road improvement program was undertaken, the network of roads are in relatively good condition.

Traffic on Guam is heavy in certain areas. The traffic on major routes is particularly heavy during the afternoon hours.

Airports. The only civilian air transportation facility on Guam is the Guam International Air Terminal (GIAT), operated by the Guam International Airport Authority (GIAA), a public corporation and autonomous agency of Government of Guam (GovGuam). GIAT, about 5 km northeast of Agana, uses two runways and related facilities that are part of the now closed Naval Air Station (NAS) Agana. GIAT handles nearly all military and commercial flights into and out of Guam. Eight major airlines operate here, making it the hub of air transportation for Micronesia and the western Pacific. The only other major aviation facility on Guam is at AAFB, which handles Air Mobility Command flights for military personnel and their dependents. Commercial aircraft may occasionally fly through Andersen's airspace, but only with permission from the Andersen control tower.

Harbors. Apra Harbor is an improved natural harbor which provides sheltered anchorage. The outer harbor features a general anchorage area for the commercial port, as well as 14 Navy moorings. The Navy owns and operates the entire inner harbor south of the main port area; the inner harbor has 11 moorings. The commercial Port of Guam handles all commercial activity and is managed by the Port Authority of Guam (PAG). All goods shipped to Guam (with the exception of military weapons, ammunition, and heavy equipment) are received at the Port of Guam. As the tourist industry grows and Guam continues to ship in approximately 90 percent of its commercial goods, the port stands as one of the busiest and most important areas on the island.

Power. The Guam Power Authority (GPA) is the main supplier of Guam's electrical power. Electricity is produced primarily by three base load steam-electric generating stations at Cabras, Tanguisson, and Piti. Cabras generates more electricity than the other two plants combined. Prior to the construction of GPA facilities, the Navy provided electrical power to the entire island. A series of joint use agreements since 1972 have gradually turned power generation responsibilities over to GPA. In August 1992, a Customer Supplier Agreement established the Navy and Air Force as customers of GPA. In addition to the regular supply from GPA, all Navy and Air Force installations maintain facilities for emergency power and peak power generation.[46]

Water and wastewater. The Public Utility Agency of Guam (PUAG) maintains and operates the islandwide water distribution system. This integrated system has a capacity of 1.14×10^5 cubic meters per day (m^3/d) and services a majority of the civilian areas on Guam. About 70 percent of PUAG's water is supplied by 92 wells tapping the Northern Lens Aquifer, which has an estimated sustainable yield of up to 60 mgd. In south-central Guam, PUAG's Ugum River Diversion Project diverts 7.57×10^3 to 15.14×10^3 m^3/d from the Ugum River to supply the districts of Talofofo and Umatac. The PUAG system relies on direct well-to-consumer service, with only minimal water storage. Therefore, power outages significantly hinder its water distribution capability. The Navy and Air Force acquire potable water from five and ten wells, respectively. The Navy sells water to PUAG from its Fena Watershed system for distribution to civilian areas in southern Guam. Eight private water supply wells are located on civilian property in various locations on Guam.

The civilian wastewater collection system is operated and maintained by PUAG. A separate wastewater collection system serves the Navy's Waterfront Annex. The PUAG-operated system is divided into three regions, two of which contain DoD commands. One additional region is formed

[46]Guam Power Authority (1992) *1992 Long Range Transmission Planning Study.*

by the Navy owned and operated Waterfront Annex collection system. A total of eight wastewater treatment plants service the island.

Solid and hazardous waste. Municipal solid waste is collected by the Department of Public Works (DPW) and private haulers and disposed of at the Ordot Sanitary Landfill. The landfill is presently in violation of several federal regulations and by law, must be closed by April 1997. Unfortunately, the Ordot landfill will not make this deadline because a new landfill will not be constructed by this time. The main problem delaying the closure of the Ordot facility is choosing the site of the new landfill. The two proposed sites at Malaa and Gautali both have drawbacks.[47] The military also maintains sanitary landfills on Guam. The Air Force operates a landfill at AAFB, and the Navy's Public Works Center (PWC) operates one in the Orote Peninsula area of the Waterfront Annex. No military-generated municipal solid waste is disposed of at the Ordot landfill.

All civilian-generated hazardous waste is handled by private operators, while the cataloguing and storage of hazardous waste and materials for military installations is the responsibility of the Defense Reutilization and Marketing Office (DRMO). This office receives the waste and materials, stores it, packs it as necessary, and arranges for its eventual disposal or recycling. DRMO Guam is also responsible for the disposal of hazardous wastes and materials from DoD activities at places such as Yap, Chuuk, Saipan, and Diego Garcia. The packing and transporting of hazardous wastes and materials from most Navy activities to DRMO is handled by the Navy PWC. The PWC goes to the activity storage area, loads the hazardous materials, and returns to the PWC hazardous waste and material storage facility, where they further pack the materials. The waste and materials are then transported to DRMO for inventory control and storage until they can be sent off-island for disposal. The materials generated by the Air Force are stored and packaged at AAFB and transported by Air Force personnel to the DRMO facility.

Firefighting capabilities. Guam has both civilian and military fire fighters, either of which may respond to emergencies as necessary. There are approximately 300 full-time professional civilian firefighters operating eight civilian fire stations. The Navy operates seven fire stations and the Air Force operates three fire stations. Both the Navy and Air Force have mutual aid agreements with the Government of Guam fire department as well as an interservice support agreement with each other. In addition, the Navy contributes water buckets that can be used as external loads for fire extinguishing. The search and rescue aviation unit on Guam routinely provides MEDEVAC service from Rota to Guam.

3.5.2 Tinian

Roads. Tinian has approximately 110 km of roads, most of which were constructed prior to and during World War II. Most roads were graded and paved and successfully supported heavy military truck traffic during the war. Roads throughout Tinian are now in fair to poor condition and traffic is extremely light. The road system is administered by CNMI's DPW.

Airports. Tinian has one commercial airport and one harbor. The West Tinian Airport is equipped with a navigational light system but has no other navigational aids or a control tower. The airfield has a single east-west runway, primarily for commuter air taxi operations. Takeoffs and landings are coordinated by the control tower at the Saipan International Airport, radio advisories among the aircraft, and by visual observations from aircraft and from the ground.

[47] Adrienne Loerzel (March 15, 1996) *Landfill shutdown hinges on new site.* Pacific Daily News.

Harbors. Tinian Harbor is protected by a deteriorating breakwater constructed during World War II. Wharfage includes a concrete wharf and two somewhat deteriorated finger piers with slips parallel to the main wharf. A small marina pier has low-draft berths along a quay and stern-to moorings; the quay is used to moor commercial barges operating between Tinian and Saipan. Commercial shipping traffic is serviced by two stevedore companies. Gasoline and diesel fuel are available at the Mobil Oil tank compound in the harbor area. The position of the Mobil refueling point and the direction of the harbor flow directs any fuel spill toward the closed end of the two finger piers. A boom is on hand and is used by any boat that is refueled. There are no tug boats at this port.

Power. Electric power is supplied by three 1000 KW generators operated by the Commonwealth Utility Commission (CUC). Peak demand on Tinian was 2 MW as of 1994. The system has operated without unplanned outages. The only existing generators of radio frequency electromagnetic radiation (EMR) on Tinian are air traffic and government radios (VHF 118.0-135.0 MHZ and VHF 160-166 MHZ, respectively). The proposed VOA transmitter would have four 2.5 MW primary power electrical generators and one supplemental generator of approximately 500 MW.

Water and wastewater. Potable water on Tinian is supplied by the CUC from a single well located in Marpo Swamp. A 1.9×10^9 cubic meter (m^3) tank and $0.95 \times 10^9 m^3$ tank provide potable water storage. Agricultural water is supplied by a well also located in Marpo Swamp. Tinian does not have a wastewater treatment plant; public and private buildings are equipped with septic tanks or cesspools.

Solid and hazardous waste. Solid waste is disposed at an open dump located north of and downwind from San Jose near the former leprosarium. It is managed by the CNMI DPW. Most residents bring their own trash to the dump. The dump is not presently in compliance with federal solid waste regulations. Tinian also does not have a hazardous waste disposal facility.

Firefighting capabilities. The Tinian Fire Department is undermanned and relies on residents acting as a volunteer fire department. Fire fighters only protect inhabited structures. Otherwise, they allow the fires to burn out on their own. San Jose Village has two fire engines, one pickup for brush fires, and an ambulance. The village also has a tanker truck which holds approximately 3.8×10^6 m^3 to help fight fires.

3.5.3 Rota

The information in this section is summarized from a master plan study regarding the physical and economic resources of Rota which was prepared by Juan C. Tenorio & Associates, Inc.[48]

Roads. Rota's roadway system consists of 140 km of road and village streets. All of the streets are located in the villages of Songsong and Sinapalo. Most of the roads were built during the Japanese period and are presently in poor physical condition. Only about 19 km of the roadway system are paved, between Songsong and the airport and within the village itself. Although the roadway system is in relatively poor condition, the entire island, except for the southern sloped areas, is accessible by roads.

[48]Juan C. Tenorio & Associates, Inc. (December 1995).

Airports. Rota International Airport, located about 18 km northeast of Songsong, is surrounded by agricultural activities and pasture land. The facility is serviced by a single asphalt runway. The terminal lies approximately 730 meters from the east end on the south side of the airfield. A single taxiway connects the runway with the air passenger terminal aircraft parking apron.

Harbors. Rota has two harbors, the West Harbor at Sasanlagu and the East Harbor at Sasanhaya. The West Harbor is located on the west of the Tapingot Peninsula and was originally developed to serve a Japanese sugar mill operation. The existing facilities were constructed around 1978 and consist of an entrance channel and turning basin. The narrow channel entrance combined with the prevailing crosswinds and variable currents prevent navigation except for boats and other small crafts.

The East Harbor is located on the southeastern tip of the island. The East dock is mainly used for discharge of fuel and as a docking facility for glass-bottomed boat operations.

Power. Electric power is supplied by a 5.2 MW power plant located in Songsong Village and operated by the CUC. The power plant contains two 2.6 MW Mitsui diesel engines. As of June 1, 1995, Rota's power has been rationed because one 2.6 MW unit is out of service. Non-essential services, such as street lights, have been temporarily disconnected.

Water and wastewater. Potable water on Rota is supplied by the Matanhanom and As Onaan springs. A ductile iron waterline connects the springs to 3.79×10^9 m^3 and 1.89×10^9 m^3 reservoirs which supply Songsong and Sinapalo, respectively. The existing water supply and distribution system barely meets the population's needs. Primary concerns are the lack of adequate pressure in some areas of Songsong and Sinapalo, water rationing during evening and night hours, and the inability to provide adequate and consistent water supply disinfection (chlorination).

Presently, Rota does not have an operating sewer system. The Variable Grade Sewer (VGS) system installed on certain streets of Songsong was never activated, due to a storm which destroyed the outfall shortly after completion. Public and private facilities are presently serviced by either septic tanks or cesspools.[49]

Solid and hazardous waste. A majority of the solid waste is disposed of in the Songsong Dump, located in Northern Rota approximately 3 km from Songsong and operated by the CNMI DPW. The Tatachog dump, granted permits by the CNMI's Department of Environmental Quality (DEQ), is located in an abandoned quarry site. Residents and businesses are responsible for transporting their own waste to the dump. Neither dump site is in compliance with federal solid waste regulations. Rota does not have a hazardous waste facility, and there are no provisions for off-island transport of hazardous wastes.

Firefighting capabilities. The existing fire station in Songsong Village is staffed by ten firemen, two cadets, and three civilians. There are three fire trucks, one large and two small. As of 1996, one small truck was out of service. The fire station also has two ambulances which service the entire island.

[49]Personal communication with Crispin M. Ayuyu, Office of the Mayor, Rota, January 20, 1997.

3.6 SOCIOECONOMIC ENVIRONMENT

Residents born in Guam, Tinian, and Rota are U.S. citizens. Since the end of World War II, Guam has experienced steady and considerable growth of its tourist industry and business community. It has become a hub of western Pacific transportation and communication, in addition to being the home of the only U.S. military installations on U.S. soil in the western Pacific. Tinian and Rota continue to develop but at a much slower pace than Guam.

FDM is not discussed in this section because it is uninhabited.

3.6.1. Culture and Economy

The majority of Marianas residents are Chamorro or part-Chamorro. The main employers are the government, tourism, construction, and the military. Tourism is the fastest growing industry in the islands and may soon surpass other industries as more resorts are developed.

3.6.1.1. Guam

Guam's population is concentrated in the central portion of the island, particularly in the capital city of Agana. In 1994, the population of Guam was 145,881. The ethnic composition of the island is 43 percent Chamorro or part-Chamorro, 23 percent Filipino, 14 percent Caucasian, 5 percent other Pacific Islanders, and 15 percent other ethnic groups. Approximately half of all residents were born on Guam, and 70 percent of them were under the age of 34 in 1990.[50] Languages spoken include English, Chamorro, and Japanese.

The major components of Guam's economy are the government, military, tourism, and construction. Government and military employment account for approximately one out of every three jobs, while tourism is the fastest growing industry. Unemployment on the island was about 7.8 percent at the end of 1995.[51] In several industries, most notably construction, a severe labor shortage requires the importation of foreign workers to fill the positions.[52]

3.6.1.2 Tinian

Tinian's population is concentrated in the village of San Jose, on the southwest coast at the site of a natural harbor. As of the 1990 census, there were 2,118 residents and non-residents on the island, of whom about half were of Micronesian ancestry. No military personnel are permanently stationed on Tinian. Languages spoken include Chamorro, English, Tagalog, Carolinian, Japanese, Korean, and Sri Lankan (Tamil).

Tinian is a largely undeveloped island. Its economic growth has been slow despite the 1989 initiative to legalize casino gambling. Tinian's economy can be broken down into the following sectors: government employment, tourism, agriculture and fishing, consumer trade, and air service

[50]Community Resources, Inc. (August 1992) *Socioeconomic Impact Assessment of New U.S. Navy Activities in Guam*. Prepared for Belt Collins & Associates.

[51]Personal communication with Rick Boice, Ernst & Young, May 29, 1996.

[52]Community Resources, Inc. (August 1992).

and airport operations. About 75 percent of the Tinian labor force is employed by the government.[53] Many also engage in subsistence farming/fishing.

3.6.1.3 Rota

In 1992, the population of Rota was 2,561, comprised mostly of residents of Chamorro descent. The people reside in Songsong and Sinapalo villages. The main languages spoken are Chamorro, English, and Carolinian. Most of Rota remains agricultural or natural habitat with a few scattered, mixed-use residential, commercial, and industrial areas located in the rural interior.

Rota's economic base relies primarily on the CNMI government, construction, and small-scale tourism activities. There is a high degree of subsistence activity with many families supplementing their income with farming and fishing. Several new hotel/golf resort developments are either proposed, permitted, or under construction.

3.6.2 Military Land Use

The Mariana Islands offer a prime strategic location for military installations. Guam's and Tinian's use as major bases for wartime operations dates back to World War II, when they served as launching points for bombing raids on Japan. During the Korean War and Vietnam War, additional forces were sent to Guam to perform long-distance reconnaissance and combat missions. To keep a strong presence in the Pacific and Asia, the U.S. military has continued to maintain several bases on Guam. These bases currently have fewer personnel than in the past, as they primarily perform a support role for military exercises in the Pacific. Military installations comprise approximately 30 percent of Guam's land area (including NAS Agana, which is in the process of being returned to the Government of Guam). The U.S. military does not have any personnel permanently stationed on Tinian, Rota, or FDM.

The main initiatives affecting the military use of land on Guam are the Guam Land Use Plan Update (GLUP 94) and the Base Realignment and Closure (BRAC) program. GLUP 94 is an update to a previous military land use plan dated September 1977. Its purpose was to develop a plan for all DoD land requirements on Guam, considering the rationale for military landholdings, combined service use of real property where feasible, and environmental effects of military land use. GLUP 94 identified over 30.8 km^2 of land considered to be releasable and another 1.82 km^2 as potentially releasable. Obtaining development controls was recommended for approximately 0.53 km^2.

BRAC is a congressional program to decrease the number of bases operated by the U.S. military at home and abroad. It has resulted in the planned closure and release of various military lands on Guam. Before the lands can be transferred to the Government of Guam (GovGuam), local officials must decide on how to use the land. GovGuam has submitted a proposed master plan for the future civilian use of NAS Agana. Reuse plans are also being prepared for the Ship Repair Facility (SRF) and the Fleet Industrial Supply Center, both of which still remain open. The Navy plans to retain the SRF dry dock facilities to continue to fulfill ship repair needs in the Pacific, but may lease out

[53]Ernst & Young (March 1996) *Draft Socioeconomic Report.* Prepared for Belt Collins Hawaii.

the dry docks on a project basis.[54] Presently, there are no plans being made for civilian use of other released lands.

On Tinian, use of military land is affected by the terms of various lease agreements and the allocation of a portion of the EMUA to the Voice of America. Training in the LBA is permitted, provided that the CNMI is notified in writing prior to a given exercise. Training on the VOA parcel will not be possible once the transmitting station is operational, due to EMR hazards.

[54]Adrienne Loerzel (March 22, 1996) *Committee members discuss progress of reuse plans.* Pacific Daily News.

CHAPTER FOUR
ENVIRONMENTAL CONSEQUENCES

This chapter provides detailed analysis of the significant issues identified during scoping (Chapter One). The results of this analysis were incorporated in the Mitigated Set of Training Activities, presented as the preferred alternative (Chapter Two). Each issue discussion includes:

- Details of **existing environmental conditions** in locations likely to be impacted
- **Evaluation criteria** for determining whether potential impacts are significant
- Brief review of **training activities** with the potential to significantly impact the environment
- **Significant impacts** which might result from training activities
- **Proposed mitigation**

This chapter focuses on the long-term and cumulative impacts of proposed and ongoing training activities and locations.[1] Short-term impacts are temporary and generally do not meet evaluation criteria for significance; they are addressed briefly at the end of this chapter but are not considered in detail.

Following the seven issue discussions, the chapter concludes with a summary of the significant issues, a review of cumulative impacts and proposed mitigation measures, and a table itemizing all significant and non-significant impacts and proposed mitigation.

4.1 IMPACTS ON BIOLOGICAL RESOURCES

This section analyzes the potential long-term and cumulative impacts of proposed and ongoing training on biological resources. Biological resources of particular concern are threatened and endangered fauna and their habitat, migratory birds, wetlands, threatened and endangered or medicinal plants, and coral reef. Threatened and endangered species are protected under the Endangered Species Act (ESA) of 1973, which includes a prohibition on takes[2] and requires designation of critical habitat.[3] Conservation of migratory non-game birds is required under several laws, including the Migratory Bird Treaty Act.

The most significant impact which could result from proposed training is export of the brown tree snake (BTS) from Guam, discussed at length in section 4.1.2.3. Training activities can also impact threatened or endangered species and migratory birds and their habitat through noise, visual disturbance, vegetative clearing, ground disturbance, fire, projectile impacts, underwater shock waves, or explosions. Whether these impacts are potentially significant has been determined using the evaluation criteria presented in Section 4.1.1.

[1]Long-term impacts are essentially permanent; a dramatic example is the eradication and extinction of various bird species on Guam as a result of brown tree snake introduction. Cumulative impacts may result from a number of otherwise non-significant impacts adding together, either as a result of repeated occurrences of the proposed training activity or as the result of a training activity combined with unrelated activities in the same location. An example is repeatedly closing tourist access to the EMUA on Tinian: one closure would temporarily inconvenience a few people, but repeated closures have the potential to affect the success of tourism on Tinian.

[2]The term "take" means to harass, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct (ESA §3(19), 16 USC 1532).

[3]As discussed in Chapter 3, there are no designated critical habitat areas in the Mariana Islands.

Mitigation measures for potential impacts to biological resources are proposed for training activities considered in this DEIS. The proposed measures have been developed specific to the training activities, and they are subject to consultation with and concurrence by several government agencies. The USFWS and NMFS have purview under Section 7 of the Endangered Species Act, and the Guam Bureau of Planning and the CNMI Office of Coastal Resources Management administer the Coastal Zone Management Act. Consultation has been initiated with these agencies.

Activities found to have potentially significant impacts are discussed, by location, in Section 4.1.2. Impacts of ongoing activities that may be of concern, but are already mitigated or are non-significant are discussed in Section 4.1.3. Potential impacts of proposed new activities that may be of concern but are non-significant are discussed in Section 4.1.4. All impacts, including various non-significant impacts, are identified at the end of this chapter.

4.1.1 Evaluation Criteria

Evaluation criteria have been applied to all proposed new and ongoing training activities to determine whether potential impacts to biological resources are significant or non-significant. The general evaluation criteria applied are:

- Are threatened or endangered species or migratory birds (collectively referred to as protected species) present at the training site, and will the likelihood of their survival and recovery be appreciably reduced by training activities?

- Are wetlands, reefs, potential habitat areas (e.g., limestone forest), or endangered or threatened or medicinal plants present at the training site, and will the natural function or appearance of these areas or plants be reduced?

If the answer to any of the above queries is yes, the potential impacts are considered significant.

Survival and recovery of protected species could be affected by training activities with "side effects" such as noise, visual disturbance, vegetative clearing, ground disturbance, fire, projectile impact, underwater shock waves, or explosions. Training activities with potentially significant side effects could cause reduced survival and recovery of protected species. If these side effects of training were severe enough, they could affect protected species by causing disturbance, distress, disruption or abandonment of nests or feeding grounds, decreased breeding success, forced relocation, interruptions of feeding, sleeping, or mating activities, or habitat invasion by weedy species. These could ultimately result in reduced survival and recovery of protected species. Thus, the likelihood of reduced species survival and recovery depends on the characteristics of a training activity's side effects. The side effects of training activities were evaluated for significance based on the criteria in Table 4-1.

4.1.2 Significant Impacts

Applying the evaluation criteria shows that certain training activities at particular locations have potentially significant impacts. This section presents the relevant existing conditions at these locations, the potentially significant impacts, and proposed mitigation measures. No significant impacts were identified as a result of training at NAVACTS Ordnance Annex (Guam).

Table 4-1
Evaluation Criteria for Side Effects Which Could Result in Reduced Species Survival or Recovery

Activity Side-Effect	Parameter	Significant if:
BTS introduction	Transport from Guam	Population is established at a new location
Loud noise generation	Unexpectedness, especially during times of heightened sensitivity: -Breeding season for Mariana crows -Night (foraging time for Mariana fruit bats)	During an atypical time of day OR By an atypical source at a sensitive location
Visual disturbance	Appearance	Threatening enough to trigger nest abandonment (Mariana crow)
Vegetative clearing	Loss of habitat	No substitute of equivalent function available
Substrate disturbance	Land: Destruction of eggs, nests, or young Water: Destruction of coral	Land: Ground-nesting species known to be present in nesting habitat Water: Coral present
Fire	Likelihood of occurrence	Ignition source is present AND Source of tinder is present and dry AND Means to extinguish is not present or a plan is not in place
Projectile impact	Hazard and accuracy	Live ammunition AND Direct fire distance to target more than 1000 m OR Indirect fire weapons used at long ranges
Underwater shock wave	Charge size and distance	Shock greater than 10 psf-ms[4]
Explosion	Effective casualty radius AND dud rate	Occurs in critical or other important habitat

4.1.2.1 Andersen Air Force Base

All military operations at AAFB are reviewed for environmental compliance through the Risk Analysis program.[5] Ground training exercises are not authorized at the Pati Point area in order to

[4]pounds per square foot per millisecond

[5]The Air Force allocates staff and financial resources to natural resources management and environmental education and awareness programs at AAFB.

avoid adverse impacts to the endangered Mariana fruit bats, or at locations that might adversely affect Mariana crows.

The only type of training activity at AAFB that has the potential to cause significant impacts is aircraft training. Aircraft training includes ongoing field carrier landing practice (FCLP) and helicopter night vision goggle (NVG) training, ongoing and additionally proposed confined-area landings (CAL), and newly proposed landing helicopter assault (LHA) training. FCLPs take place at Main Base. Three CAL and five LHA landing sites are proposed for Northwest Field, and two CAL landing sites are proposed southeast of Northwest Field (see Figure 2-9). These activities have the potential to affect the endangered Mariana crow and Mariana fruit bat with noise and visual disturbance. Potential disturbance of these endangered species will be mitigated by limiting aircraft training activities during the Mariana crow breeding season. If mitigation is required for night flights and their potential impacts to the Mariana fruit bat, it will be determined from the consultation process.

Existing Conditions. Endangered species at AAFB include the Mariana crow and Mariana fruit bat. Only 12 crows remain on Guam, and all of them are at AAFB. The population will be doubled temporarily if captive crows are released at AAFB as planned.[6] In the past, crows were observed at Northwest Field, the Tarague cliffline, and the Munitions Storage Area (MSA). No crows currently nest on the south runway at Northwest Field; most of the crows have moved to the MSA.

A Marianas fruit bat colony of approximately 300 individuals roosts at Pati Point, and a few isolated individuals occur at Ritidian Point. Fruit bats forage at night along the limestone cliffs between these two points.

Potential Impacts. Noise and visual disturbance from FCLP, NVG, CAL, and LHA training may directly or cumulatively impact Mariana crows and Mariana fruit bats.

USFWS conducted a three-year study between 1992-1995 to determine the effects of FCLPs and other aircraft overflights (including HC-5 helicopters used for NVG training) on the Mariana crows and Mariana fruit bats at Main Base.[7] The study found that crows responded to some low-altitude aircraft overflights with distress and flight, but there was no evidence that overflights contributed directly to nest abandonment or nest failure during this study. In fact, Mariana crows have been known to tolerate relatively high air-traffic volumes at altitudes ≥305 meters (1000') above ground level (AGL).[8] Although the study also identified the potential for nocturnal FCLPs to disturb foraging bats under the FCLP track, it concluded that current air traffic volumes were tolerable to the Mariana fruit bat colony at Pati Point.

[6]Twelve captive crows raised in Houston are planned for release at AAFB (as recommended in a National Academy of Science report), pending CNMI approval. Releases are planned to occur mostly in the MSA; two individuals will be released in the Tarague cliffline. Two additional crows raised in captivity on Guam are in the process of being released. (National Research Council, Committee on Scientific Bases for Preservation of the Mariana Crow, Commission on Life Sciences, *The Scientific Bases for Preservation of the Mariana Crow*, National Academy Press, 1996.)

[7]USFWS (July 1996) *Final Report: The Effects of Aircraft Overflights on Endangered Mariana Crows and Mariana Fruit Bats at Andersen Air Force Base, Guam.* Prepared for the Department of the Navy, Pacific Division, Naval Facilities Engineering Command.

[8]During the peak of the Tandem Thrust exercises a pair of Mariana crows (the "pipeline pair") constructed a nest within approximately 915 m (3000') of the active runway.

Daytime and nocturnal FCLP training is infrequent, occurring only two to four times per year.[9] NVG training occurs approximately 3 nights per week, commencing after sunset for a duration of up to three hours. Helicopters are the only aircraft that may fly lower than 305m AGL along the limestone cliff bat foraging area. No new FCLP activities or NVG generating higher noise levels are proposed at Main Base or Northwest Field, respectively.

By their nature, CAL and HLA training involve small landing zones, which restrict the number of helicopters that can be landed simultaneously. Each of these sites has a designated flight track and approach and departure altitude.

Proposed Mitigation. During the Mariana crow breeding season (approximately October 15-April 15), aircraft will avoid an area 1.85 km (one nautical mile) in diameter around all known Mariana crow nesting areas. Nest locations will be identified by Air Force environmental personnel in cooperation with Guam DAWR and plotted on maps for all air crew. Any mitigation for potential impacts on Mariana fruit bats will be decided through Section 7 consultation.

4.1.2.2 NAVACTS Waterfront Annex

Proposed deep underwater demolition training with 20-pound charges in Outer Apra Harbor is the only training activity with potentially significant impacts at NAVACTS Waterfront Annex. Possibly affected species are the hawksbill sea turtle and green sea turtle. At a minimum, potential impacts to these sea turtles will be mitigated by compliance with the protocol established by the Guam EPA and USFWS for charges up to ten pound, and by performance of post-blast dives.

Existing Conditions. The endangered hawksbill sea turtle and threatened green sea turtle frequent Outer Apra Harbor. The outer harbor bottom varies from degraded dredged areas to relatively pristine, well-developed coral reefs in the outer reaches of the harbor. Bottom composition at the EOD site within Outer Apra Harbor consists of very fine calcareous silt with abundant patches of calcareous algae (*Halimeda*). No fish or corals were observed at these sites during the August 1996 site survey.[10]

Potential Impacts. The potentially significant impact from underwater shock waves due to live, 20-pound charge underwater demolition is the disturbance of protected species (threatened green sea turtles and endangered hawksbill turtles) in Outer Apra Harbor. The use of 10-pound charges has been approved by Guam EPA and USFWS.[11] The use of 20-pound charges are estimated to increase the area of potential impacts on sea turtles by approximately 50 percent. Shock wave data for underwater demolition of larger charges[12] indicates that doubling the charge size at a given depth increases the radius of effect by approximately 50 percent. Any coral in the area could be damaged, but none is present at the deep EOD site in Outer Apra Harbor.

[9]Personal communication with Byrnes Yamashita, NAVFAC EFDPAC, January 13, 1977.

[10]Letter from Steve Dollar, Marine Research Consultants, August 16, 1996.

[11]Impacts of charges of up to 10 pounds have been studied by Guam EPA and are within the 100 foot fish kill radius compliance. (A list of fish species killed during four underwater mine detonations in Apra Harbor, between September 1995 and March 1996, is included as Appendix D). The use of these charges is ongoing. EOD training complies with current agreements. [Source: Personal communication with Mel Borja, Guam EPA, August 22, 1996.]

[12]Personal communication with EOD Detachment Guam, October 30, 1996, using unclassified information.

Proposed Mitigation. At a minimum, potential impacts on sea turtles will be mitigated by compliance with the protocol established by the Guam EPA and USFWS for up to ten pound charges,[13] which requires preliminary dives to determine the presence of turtles and schools of fish, and the use of hand thrown diver recall scare charges.[14] These pre-exercise precautions will be taken over the larger area affected by larger charges. In addition, post-blast dives will be conducted by Navy personnel to determine the number of fish kills and whether sea turtles were killed/maimed as a result of the explosions, so that pre-exercise procedures can be improved.

4.1.2.3 Tinian

Training activities on Tinian with the potential to cause significant impacts are ongoing logistics support operations, which could introduce the BTS, and newly proposed AAV landings at Unai Babui, which could damage coral reef and disturb green sea turtle nests. The potential for BTS introduction will be mitigated by strict compliance with *The Brown Tree Snake (BTS) Control/Interdiction Plan for Military Training Exercises (BTS Control Interdiction Plan)*(Appendix F). Mitigation for AAV landings at Unai Babui will be surveying for the presence of sea turtle nests, restricting the vehicle approach lane, restoring the beach to its approximate original topography, and timing of training activities.

Existing Conditions. Three protected bird species (Tinian monarch, Mariana common moorhen, and Micronesian megapode) are known to occur on Tinian.[15] The Tinian monarch nests in trees in limestone forest, secondary forest, and tangantangan. Mariana common moorhens nest near the water at Lake Hagoi. The Micronesian megapode utilizes native limestone forest along the clifflines of Tinian.[16]

Coral reefs, beaches, and coastal strand vegetation are sensitive habitats on Tinian. Reefs provide important habitat for threatened and endangered sea turtles. The green sea turtle nests at virtually all beaches on Tinian, and the endangered hawksbill sea turtle is found in the nearshore waters.

The coral reef flat at Unai Babui is almost barren, with one percent or less living coral coverage at depths shallower than two meters (Figure 4-1).[17]

Potential Impacts. The primary concern on Tinian is the potential for introduction of the BTS from logistics support operations involving the shipping of cargo and vehicles from Guam, which would have devastating long-term impacts on Tinian's native bird and bat population.[18]

The natural functions and appearance of the coral reef at Unai Babui could be reduced by AAV landings. AAVs have the potential to damage or destroy any coral present in waters less than about

[13] Codified as COMNAVMARIANAS instruction 5090.7, "Underwater Detonation of Explosives In and Around Apra Harbor" (Appendix E).

[14] Hand thrown diver recall scare charges, used to encourage animals to leave the general vicinity, will not significantly affect fish and sea turtles. Use of these small charges, which contain less than ten grams of net explosive weight, does not require prior permission according to COMNAVMARIANAS Instruction 5090.7.

[15] The island swiftlet may also be present, but it has not been sighted on Tinian since 1976.

[16] It is not known whether a resident breeding population exists on Tinian (USFWS, April 1996, *Wildlife Research Report*).

[17] Personal communication with Steve Dollar, Marine Research Consultants, December 12, 1996.

[18] USFWS (April 1996).

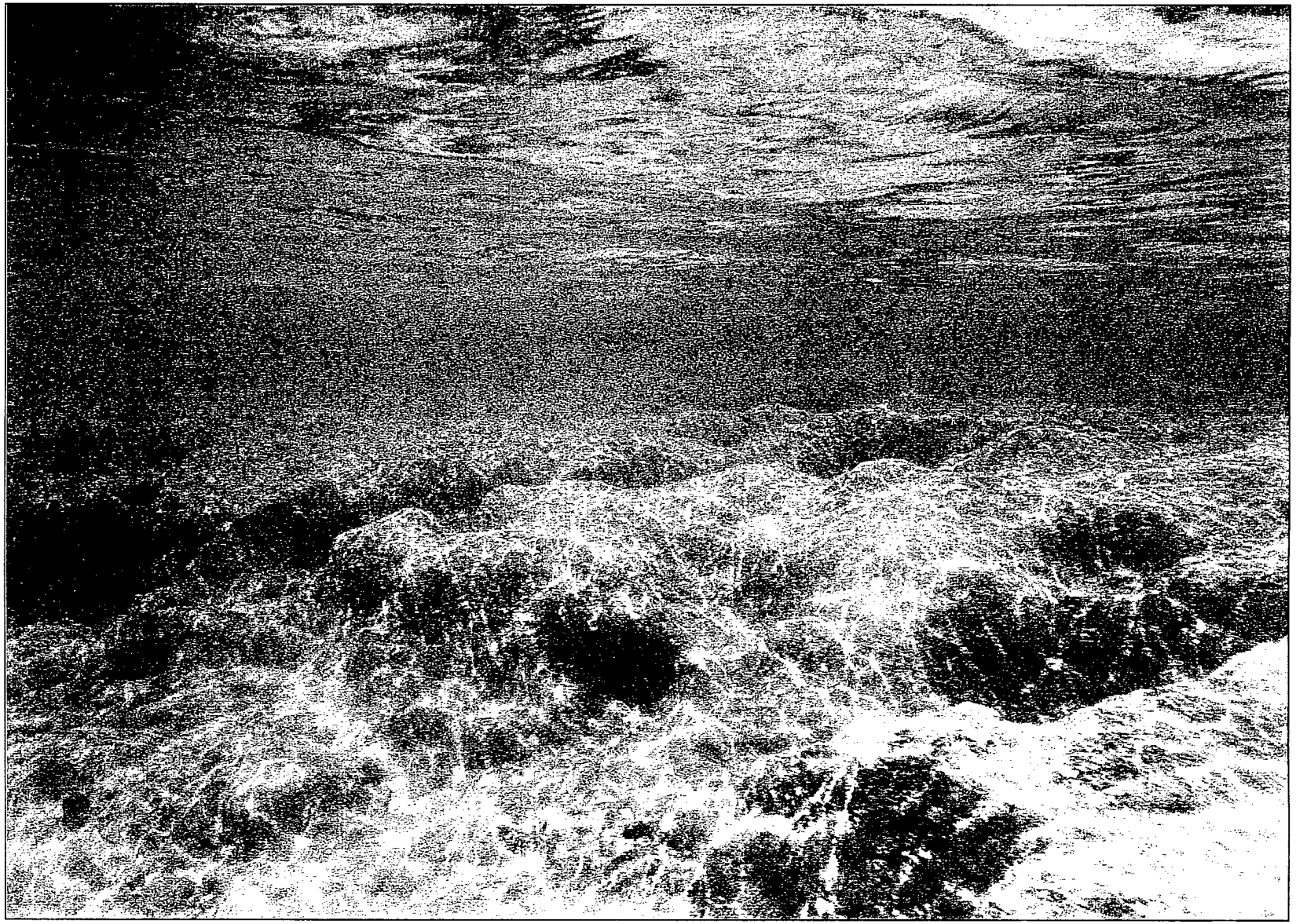


Figure 4-1
REEF FLAT AT UNAI BABUI

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1.8 meters deep. In addition, AAVs arriving on the beach would disturb the upper sand layer, above possible green sea turtle nests.

Proposed Mitigation. Mitigation of the BTS problem will be provided by requiring strict compliance with the *BTS Control/Interdiction Plan* for all training activities originating from or transitting through Guam to Rota, Tinian, or Hawaii (see Appendix F). BTS control procedures include: (1) coordinating cargo handling with the USDA Animal Damage Control office on Guam for cargo departing Guam, (2) establishing snake sterile zones for staging of equipment and cargo, (3) steam cleaning all vehicles prior to transport, (4) performing quarantine activities at arrival locations, (5) activating snake traps at ports of entry, and (6) reporting any BTS sightings to USDA officials.

Potential coral reef impacts of AAV landings at Unai Babui will be mitigated by restricting vehicles to an established approach lane, to minimize the area impacted (see Figure 2-16), and by allowing landing only during high tide. Designated lanes will be approximately 15 m wide and 70 m long (i.e., the width of the reef at depths of less than 2 m), reducing the area of potential coral damage to 24 m^2 or less.[19] Much of the approximately 30-mile-long coastline contains reef flats, some of which are up to 170 m in width. Therefore, 24 m^2 of potential reef damage represents a very small portion (<0.01% by conservative estimate) of Tinian's coral reef flat.

Prior to AAV landings, beaches will be surveyed for the presence of sea turtle nests. Beaches will be flagged to restrict vehicles from areas suspected of containing nests. No engineered modifications of the beach, such as regrading, will be permitted prior to landings. After exercises are completed, beaches will be restored to their approximate original topography.

4.1.2.4 Rota

The only activity with potentially significant biological impacts on Rota protected species is night vision goggle (NVG) training at Rota Airport. Short touchdowns during this training could result in BTS introduction, which will be mitigated by strict adherence to the *BTS Control/Interdiction Plan*. Noise from NVG training may affect Mariana crows, but Mariana fruit bats will not be significantly impacted because they do not occur in the training area. Visual impacts will be non-significant. Noise mitigation involves imposing limitations on timing, location, and helicopter altitude.

Existing Conditions. The largest remaining population of the endangered Mariana crow in the Mariana Islands is on Rota (approximately 600 crows according to a 1996 survey).[20] The eastern end of the island is considered the best crow habitat on Rota. Mariana crow population densities of high, medium, low, and none are depicted in Figure 4-2,[21] as are locations of known crow nests. An aggressive Mariana crow banding study was initiated by the USFWS in October 1996 and will

[19]Coral cover is one percent or less on the reef flat (approximately 60 m long) and ten percent or less on the reef margin (approximately 10 m long). Therefore, the area of affected coral is: 15 m x 60 m = 900 m^2 multiplied by 1%, equaling 9 m^2 for the reef flat, plus 15 m x 10 m = 150 m^2 multiplied by 10%, equaling 15 m^2 for the reef margin, for a total of 24 m^2 of potentially affected live coral.

[20]Grout, Daniel J., Michael Lusk, and Steven Fancy (FWS) (June 1996) *Results of the 1996 Mariana Crow Survey on Rota.*

[21]Densities were determined by a 1982 study and identified in the *Physical and Economic Master Plan for Rota*, prepared by Juan C. Tenorio & Associates, Inc.

provide further information on location of active crow nests; recently USFWS has found an active crow nest within 0.5 km of the northwest corner of the Rota airport boundary.[22]

Endangered Mariana fruit bats roost in the Sabana Heights Wildlife Conservation Area, located approximately 5 km southwest of the Rota International Airport (see Figure C-3 in Appendix C).

Potential Impacts. Short touchdowns during NVG training could result in BTS introduction to Rota. As discussed in Section 3.3.1.4, the BTS has been sighted on Rota but is not thought to be established there. Unless intercepted, introduced BTS could cause ecological and economic problems similar to those on Guam.

Noise from NVG training could significantly impact Mariana crows nesting in the vicinity of Rota International Airport. The proposed helicopter flight tracks are adjacent to crow habitat (see Figure 4-2). Training consists of flying 19 closed-pattern loops with occasional short touchdowns in the same area used for commercial fixed-wing flight approaches and turn-arounds. It will occur 120 times per year. The proposed NVG training will commence one hour after sunset or after the last commercial flight, whichever is later, and will end by 10:00 PM, so noise will be continuous for a period of up to three hours. Therefore, the noise will occur in a familiar location but at an atypical time.

At present, no statistically-based data on peak sound level effects on Mariana crows are available, although some incidental observations have been recorded.[23] Therefore, it cannot be determined whether training will disturb Mariana crows nesting and/or foraging in woodlands adjacent to the airport. The peak NVG sound level at the nearest known crow nest (approximately 1.5 km away) was calculated at 84 dBA without consideration of the shielding effect of intervening vegetation (Appendix G). For nests in the "high crow density" areas further away from the airport, noise attenuation due to vegetation would be significant, greatly reducing the peak sound levels experienced. Impacts from NVG training may be similar to those indicated for low-altitude aircraft overflights at AAFB,[24] where NVG training has been allowed by the USFWS.

Proposed Mitigation. The potential for BTS introduction to the island will be mitigated by strict adherence to the *BTS Control/Interdiction Plan*. NVG training descents will be performed at the eastern end of the runway, where the horizontal distance between the runway and the edge of the high crow population density area is greatest.[25] Helicopters will maintain a minimum altitude of 366 meters[26] AGL in the landing pattern circling the airport prior to and after approach and departure from the runway.

Potential noise impacts cannot be fully mitigated without eliminating NVG training on Rota. If eliminated, NVG training would be feasible but impractical on Tinian. Flights from Guam to Tinian

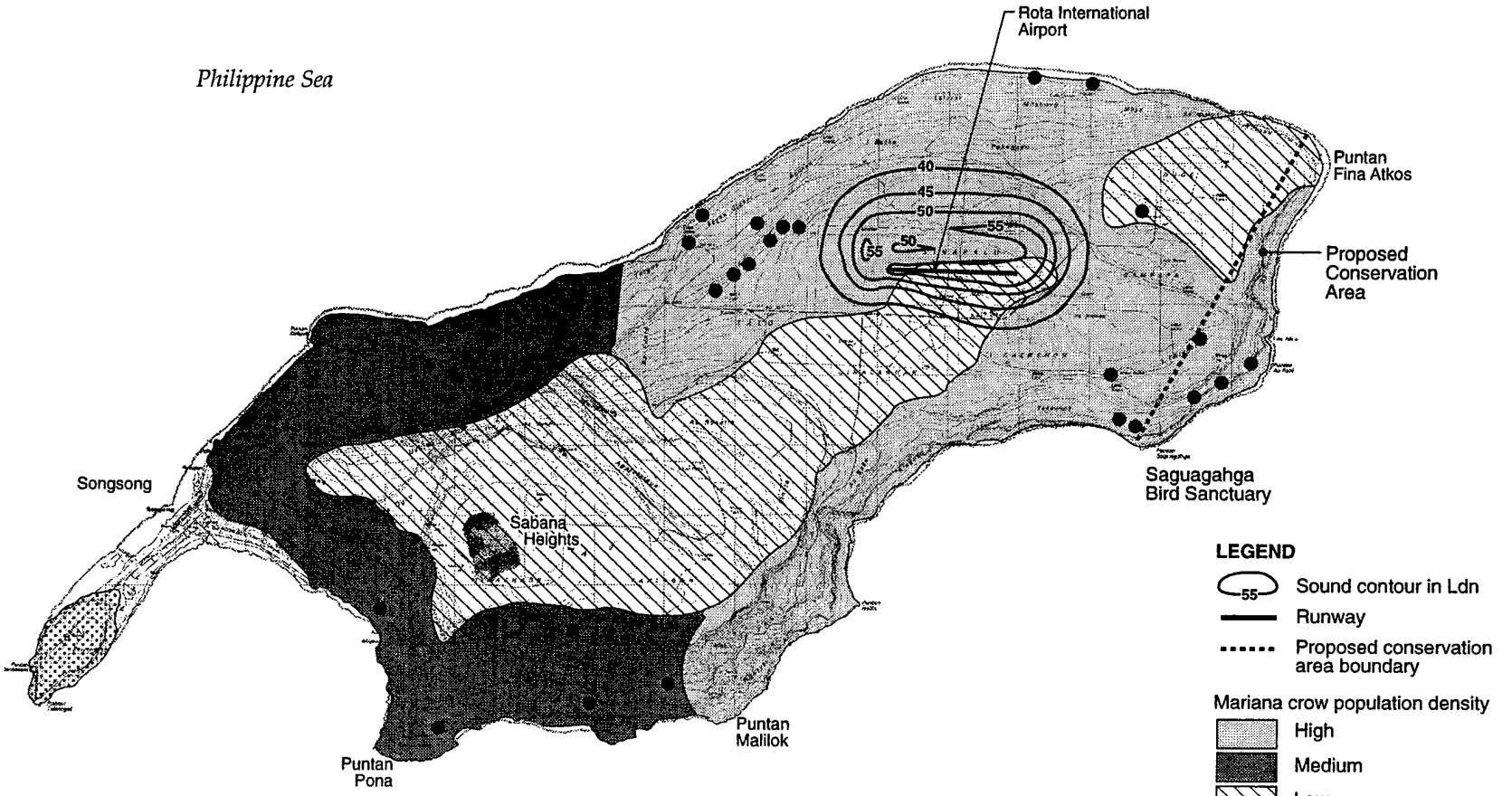
[22]Personal communication with J.M. Morton, Ph.D., USFWS, December 24, 1996.

[23] Anecdotal evidence of disturbance of Mariana crows from HC-5 helicopters was documented in 1980 (personal communication with Bob Beck, Guam DAWR, May 16, 1996). Nest defense and the attack of female crows by outside male crows were among the types of behavior displayed.

[24]Impacts on the Mariana crow from low-altitude aircraft overflights at AAFB include distress and flight, which may disrupt nest construction, incubation, and nest attendance during breeding season. (USFWS, July 1996).

[25]This area is greater than 3 km away from the recently discovered active crow nests located northwest of the Rota Airport.

[26]1200 feet.



Source: Darby & Associates (1996), *HC-5 Helicopter Noise Study for Night Vision Goggle Training at Rota Airport, Rota, Mariana Islands*; Atlas of the Reefs and Beaches of Saipan, Tinian, and Rota; Personal communication with Michael Lusk, USFWS, November 1996

NORTH

0 1000 2000 (Meters)

0 4000 8000 (Feet)

Figure 4-2
DAILY AVERAGE DNL CONTOURS FOR NVG TRAINING
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require twice as much time and fuel as flights to Rota, imposing additional funding and time requirements on the unit and necessitating the use of an additional fuel tank. Training would need to be too brief to be effective, or extra funds would be required to allow refueling on Tinian. In addition, Tinian is not equipped with the backup safety features that are available at Rota International Airport and are necessary in the event of vehicle failure.[27]

4.1.2.5 Farallon de Medinilla

FDM has been used as a bombardment range for the past 25 years. During a brief November 1996 survey, four endangered Micronesian megapodes and five species of migratory birds were sighted on the island. Potentially significant impacts from ongoing and newly proposed training activities are due to BTS importation and explosions. Mitigation measures involve limiting the types of targets imported to prevent BTS introduction, conducting further studies on bird densities and distribution, limiting targeted areas, spraying rodenticide to limit the rat population, and enhancing the Micronesian megapode population on another island in the Marianas.

Existing Conditions. FDM has been used as a bombardment range since October 1971. Unexploded ordnance (UXO) is found throughout the island (Figure 4-3). Bombing targets (old cars) are imported, and bombs used are either aerial- or surface-delivered. The types of explosive used are point-detonating (explode upon impact) and variable-time fused (explode in the air, thus affecting a larger area). The bomb type and delivery method affect the degree of impact; for example, variable-time fused bombs are more likely to produce casualties than point-detonating bombs. The frequency and duration of the use of FDM have varied over the years. Bombing does not occur north of the range limit line (see Figure 2-6).

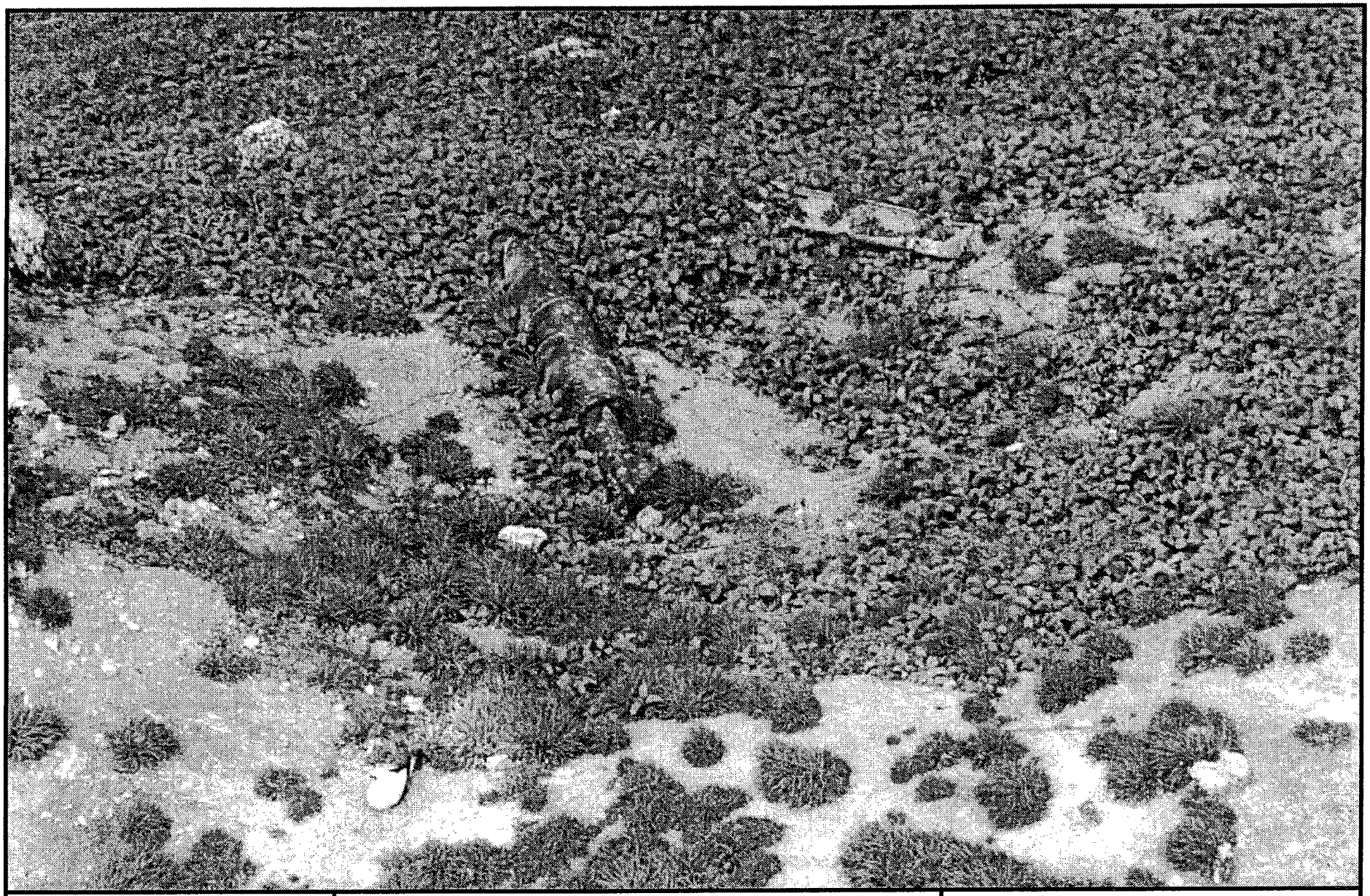
A 1975 report estimated the population of masked, red-footed, and brown boobies to be 50,000 individuals on FDM. The accuracy of this report is questionable because there is no explanation of methodology and the density estimate is extremely high (other literature reports numbers to be fewer than 4,000 boobies for the entire Mariana Islands).[28]

During a brief, half-day avifaunal survey in November 1996 (Appendix H), four endangered Micronesian megapodes were flushed from dense vegetation in the western, central part of the island. Five migratory bird species were observed. These were the bristle-thighed curlew (listed as a species of concern by USFWS), cattle egret, Pacific golden-plover, whimbrel, and ruddy turnstone. Seabirds were also observed, including the masked, brown, and red-footed boobies, estimated to number 750, 200, and 400 individuals, respectively. More thorough, systematic surveys are necessary to determine a more accurate picture of species abundance and distribution. Other fauna encountered were rats and two Mariana fruit bats (not a protected species on FDM).

The southern and northern portions of FDM are physically separated, because the narrowest part of the island is highly eroded (Figure 4-4). Vegetation in the southern portion is less dense than in

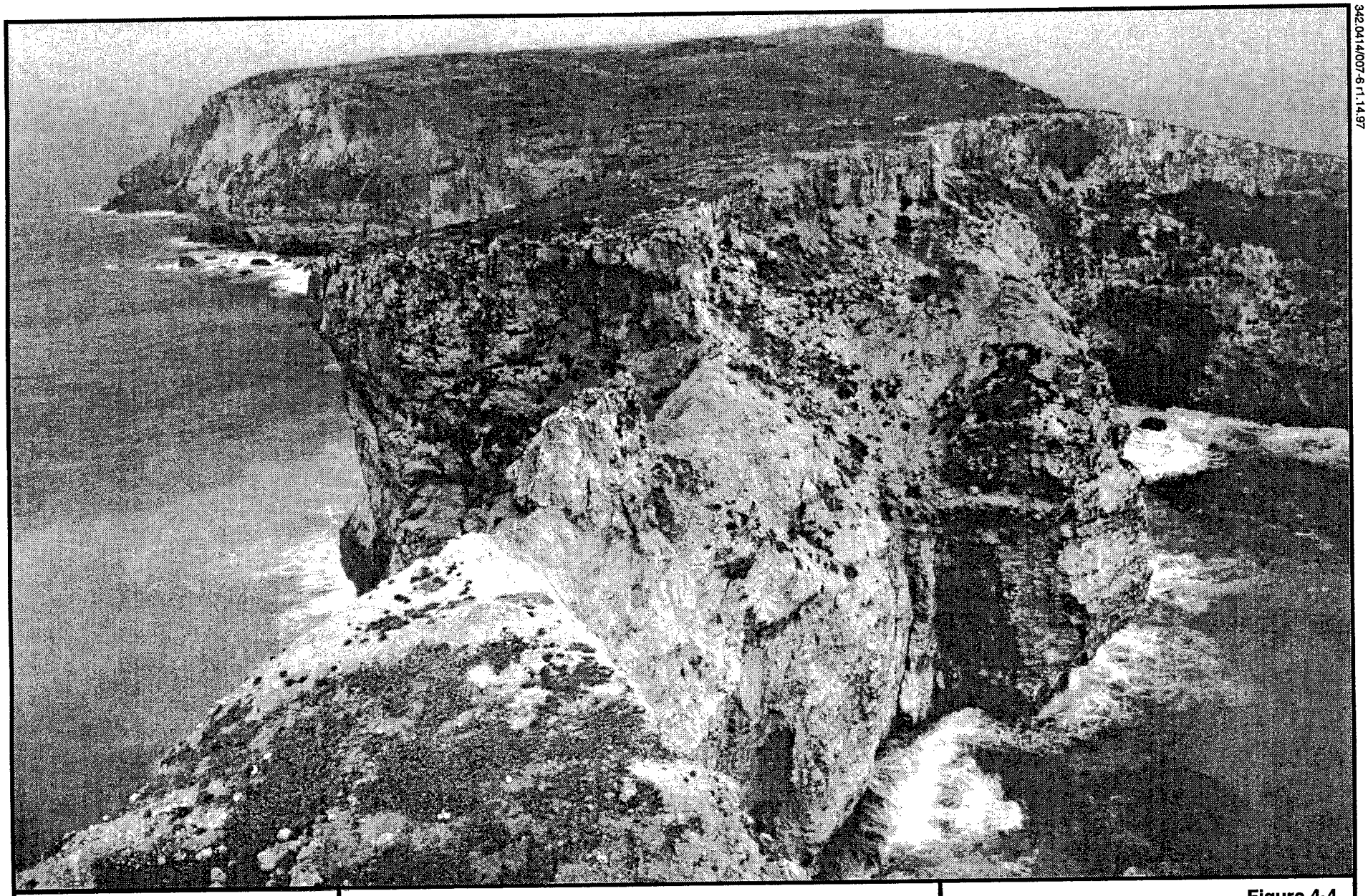
[27]Personal communication with Lt. Commander Scott, Guam HC-5 Unit, August 8, 1996.

[28] Two other bird surveys published shortly afterwards characterize the maximum population of boobies (between the years of 1979-1988) as between 750-2200 individuals on FDM, or a total of 1,380 to 3,800 individuals in the whole Mariana Islands. (Reichel, J. (1991) "Status of Conservation of Seabirds in the Mariana Islands," in *Seabird Status and Conservation: A Supplement, ICBP Technical Publication No. 11* edited by J.B. Croxall and USFWS (1985) *Job Progress Report Research Project Segment: Seabird Survey and Inventories for October 1, 1984 through September 30, 1985.)*



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Figure 4-3
UNEXPLODED ORDNANCE ON FARALLON DE MEDINILLA
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Figure 4-4
STEEP CLIFFS OF
FARALLON DE MEDINILLA
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

the northern portion. During a brief, half-day botanical survey (Appendix H), no threatened or endangered plant species were observed on the island. A small number of native plant species occur on the island; of these, seaside cotton (*Gossypium hirsutum*) and the bunch grass (*Digitaria gaudichaudii*) are considered rare or uncommon.

The degree to which previous and future bombing activities have affected and will affect species populations on FDM cannot be conclusively determined based on existing information. However, recent evidence of the presence of species on FDM and the 25-year history of use as a bombardment range suggest that some sort of equilibrium between the bird population and ongoing use has been established.

Potential Impacts. BTS could be introduced through importation of bombing targets. Explosions from high altitude aerial bombardment could affect the endangered Micronesian megapode and migratory birds on FDM in two ways: direct contact, or alteration of habitat and/or food source.

Mitigation. To address BTS importation, the measures in the *BTS Control/Interdiction Plan* will be adhered to. Constructed targets, rather than recovered vehicles, will be imported to FDM.

Further studies on seabirds and megapodes will be conducted for a better understanding of the effects of bombing on the birds that live on or migrate to FDM. Flyovers will be performed and aerial photographs will be taken on a quarterly basis for two years, to determine population densities, specific areas used by the birds, and their peak nesting season.

Until additional information can be collected and analyzed, locations of target areas will be temporarily limited. Point-detonating explosives will be limited to the center of the northern portion of the island, below the range-limit line. Variable-time fused bombs will be targeted to the southern portion of the island, where birds are less likely to occur because of the low quality of vegetation. In addition, only the western cliff-face of both the northern and southern portions of the island will be targeted.

To address long-term survival of the species, additional mitigation may include enhancing the Micronesian megapode population on another island in the Marianas. This will be determined in consultation with the USFWS and National Marine Fisheries Service.

4.1.3 Non-Significant Impacts: Proposed New Activities

This section discusses newly proposed activities that have raised concerns, but the impacts are considered non-significant based on the evaluation criteria. These issues are discussed below by location.

4.1.3.1 Andersen Air Force Base

Rapid Runway Repair. This activity will require a limited amount of excavation (with explosives) and patching on the south runway of Northwest Field. Explosives of up to 15 pounds are used, tamped in bore holes. There are no endangered Mariana crows nesting near the runway, so they are not expected to experience noise impacts from the use of these explosives. However, if crow nesting activity is reported to be in the vicinity, exercises will be temporarily halted.

4.1.3.2 NAVACTS Waterfront Annex

Shallow water mine countermeasure training at the NAVACTS Waterfront Annex involves the use of very low charge underwater explosives at two locations but will not cause significant impacts. Use of underwater explosives of up to ten pounds at a new site at Dadi Beach will not cause significant impacts because no protected species or coral are present. Potential impacts of LCAC landings at Dadi Beach are non-significant.

Shallow Water Mine Countermeasure Training. Seven sites are proposed for this training: six in Outer Apra Harbor (Drydock Island, Polaris Point, Breakwater Beach, and Gabgab Beach) and one offshore of Dadi Beach. Training will involve live charges (strings of 20 one-pound charges) at only two of these sites: Breakwater Beach and Dadi Beach. Blanks are proposed for the other sites.

A marine survey performed for this DEIS found that coral growth at most of the proposed sites is either marginal or widely spaced (Appendix I). No significant impacts will occur at training sites where blanks will be used. The two sites chosen for live ammunition lack biota; Dadi Beach has essentially no macrobiota on either the reef flat or the sandy area beyond the reef flat, and Breakwater Beach has no biotic community structure.

Training at Gabgab Beach is included in the Augmented Training Alternative but not in the Mitigated Set. Use of this location for shallow water mine countermeasure training is not being proposed in the mitigated set of training alternatives because it is one of the most well-developed coral reefs in Apra Harbor.

Underwater Demolitions at Dadi Beach. According to the recent marine survey, the proposed new EOD site offshore of Dadi Beach is a very flat featureless sand plain about 24 meters deep, with isolated rocks in the nearshore area. Use of explosive charges of up to ten pounds is proposed for this area. No significant impacts are anticipated. Potential impacts of these charges on sea turtles will be mitigated by continued compliance with Guam EPA and USFWS protocol, developed for similar activities in Outer Apra Harbor.

Floating Mine Neutralization Outside Apra Harbor. The proposed site is approximately 3.2 km north of Apra Harbor in waters over 600 m deep. The proposed shot will be a 10-pound charge detonated within 3 m of the surface. No significant impacts on biota are expected. Potential impacts on sea turtles will be mitigated by using scare charges 30 minutes in advance of any detonation.

LCAC Landings at Dadi Beach. Newly-proposed LCAC landings at Dadi Beach are not expected to impact coral, as the vehicles do not contact the ground until they are fully over dry land. However, LCAC fans have the potential to suspend and disperse sand on the beach, resulting in possible minor disturbance of strand vegetation and any sea turtle nests present. The proposed LCAC landing site at Dadi Beach has low, spreading mats of vegetation (beach morning glory and various grasses) covering some areas of sand. None of the plants in the area are threatened or endangered.[29] Sea turtle impacts are unlikely; green sea turtles have not nested on Dadi Beach for

[29]Helber Hastert & Fee, Planners (March 1995) *Environmental Assessment for the Navy Lodge, Waterfront Annex, U.S. Naval Activities, Guam.* Prepared for Navy Exchange Service Command.

at least 20 years.[30] If DAWR finds that turtles have returned to this area, they will notify the Navy, and LCAC training activities will be mitigated by surveying and flagging turtle nests prior to exercises.

4.1.3.3 NAVACTS Ordnance Annex

Proposed training activities of concern for this area include construction and use of a sniper range, construction and use of a shooting house, and creation of a helicopter landing zone.

Sniper Range. The proposed sniper range location is on the west side of the NAVACTS Ordnance Annex; the firing points will be on a small hill, site of the former West Lookout Tower (see Figure 2-7). The topography consists of hilltops, ridges, gentle to steep slopes, and a ravine that leads down into the lower elevations of the Ordnance Annex. According to a recent flora survey (Appendix J), virtually all of the area is disturbed, most of it by periodic fires that ravage the hillsides, eliminating tree species and allowing the sword grass and mission grass to dominate.[31] Many native species were found in the ravine forest, but no endemic species were found at the proposed sniper range during a recent faunal survey (Appendix K). Because the area is already disturbed, impacts from minor construction will be non-significant.

Possible side effects from the use of the proposed sniper range are projectile impact and fires. Projectile impact is non-significant because of the low volume of fire and minute effect of the projectile. Because the distance to target is less than 1000 m (firing positions will be located 700 m to 900 m from targets, target/backstop impacts will be consistent, with few strays. Fires could be ignited by sparks created by rounds ricocheting off metal target frames, but will be mitigated by strict adherence to the fire prevention and response plan. In addition, a helicopter with water hauling capabilities will be on call during training sessions at the sniper range.

Breaching House. The proposed site for the breaching house is near the sniper range firing line (see Figure 2-7). An area 30 m by 30 m will be cleared for construction of the proposed 14 m by 14 m breaching house. The house will be within the sniper range SDZ. The area is entirely disturbed (there is no sensitive vegetation) and is dominated by sword-grass savanna.

No significant impacts to biota are expected from construction of the breaching house because the area is already disturbed. Construction impacts will be minimal and will be mitigated by standard erosion control procedures.

No significant impacts are expected during breaching training. The potential for impacts from six-pound shape charges is minimal because the charges are designed to explode material into the house, instead of away from it. The potential for projectile impacts and for fire hazard are also low, as simulated ammunition made of plastic (Simunition) will be used instead of live ammunition and the house will be constructed of fire-resistant material, respectively.

Helicopter Landing Zone. The proposed LZ will be utilized for field exercises, helo insertions, and HC-5 fire bucket training. Creation of this LZ might involve limited brush clearing. However, no limestone forest is located in the area that may be cleared, and no endangered species have been

[30]Personal communication with Gerry Davis, Guam DAWR, January 8, 1997.

[31]The majority of these fires are thought to have been deliberately set by deer poachers to increase deer habitat. (Personal communication with Gary Wiles, Guam DAWR, May 16, 1996.)

observed in the immediate area. Therefore, no significant impacts are expected and no mitigation is required.

4.1.3.4 Non-DoD Land (Vicinity of Ordnance Annex)

The only activity of concern for this area is river insertion in the Talofofo River Valley. This training will involve the use of boats only. Personnel will paddle silently upriver under stealth conditions. No endangered species were identified in this immediate area and no impacts are expected. Landowners would be notified and permission requested for any planned overland maneuvers. The effects of these maneuvers is essentially that of cross-country hiking.

4.1.3.5 Tinian

Proposed activities on Tinian that are of concern but will not cause significant impacts are the construction and use of a new firing range and a new shooting house. Potential impacts would be due to clearing, fire, and projectiles.

Shooting House and Firing Range. Potential impacts from clearing during construction and from fire hazards and projectile impacts during use of the shooting house and firing range will be non-significant.

Construction of a shooting house and a new firing range will result in clearing of tangantangan brush. Approximately 1000 m^2 for the shooting house and 0.1 km^2 for the firing range will be cleared (see Figure 2-12).[32] Tangantangan brush serves as secondary habitat for the threatened Tinian monarch and may contain plants used for medicinal purposes. Tinian monarchs may nest year-round in limestone forest, but nesting in tangantangan has only been observed in the months of May, August through October, and December.[33]

Potential impacts on Tinian monarchs from this clearing will be mitigated by avoiding clearing activities from May through December. Clearing is not anticipated to result in cumulative impacts with the VOA site development by the U.S. Information Agency. The U.S. Information Agency will mitigate removal of the tangantangan forest in the VOA area by replanting an area (of approximately 0.2 km^2) of tangantangan in the vicinity of the area being closed.[34]

Potential clearing of some medicinal plants does not require mitigation, since these plants are scattered throughout the island.[35]

The potential fire hazard from use of the proposed firing range will be mitigated by strict adherence to the fire prevention and response plan used in Tandem Thrust 95. Preventive measures outlined

[32]Personal communication with Naval Special Warfare Unit-1, January 13, 1996.

[33]USFWS (April 1996).

[34]Development of the VOA site by the U.S. Information Agency will result in clearing 0.3 km2 of tangantangan forest, displacing a total of up to 255 monarchs. Based on a USFWS island-wide estimated of 30,000 to 60,000 Tinian monarchs, less than one percent of the total population will be affected. (United States Information Agency, Internal Broadcasting Bureau, Voice of America, *Final Environmental Assessment and Finding of No Significant Impact for the Voice of America Mariana Relay Station, Tinian, Commonwealth of the Northern Mariana Islands,* August 1995.)

[35]Personal communication with HPO Personnel, February 8, 1996.

in this plan include curtailing the use of fire-causing objects during periods when fire hazard is high, and having fire-fighting equipment readily available.

Projectile impacts are non-significant at the shooting house and firing range. The shooting house is designed to trap bullets inside, thus minimizing potential contact with fauna. At the firing range, the distance from direct fire to target is less than that considered significant (1000 m; see Section 4.1.1).

4.1.4 Non-Significant Impacts: Ongoing Activities

This section discusses impacts of ongoing activities over which concerns have been raised in the past. Impacts from these ongoing activities are either non-significant (by the evaluation criteria) or are potentially significant but already have ongoing mitigations in place. These activities are discussed by location below.

4.1.4.1 Andersen Air Force Base and NCTAMS Finegayan

Ongoing, already mitigated activities at AAFB include paradrops, bivouacs, and NVG training at Northwest Field. Combat swimmer insertion in the Haputo Ecological Reserve Area (ERA) is also discussed below.

Paradrops. Both small (4 to 12 people) and large (90 people) group jumps are ongoing at Main Base and Northwest Field. Pilots fly the pattern at 152 m AGL.[36] Nesting areas of the Mariana crow in the vicinity have the potential to be temporarily disturbed by noise and visual stimuli. No long-term or cumulative impacts are anticipated.

Disturbance is not expected to affect crows during the non-breeding season, particularly as drops will be targeted at the runways to avoid injuries from contact with trees and other obstacles. During the crow breeding season (approximately October 15-April 15), paradrops at Northwest Field will occur from aircraft flying no less than 305 m AGL.

Bivouacs. Field exercises at Main Base and Northwest Field that require bivouac for medical, communication, security, or other skills training have been conducted at the areas indicated on Figure 2-3 for over 15 years. Groups of 100 or more have not caused known disturbance to Mariana crows. Crows are not known to have nested in the area in recent years.

Troops are not permitted to light open fires, clear vegetation, or dig, other than limited digging for foxholes. The area is closely monitored by AAFB personnel to maintain the integrity of field conditions for follow-on troop exercises. Because mitigation is in place for ongoing bivouacs, potentially significant impacts are not anticipated.

NVG Training. Night vision goggle training is ongoing at Northwest Field. Although Mariana crows occur in the general area, there are no Mariana crow nests on the south runway where touch-downs occur. Training aircraft will avoid an area 1.85 km (one nautical mile) in diameter around all known Mariana crow nesting areas during breeding season (approximately October 15-

[36] 36th Operations Support Squadron (36 OSS) and Helicopter Combat Support Squadron (HC-5)(undated) *Letter of Agreement: Air Traffic Control (ATC) Procedures for HC-5 Operations at Northwest Field, Guam.*

April 15). Nest locations will be identified by Air Force environmental personnel and plotted on maps for all air crew.

Combat Swimmer Insertion. This activity is proposed at Haputo and Double Reef Beaches in the Haputo ERA (located along the coastline of NCTAMS Finegayan). Maneuvers consist exclusively of rubber boat landings on the beach and small groups hiking up the established trail and steps and proceeding out of the ERA. No significant impacts are expected from this activity.

4.1.4.2 NAVACTS Waterfront Annex

There are two ongoing activities at the NAVACTS Waterfront Annex that have raised concerns but will not cause significant impacts. River insertion training causes no significant impacts, and ongoing deep water demolition of up to ten-pound charges is already mitigated.

River Insertion Training. Riverine training at the Atantano River mouth (see Figure 2-2) consists of small clandestine groups traveling the river and certain areas of the associated marshland, wading, walking, and firing blanks. Endangered Mariana common moorhen occur in the general vicinity. They are known to inhabit the complex of marshes and ponds located near the entrance to Apra Harbor, referred to collectively as the Naval Station Marsh. This marsh is one of the primary moorhen habitats on Guam.[37] They are also known to occur further inland of the rivermouth, such as at the Shell Guam wetlands. In addition, mangrove swamps, a protected habitat, occur near the river mouth.

Although the moorhen could be present at this training site, it is a freshwater bird and tends not to nest in brackish water that is under tidal influence, as is the case at the mouth of the Atantano.[38] Personnel will be informed about this endangered bird and instructed not to shoot at it or disturb any nests that may occur in the area. The mangrove swamps will not be significantly impacted by hiking activities. No vegetation clearing is planned.

Underwater Demolitions. Underwater demolition training in Outer Apra Harbor has occurred regularly since 1992. Underwater demolition charges of up to ten pounds are used in training at one site in Outer Apra Harbor (see Figure 2-2). To date, there is no record of sea turtle kills occurring as a result of underwater demolitions training.[39] Established Guam EPA/USFWS protocol requires preventive measures to avoid harming the threatened green sea turtle and the endangered hawksbill turtle. The measures include preliminary dives to determine the presence of turtles and schools of fish, and the use of hand thrown diver recall scare charges.

4.1.4.3 NAVACTS Ordnance Annex

The only ongoing activities in the NAVACTS Ordnance Annex that have raised concern are bivouacs, which create a potential fire hazard, and land navigation training, which may occur in rare species habitat.

[37]USFWS (September 1992) *Recovery Plan, Mariana Common Moorhen.*

[38]No formal surveys have taken place in this area. (Personal communication with Bob Andersen and Bob Beck, Guam DAWR, December 10, 1996.)

[39]Two unexploded 500-pound bombs from WWII were detonated in the Rota East Harbor in May 1996 for safety reasons. These detonations were unrelated to any military training activities. CNMI regulatory agencies approved the detonation, the environmental consequence of which were determined to be minimal.

Protected species in the NAVACTS Ordnance Annex are several species of migratory shorebirds and waterbirds which use Fena Reservoir; the Mariana common moorhen, found in the wetland areas and at Fena Reservoir; the island swiftlet, located along the Talofofo River and in the Mahlac Cave (located in the vicinity of the Fena Reservoir); and a few individual Mariana fruit bats, also found in the limestone forest areas between Mt. Almagosa and East Tower. In addition, two reptiles and two tree snails listed as endangered on Guam, and several rare and sensitive invertebrates were identified during the USFWS faunal inventory surveys in the Ordnance Annex. No newly proposed training will occur in the Fena Reservoir or near the swiftlet caves.

Bivouacs. The bivouac area is confined to one location that has already been disturbed, so none of the species mentioned above are expected to be significantly impacted. In addition, bivouac activities have ongoing mitigation, similar to that at AAFB, i.e., a fire prevention plan is in place and helicopter water-drop assistance is available. The Fire Prevention and Response Plan used for the Tandem Thrust 1995 exercise will be finalized by COMNAVMARIANAS and used at the Ordnance Annex (Appendix L).

Land Navigation Training. Land navigation training occurs in the southern end of the Ordnance Annex. Located within this area is the Almagosa spring which contains a *Merrilliodendron* forest that supports three rare species: the Marianas eight-spot butterfly, the Almagosa Cave isopod, and the Almagosa Cave amphipod. This site is also a potential area for the reintroduction and maintenance of native tree snails, some of which are listed as endangered by the territory of Guam. Another limestone sinkhole located south of Almagosa Pit contains similiar rare plant and animal species. No significant impacts are expected in either of these two areas because training is limited to small numbers of people hiking through these areas under stealth conditions. These areas will be designated off-limited or NGD/NWD.

4.1.4.4 Tinian

LCAC landings on Tinian have raised concern about potential impacts to coral, but these will be non-significant. Another possible impact is suspension and deposition of sand on vegetation and sea turtle nests, which is being mitigated.

LCAC Landings. LCAC landings at Unai Chulu and Unai Dankulo are not expected to impact coral, as the vehicles do not contact the ground until they are fully over dry land. However, the LCAC fans have the potential to suspend and dispose sand on the beach, resulting in possible disturbance of strand vegetation and any sea turtle nests present. While LCACs are extremely unlikely to disturb turtle nests, offloaded vehicles may. For mitigation, beaches are surveyed prior to LCAC landings for the presence of sea turtle nests. LCAC entry lanes on the beaches are flagged to restrict exiting vehicles from areas suspected of containing nests. No engineered modifications of the beach, such as regrading, are permitted. After exercises are completed, beaches are restored to their approximate original topography.

4.2 IMPACTS ON CULTURAL RESOURCES ON GUAM AND TINIAN

Many cultural resources are located on DoD land on Guam and Tinian. Cultural resources include buildings, structures, objects, sites, districts, and archaeological resources. Because access to areas under DoD control, such as the Ordnance Annex, is restricted, the archaeological/historic resources

have been left undisturbed and are well-preserved. This section analyzes the potentially significant impacts of several proposed new training activities on cultural resources on Guam and Tinian according to certain evaluation criteria. The issue is significant because of the potential to affect sites protected under the National Historic Preservation Act (NHPA).

The existing cultural resources on Guam and Tinian are presented first, followed by a general discussion of potential impacts of training activities and proposed mitigation. Particular locations of concern are then addressed, including detailed descriptions of training activities and existing conditions, potential impacts, and mitigation. Cumulative impacts of ongoing training on Tinian have been addressed in detail in the past[40] and continue to be mitigated by limiting ground disturbing activities and by complying with a recently developed Site Protection Plan.[41]

The only land-based training proposed for Rota consists of small encampments at Angyuta Island. *The Physical and Economic Master Plan for Rota* by Juan C. Tenorio & Associates, Inc. indicated that no archaeological or historic resources are known to exist at that location. A brief reconnaissance survey and literature search did not provide any reliable evidence of archaeological resources on FDM (Appendix M). Therefore, this analysis is limited to Guam and Tinian.

4.2.1 Existing Cultural Resources

Information presented in this section is based on a review of existing survey reports, overview survey reports, draft and final cultural resource management plans, consultation with archaeological contractors conducting surveys in proposed training areas, and data gathered during site visits in March, April, July, and August 1996. The review was performed by International Archaeological Research Institute, Inc. (IARII) in December 1996 (Appendices N and O). The IARII reports identify sites, determine historical "significance," and propose mitigative actions. Archaeological and historic resources on Guam and Tinian were evaluated for historical "significance" in terms of their ability to meet the criteria of eligibility for nomination to the National Register (NR) of Historic Places under the NHPA.[42]

4.2.1.1 Guam

DoD land on Guam contains numerous cultural resources, which are described in detail in Appendix N. The Ordnance Annex has many ancient Chamorro latte sites and World War II Navy structures. The Waterfront Annex contains several pre-World War II and World War II Navy

[40]Belt Collins Hawaii (November 1994) *Environmental Assessment Military Exercise, Island of Tinian: Tandem Thrust 95.*

[41]International Archaeological Research Institute, Inc. (December 1996) *Prefinal Tinian Historic Site Protection Plan for the Military Lease Area.*

[42]Historical "significance" should not be confused with significance of a potential impact. To be considered eligible for nomination to the NR under the NHPA and referred to as a historically "significant" resource, a resource must possess integrity and meet at least one of the four following criteria of historic value:

A: The resource is associated with events that have made a significant contribution to the broad patterns of our history.
B: The resource is associated with the lives of persons significant in our past.
C: The resource embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.
D: The resource has yielded, or may be likely to yield, information important in prehistory or history.

structures. AAFB has one latte site, surface pottery scatters, and rock shelters in the Tarague embayment, where training activities are not conducted. The Tarague embayment and Pati Point sites are listed on the Guam Register of Historic Places. Sites associated with WWII and the Vietnam conflict include primarily the runways at AAFB's Northwest Field. Nominations to the Guam and National Registers are pending.

Complete inventory surveys for all Guam training areas have not been performed; Figures 4-5 through 4-7 show locations surveyed to date. Surveys are currently being performed of portions of AAFB and were recently completed for areas of the Ordnance Annex. No current surveys are in progress at the Waterfront Annex or NCTAMS Finegayan, although portions have been surveyed in the past. No surveys have been performed of Andersen South or NCTAMS Barrigada.

Proposed training areas on Guam known to have or suspected of having significant cultural sites[43] and proposed as training areas include:

- Southern and western portions of NAVACTS Ordnance Annex (numerous latte sets)
- Orote Airfield (World War II site)
- Outer Apra Harbor (submerged World War I and II shipwrecks)
- Haputo Beach (vicinity of a major latte complex)
- Northwest Field at AAFB (World War II site potentially eligible for the National Register)

Although most of the known cultural resources located within the training areas are not vulnerable to training activities, there is a potential for impacts to some important sites on Guam.

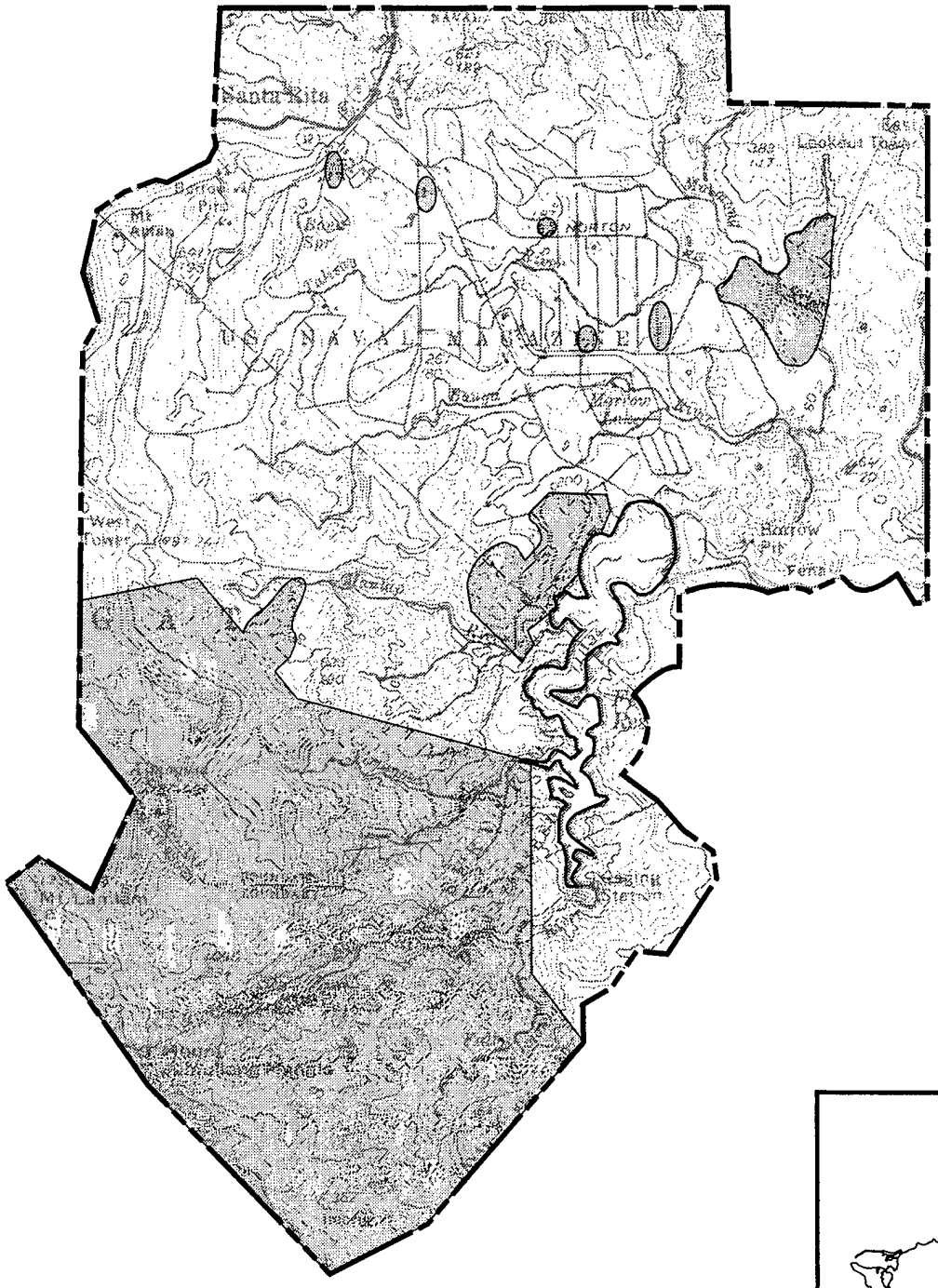
Ordnance Annex. In the NAVACTS Ordnance Annex, the Alifan Ridge Complex is located within an existing bivouac area, and the latte complex and recently discovered large latte village are within the safety fan of the proposed sniper range (see Figure 4-5).

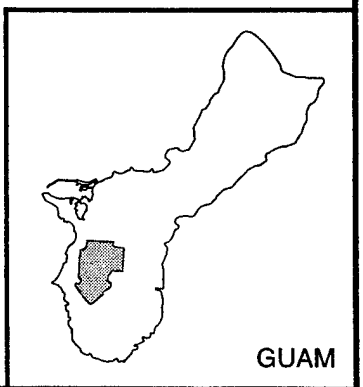
Waterfront Annex. The three areas of concern in the Waterfront Annex are Orote Airfield, the Orote Historic Complex, and the underwater resources in the harbor. Orote Airfield, a significant World War II site listed on both the National Register and Guam Register, is located near an existing firing range proposed for extension. The Orote Historic Complex is located at the end of the peninsula near a bivouac area and contains several important historic features. The outer harbor, where underwater demolition training is proposed, contains several submerged historic resources (see Figure 4-6).

AAFB. The coastal areas and Northwest Field are the main areas of concern at AAFB (see Figure 4-7). The EOD range contains several sites, including burial areas and remnants of prehistoric villages. Northwest Field is considered historically significant by the Air Force because of its role in World War II. The only known historic structure at Andersen South is Building 1125. Andersen South also has one prehistoric site, the Pagat Point latte site. Both Building 1125 and the Pagat Point latte site have potential significance, although their eligibility status has not been determined.

NCTAMS WESTPAC. Haputo Beach in NCTAMS Finegayan, where swimmer insertions and maneuvers by the SEALS are conducted, is the site of a latte complex that is listed on the National and Guam Registers. Also located in this area are the Pugua Point rockshelters and Tweed's Cave, both of which are potentially eligible to be listed on the National Register.

[43]Significant sites are defined as those eligible for listing on the National Register of Historic Places.





NORTH

0 500 1000 (Meters)

0 2000 4000 (Feet)

LEGEND

Archaeological survey performed

Figure 4-5
NAVACTS GUAM ORDNANCE ANNEX ARCHAEOLOGICAL SURVEYS
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

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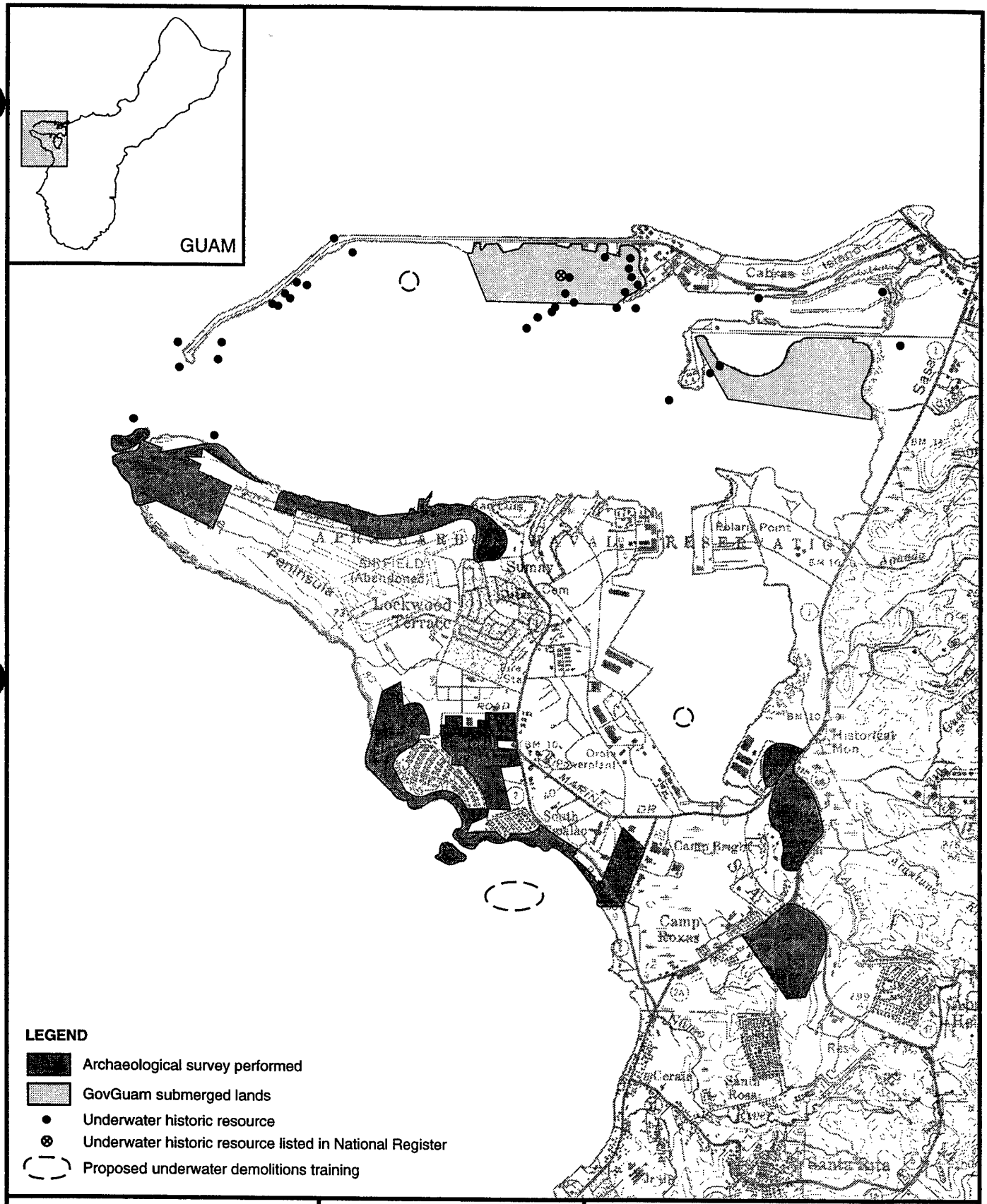
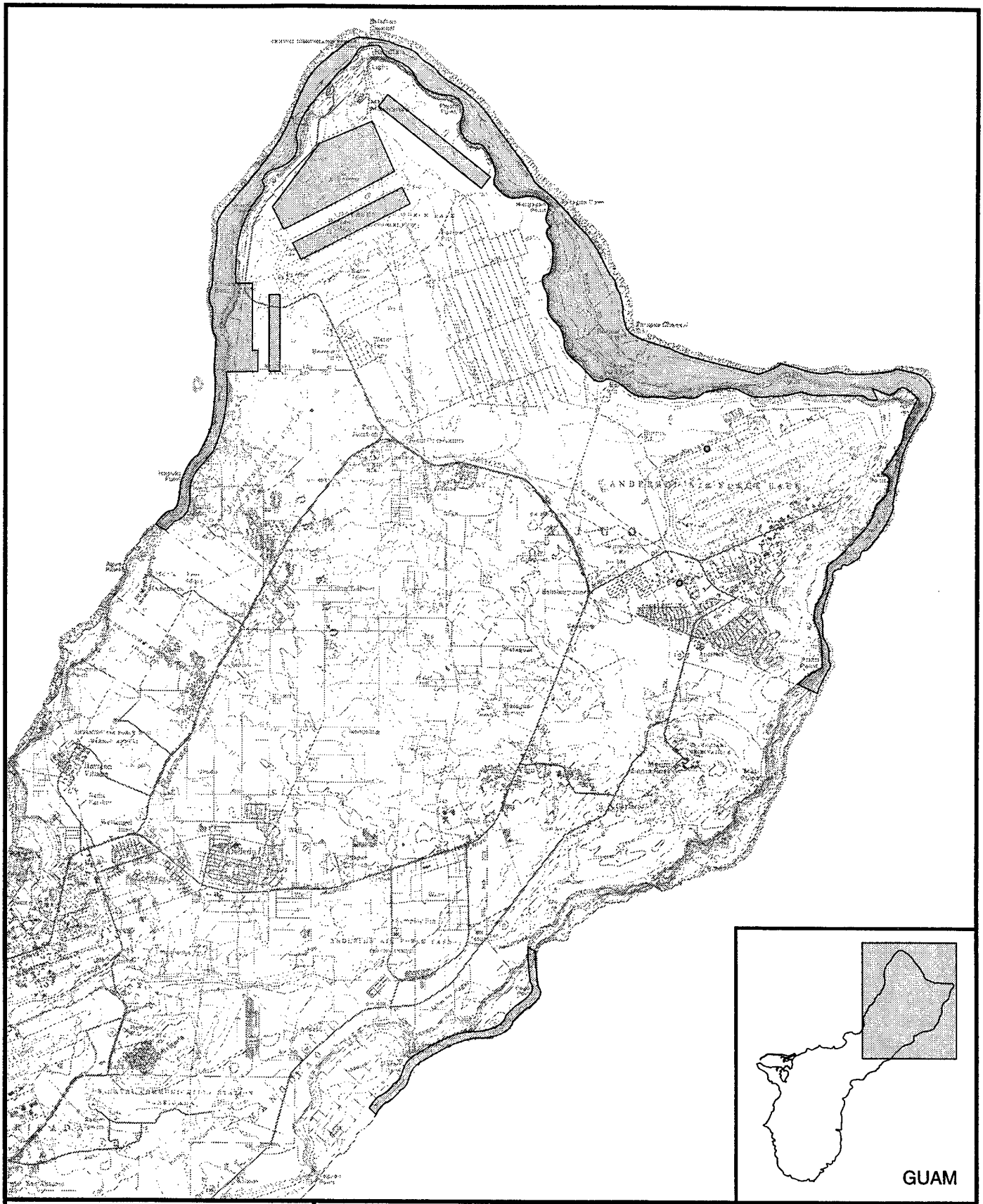


Figure 4-6
NAVACTS WATERFRONT ANNEX
ARCHAEOLOGICAL SURVEYS
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997



NORTH

0 1000 2000 (Meters)

0 4000 8000 (Feet)

LEGEND

Archaeological survey performed

Figure 4-7
ANDERSEN AIR FORCE BASE/NCTAMS ARCHAEOLOGICAL SURVEYS
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

4.2.1.2 Tinian

The Navy has commissioned intense inventory surveys of the entire EMUA and along the coastline of the MLA (Figure 4-8), with the exception of the three originally proposed VOA transmitter sites. Only reconnaissance surveys of the VOA sites have been performed, so certain portions have been surveyed intensely while the rest of each area was left unsurveyed (see Figure 4-8).

The results of the surveys, which are summarized in the IARII report in Appendix M, show that Tinian has numerous archaeological and recent historic resources. Many of Tinian's known archaeological sites and historic resources are located in the EMUA, including:

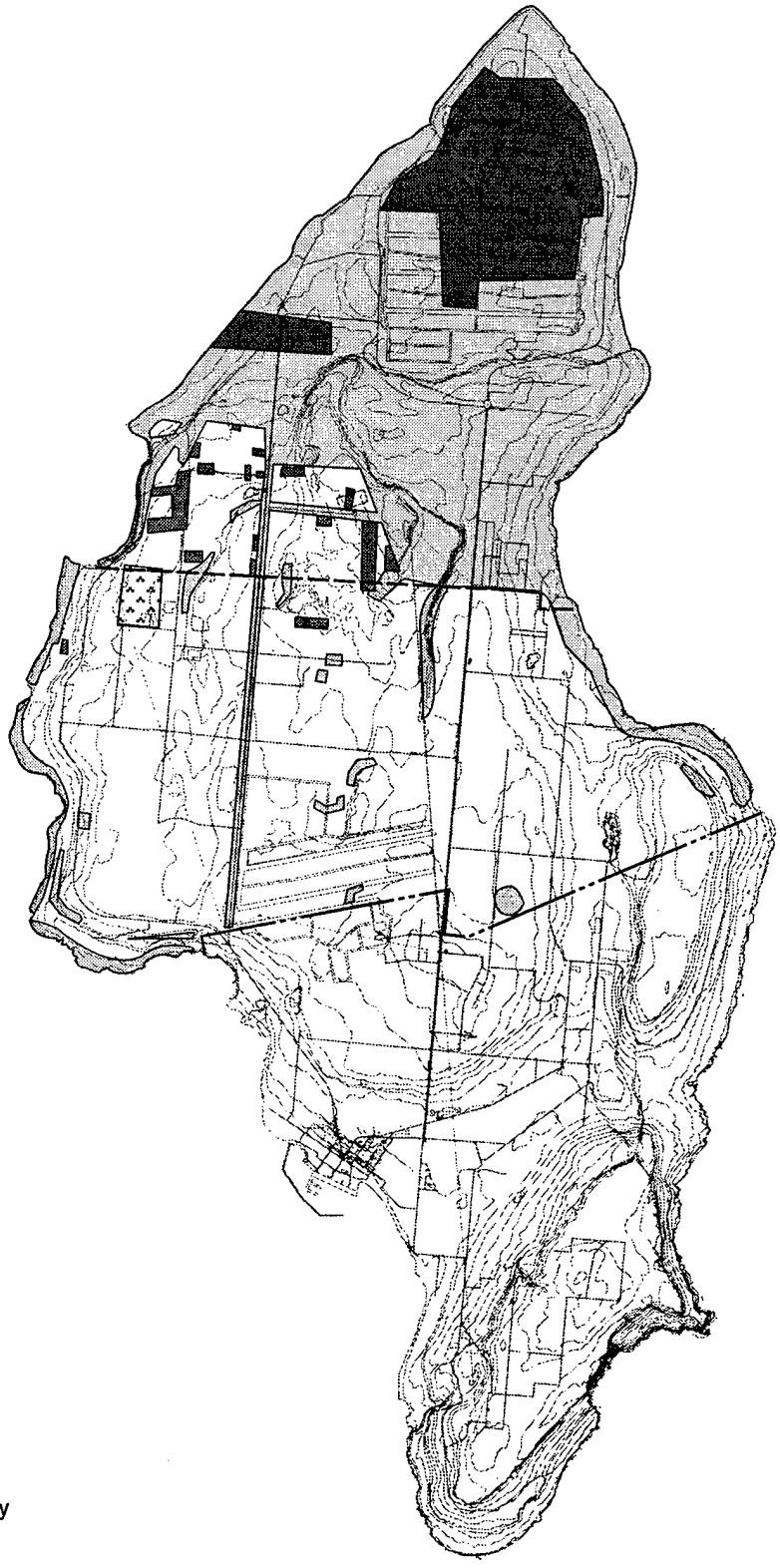
- Sites associated with Chamorro settlements dating circa 1000 B.C.
- Marshes, especially Lake Hagoi, where sediments can provide data concerning natural and human-induced environmental changes
- Pre-World War II sites, including Spanish (1668-1899), German (1899-1914), and Japanese (1914-1944) historic structures and artifacts
- Japanese World War II defensive sites
- Sites and features associated with the U.S. invasion of Tinian in 1944
- U.S. World War II airfields and support facility sites, including features associated with the assembly and employment of two nuclear weapons against Japan (many of these features are part of North Field National Historic Landmark, created by the National Park Service in 1987)
- Historic and modern commemorative shrines
- Substantial latte sites at Unai Chulu, Unai Babui and Unai Dankulo

Several surveys have identified significant surface and subsurface prehistoric deposits, such as intricately decorated pottery, which are theorized to date from the earliest human habitation of the island. A majority of the cultural resources on Tinian are associated with U.S. and Japanese military activities on the island. These resources include ceramic scatters, concrete piers and pads, earth/rubble berms, building foundations, roads, and structural remains. A number of caves and rock shelters contain artifacts and debris associated with Japanese defense of the island during the 1944 U.S. invasion. These are particularly present in the cliffs of Laderan Chiget and around the ridges of Maga Mahalang and Lasso.[44]

The CNMI Office of Historic Preservation has expressed great concern for intact prehistoric sites and relatively unique and significant historic sites. In particular, they are concerned about sites at Unai Babui, Unai Chulu, and Unai Dankulo, and sites on the clifflines which contain prehistoric deposits in shelters and caves, as well as numerous World War II features.[45] Other areas of concern exist throughout the MLA. The northwest coast of the EMUA has prehistoric deposits at both Unai Babui and Unai Lamlam, as well as latte sets and prehistoric deposits along the coast, the Japanese revetment complex of the north coast, the American revetments along the west coast where the atomic bombs were assembled, and the highly significant portion of Japanese Ushi Field. There are numerous latte sites and prehistoric deposits along the west coast of the EMUA and possibly at Lake Hagoi. As much of the MLA has not been surveyed (see Figure 4-8), cultural resources that may exist in this area have yet to be discovered.

[44]Belt Collins Hawaii (November 1994).

[45]International Archaeological Research Institute, Inc. (December 1996) *Revised Prefinal Military Exercises and Historic Sites in the Military Lease Area of the Island of Tinian, CNMI: An Archaeological Assessment.* Prepared for Belt Collins Hawaii.



SURVEY INTENSITY

- High
- Medium
- Low
- Site-specific
- EMUA boundary
- MLA boundary

Source: Welch & Tuggle, 1996

NORTH

0 1000 2000 (Meters)

0 4000 8000 (Feet)

Figure 4-8
TINIAN ARCHAEOLOGICAL SURVEYS

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

Council on Historic Preservation, the National Park Service, and the Historic Preservation Coordinator for Tinian and Aguijan. A second MOA was signed in 1994 prior to Tandem Thrust 95.[46] Both MOAs stipulated numerous mitigative measures to be observed by the Navy in consultation with the other signatories.

To supplement these actions, the Navy obtained funding from the DoD Legacy Resource Management Program to develop an interpretive program for north Tinian. The purpose of the interpretive program is to inform the public (residents and tourists) of Tinian's cultural and natural resources and to instill an ethic that emphasizes preservation and protection. Included in this program, which was implemented in 1995, are four interpretive trails, thirty-six signs, and a brochure (Figure 4-9).[47]

4.2.2 Evaluation Criteria

Ongoing and proposed training activities have been evaluated to determine whether potential impacts to historically "significant" cultural resources are significant or non-significant in the NEPA sense. The general evaluation criteria used are:

- Are there cultural resources in the area where training activities will take place?
- Is there potential for the activity to have an effect that is not considered harmful to a cultural resource?
- Is there potential for the activity to have a harmful effect on a cultural resource?

If the answers to the first and second questions are yes, the training activity would cause a non-significant impact. If the answers to the first and third questions are yes, the potential impacts are considered significant.

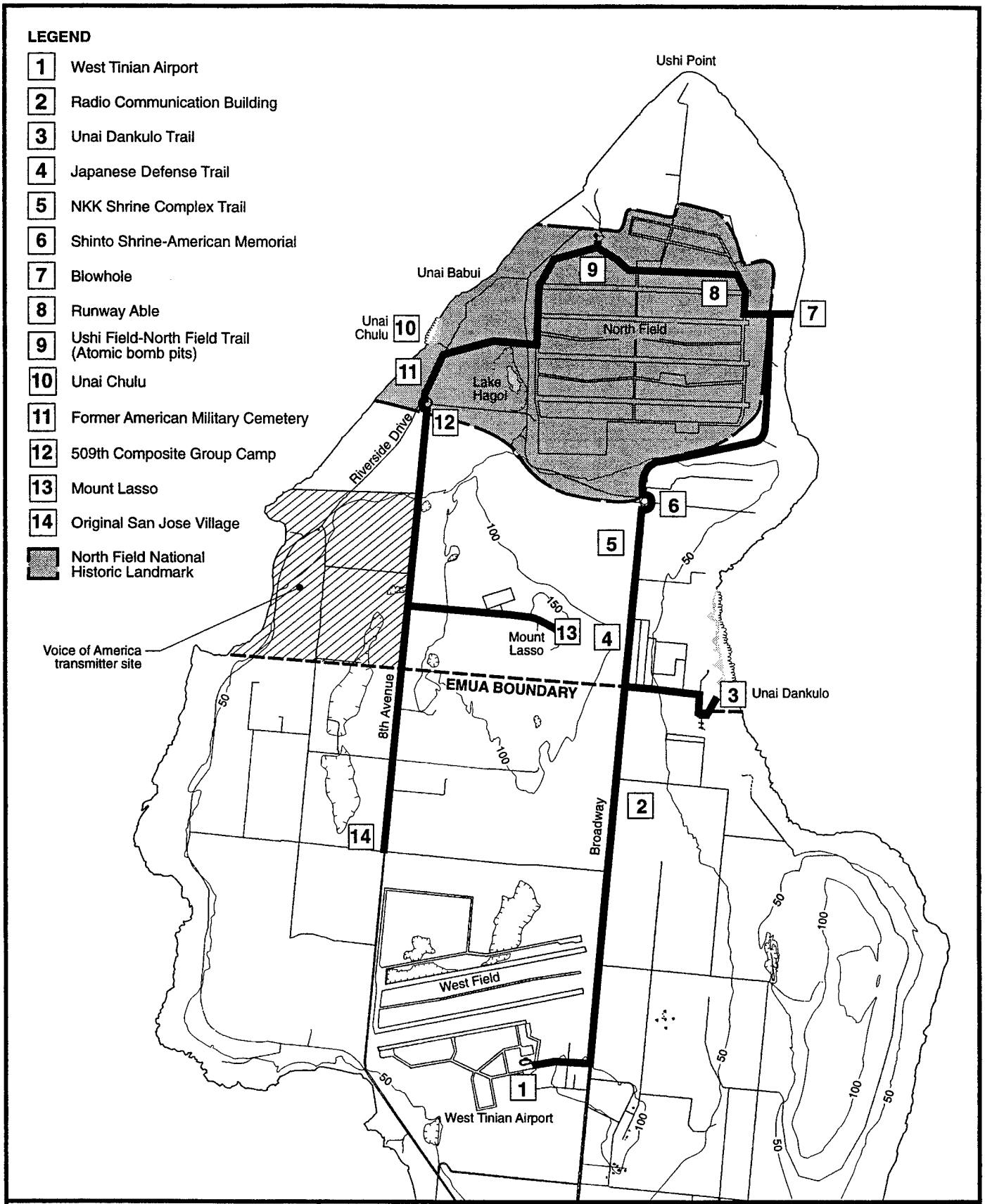
To determine the likelihood of diminishing the integrity of historically "significant" cultural resources, a more detailed evaluation of training activities has been performed. Historically "significant" resources can be affected by training activities which disturb the ground, ricochets, underwater shock waves, or vandalism. Only certain activities may have a significant impact or adverse effect on resources. The evaluation criteria used for the detailed analysis are listed in Table 4-2.

4.2.3 Non Site-Specific Impacts and Mitigation

In general, long-term impacts of the various ongoing and proposed training activities include both non-significant and potentially significant impacts. Non-significant impacts include minor ground disturbance (e.g., vehicle tracks) in culturally significant areas without damage to artifacts or architectural features. Potentially significant impacts include movement, removal, or defacement of important artifacts or structural features, resulting in loss of archaeological or historic data or inherently important features. The potential cumulative impact is the loss of a major portion of the

[46]Titled *Memorandum of Agreement between the Advisory Council on Historic Preservation, CINCPAC Representative/COMNAVMARIANAS, and Commonwealth of the Northern Mariana Islands Historic Preservation Officer concerning Tandem Thrust 95 Military Exercises on Tinian.*

[47]Belt Collins Hawaii and IARII (1995) *Self-Guided Tour of Historic North Tinian.*



Source: Self-Guided Tour of Historic North Tinian, 1995

0 .5 1 2 (Km.)

0 .5 1 (Miles)

NORTH

LEGEND

Auto Route

1 Location of site or trail

Figure 4-9
TINIAN INTERPRETIVE TRAILS

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

Table 4-2
Evaluation Criteria for Potential Impacts on Cultural Resources

Resource	Effect of training activities	Significant if
Historically "significant" resources and National Historic Landmarks	Ground disturbance/damage to resources	Mechanical vegetation clearing activities are planned.
		Vehicles used off established roads.
		Subsurface excavation activities are planned.
		A 20-pound charge is used for underwater demolitions training when submerged ships are within 500 m.
		Large numbers of personnel are present.
	Direct impact of projectile/ ricochets	Live fire is used and resources are in line of fire.
	Underwater shock wave	A 20-pound charge is used for underwater demolitions training and resources are within 1000 m.
	Vandalism (includes removal, defacement, and movement of resources)	Activities require movement of resources.
		Large numbers of personnel are present.

historic and/or archaeological record and the resulting loss of information from repeated non-significant impacts (e.g., small disturbances), or the loss of an artifact with intrinsic importance within its historic context.

Mitigation of many potential impacts to cultural resources consists primarily of prohibiting certain training activities in certain locations. These measures include identifying off limits (OL) areas and areas of no ground disturbance (NGD) (see Figures 2-17 through 2-21 and Section 4.2.4). OL means military use of the area is limited to troop and vehicular movement on established roads. NGD means:

- The area is limited to pedestrian activity off-road, with vehicles restricted to established roads
- No digging is allowed
- Collection of historic artifacts and vandalism is prohibited

On Tinian, additional protective measures, which are detailed in the *Prefinal Tinian Historic Site Protection Plan for the Military Lease Area*, include:

- No digging within three feet of any historic structure with concrete walls or in any caves
- Permanent fencing of OL areas
- Installation of appropriate signs in other constrained areas used for military training

- Completion of data recovery or surveys to possibly enable off-road vehicle travel in areas previously designated "no ground disturbance"

Additional mitigative measures include the following:

- Briefing exercise personnel on the significance of archaeological resources and historic structures, including certain areas where activities are limited and areas are off-limits
- Physically marking selected site boundaries prior to an exercise
- In-field monitoring during and immediately after the exercise
- Carefully selecting sites for exercise activities with damaging potential

These measures will be incorporated in the next revision of COMNAVMARIANAS INST 5440.1, the order governing training on Navy lands on Guam and Tinian.

4.2.4 Potential Impacts and Mitigation for Particular Areas of Concern

There is potential for certain site-specific training activities to adversely affect particular resources listed in the National Register of Historic Places, including possible loss/destruction of archaeological and/or historic data. Such activities may include ground and surface disturbance (moving stones, excavation, explosion, projectile impacts, underwater demolitions, destruction by wheeled or tracked vehicles), collection of artifacts (e.g., as souvenirs), and defacement of sites by graffiti and littering during training activities (as opposed to defacement by hunters and tourists). Therefore, the main areas of concern are NAVACTS Ordnance Annex, NAVACTS Waterfront Annex, and particular areas of Tinian.

4.2.4.1 NAVACTS Ordnance Annex

A sniper range, jungle trail, and breaching house have been proposed for the Ordnance Annex (see Figure 2-7).

- The *Augmented Alternative* would allow personnel to shoot from the proposed firing positions, breaching house, and jungle trail in any direction subject to range safety restrictions. Non-lethal, plastic ammunitions (Simunitions) would be used for any shooting in the breaching house.

- The *Mitigated Alternative* would allow personnel to shoot from the proposed sniper firing positions, breaching house, and jungle trail at specific target areas limited to avoid projectiles impacting cultural resources.

Existing Cultural Resources. Existing archaeological/historic resources in the Ordnance Annex include ancient Chamorro latte sites and World War II Navy structures. A recently discovered large latte village is within the range safety fan of the proposed sniper range. This village consists of more than 40 latte sets and may be the largest and best preserved on Guam. There is a second latte complex located within the range safety fan. This complex consists of 12 latte sets and is in the vicinity of the proposed breaching house. Both latte sites (Figure 4-10) are determined to be "significant" under the NHPA.

Proposed Sniper Range.

- *Potential impacts*. Firing range activities have the potential to damage significant sites by direct impact of projectiles. As shown in Figure 4-10, there are numerous significant cultural sites located in the Ordnance Annex within the proposed safety fan. Of concern are the latte village and latte complex, both within the proposed fan. The latte village is about 1,500 meters behind the targets on the back-side of a ridge, overlooking an inland wetlands area, and the latte complex is on a gradually sloping area about 200 meters southeast of the breaching house location. In addition, construction of the firing range will require clearing some vegetation which may be hiding archaeological/historic resources from view. Clearing activities could potentially damage resources if not conducted with care.

  The proposed sniper range may be used daily by small groups (two to five snipers) each firing up to 20 rounds of 7.62/5.56 mm ammunition (no tracers). The maximum range of the weapons to be used is approximately 4,800 meters; the distance of the latte village from the firing points is at least 2,400 meters at approximately the same elevation. The smaller latte complex is within 1000 meters of all proposed firing positions at an elevation about 31 m lower. Weapons are to be fired straight down the range for a known distance for a score.[48]

  Each projectile follows a ballistic trajectory[49] that arcs downward increasingly with distance and loss of velocity; 1000 meters is the maximum effective range. The bullet trajectory, in case of a miss, would impact the terrain directly behind, or continue over a valley and impact terrain well beyond. Since this range is for aimed fire, using accurate weapons, the potential impact areas for misses can be determined. Therefore, targets can be located in areas that prevent stray bullets from damaging cultural resources. Target areas can be sited so that "significant" cultural resources are protected by topographical features, or so the horizontal and/or vertical distance between the target and firing position is large enough that the likelihood of a missed shot damaging a historically "significant" resource is minimized to non-significance.

  No significant impact on the latte village is expected because it is naturally protected by the terrain from impacts originating at the designated firing points. On the other hand, there is potential for impact to the latte complex, should individual lattes be directly impacted by projectiles.

- *Proposed mitigation*. The position of the range safety fan is limited by military regulations for public safety considerations. Prior to initiating use of a range, it will be safety certified by the Navy (see discussion in Section 4.6.2). Potentially significant impacts on cultural resources have been mitigated under the Mitigative Alternative by selecting the firing positions, target areas, and firing directions to meet the following conditions:

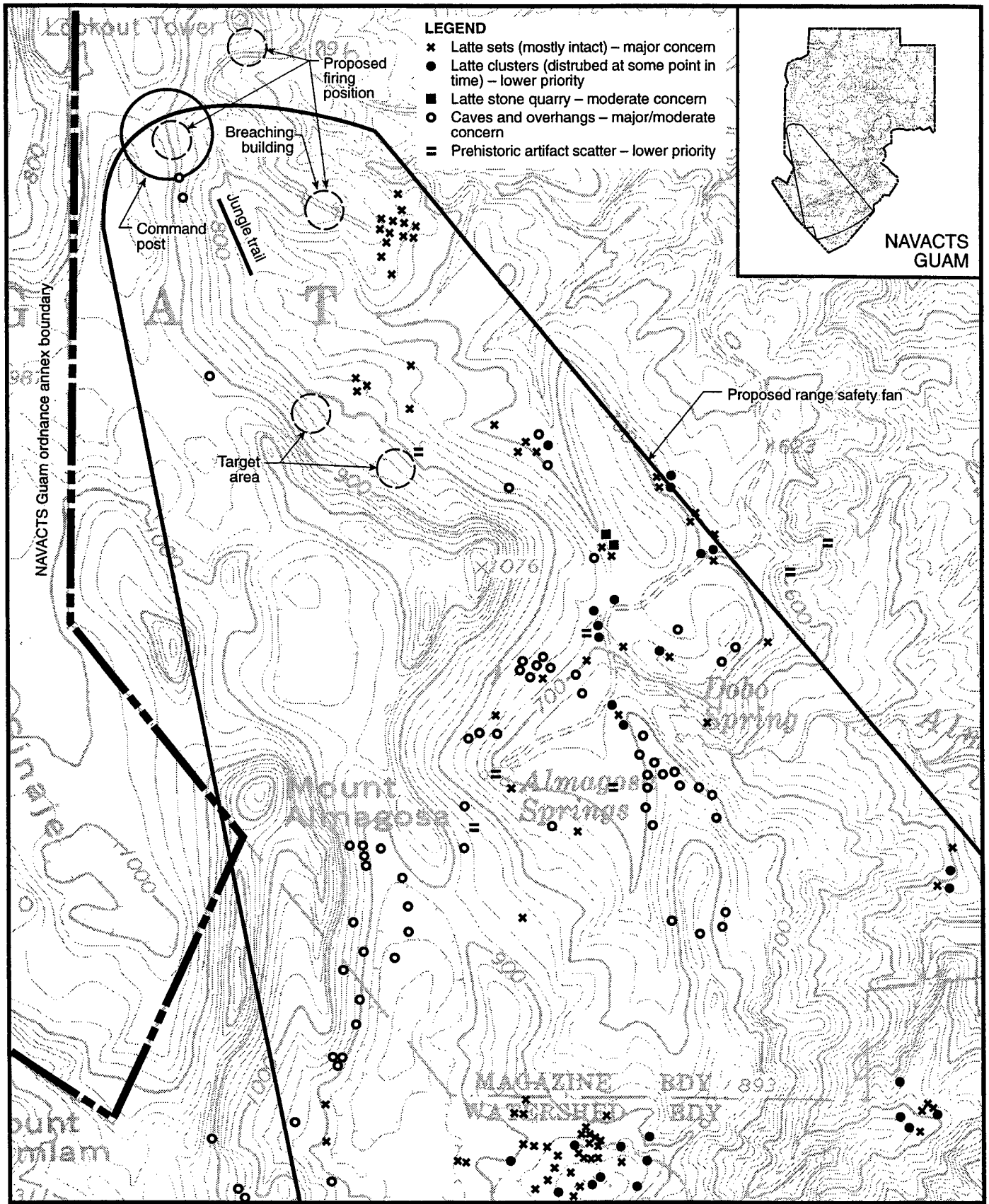
  - Provide target areas approximately 1 km or closer to firing points and at about the same elevation as the firing position (training requirement)

  - Site target areas to avoid the potential for projectiles to impact and damage cultural resources (mitigation)

[48]See Appendix B.

[49]See Appendix B.

342.0414/003-20 r1.17.97



NORTH

0 125 250 (Meters)

0 500 1000 (Feet)

Source: Compiled by IARII from Paul H. Rosendahl, Ph.D., Inc. (1996) *Prefinal Report: Phase I Archaeological Survey and Subsurface Testing, U.S. Naval Activities Ordnance Annex, Guam*

Figure 4-10
ORDNANCE ANNEX SENSITIVE ARCHAEOLOGICAL/HISTORIC AREAS
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

Additional mitigation is provided by restricting which target area can be used from each of the three firing positions, in order to keep the safety fan within Ordnance Annex boundaries while still protecting cultural sites (Figure 4-11). From the western firing position, personnel can shoot at either target area. Personnel can shoot at both the eastern target area and the shooting house from the northern firing position. Only the eastern target area will be used by personnel shooting from the breaching house. Lattes within these fans are well below the trajectories involved and will not be impacted by projectiles.

The final range and safety fan will be approved by a Navy archaeologist to ensure that the sniper range will avoid any potential impacts to archaeological/historic resources from projectiles.

Jungle Trail with Pop-up Targets.

- *Potential impacts*. Training at the proposed jungle trail involves a single person walking on a designated path, shooting at radio-activated pop-up targets located at short distances, for a score. These targets stand alone on the ground. A limited amount of vegetation clearing will be necessary to delineate a path. The clearing activities will be performed by hand. This activity has the potential to damage archaeological/historic resources in the line of fire by direct impact of the projectile, should targets be missed. With the following mitigation, no significant impact is expected.

- *Proposed mitigation*. Mitigation of potential impacts of the proposed jungle trail in the Ordnance Annex includes verification from a Navy archaeologist that the targets are placed so that the direction of fire is consistent with the safety fan for the proposed sniper range, and so that no significant cultural resources are in line to be impacted by projectiles.

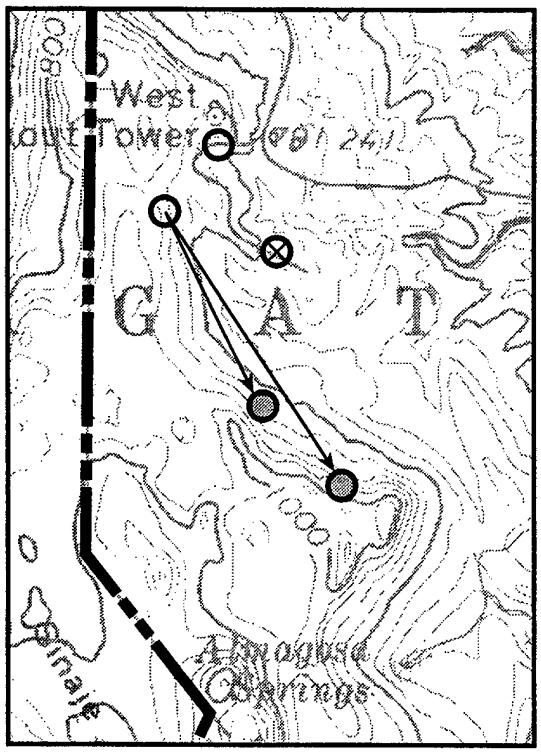
4.2.4.2 NAVACTS Waterfront Annex

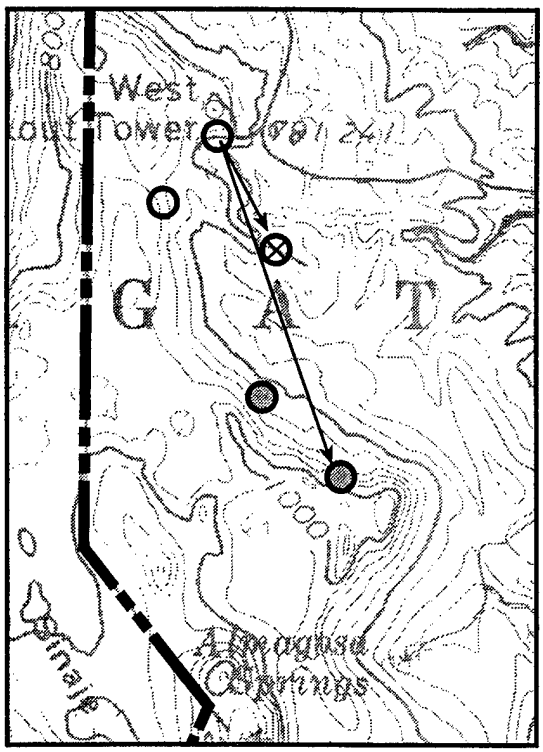
Deepwater demolition training exercises using 20-pound charges have been proposed for Outer Apra Harbor.

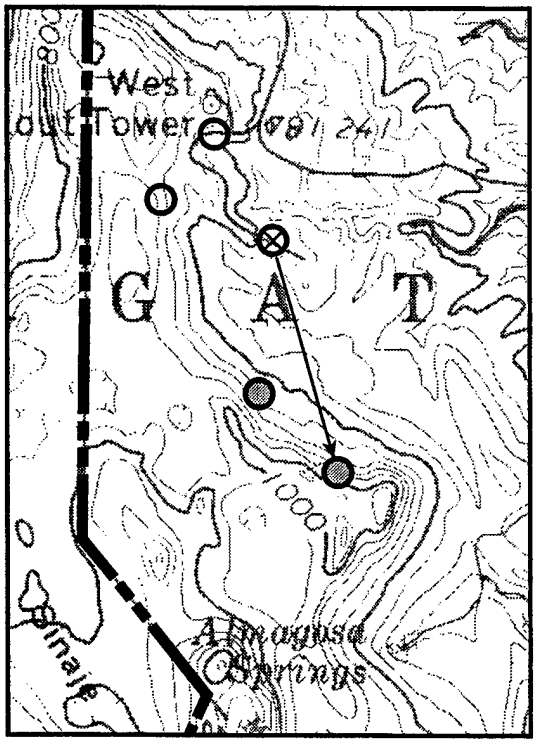
- The *Augmented Alternative* proposes detonation of charges up to 20 pounds at the existing site in the Outer Apra Harbor, ≤10-pound charges at the proposed site off of Dadi Beach, and ≤5-pound charges in Inner Apra Harbor. Charges up to 10 pounds are currently detonated at the existing site (see Figure 2-2 and 2-8).

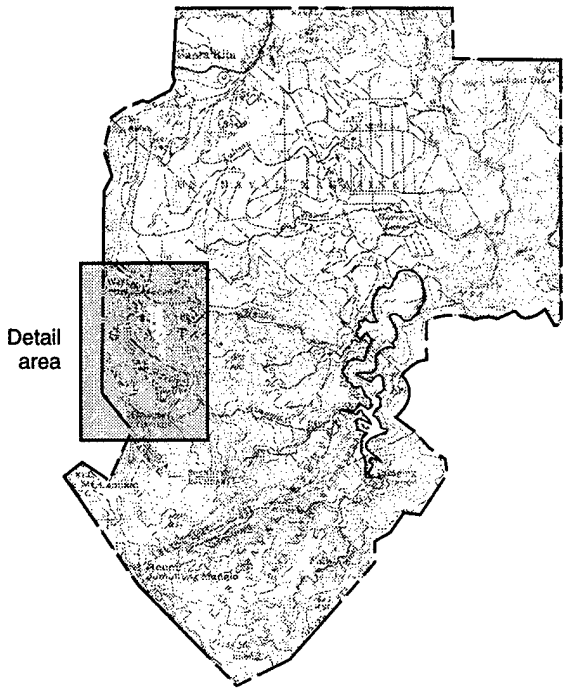
- The *Mitigated Alternative* is the same as the Augmented Alternative.

Existing Cultural Resources. The Waterfront Annex contains several World War I and World War II Navy structures. The proposed underwater demolition site in Outer Apra Harbor is in the vicinity of several submerged historic resources, including at least four of historical significance: the Kitsugawa Maru, Tokai Maru, Nichiyo Maru, and the S.M.S. Cormoran (see Figure 4-6). The Tokai Maru is listed on both the National and Guam Registers and the S.M.S. Cormoran is listed in only the Guam Register.









Source: Marianas Training Plan Briefing Booklet

NORTH

0 250 500 (Meters)

0 1000 2000 (Feet)

LEGEND

- Firing position
- Breaching house
- Target

See text for explanation

Figure 4-11
FIRING RESTRICTIONS

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

Deepwater Demolition Training in NAVACTS Waterfront Annex.

- *Potential impacts*. Proposed demolition of 20-pound charges at the deepwater demolition site in Outer Apra Harbor has the potential to impact submerged (sunken) ships. Explosions on the seabed cause cratering and disturb bottom sediments over an area estimated to be roughly twice the diameter of the crater.[50] A 20-pound charge exploded on mixed sand and clay in relatively deep water (greater than about 30 m) is estimated to result in a crater about three meters in diameter,[51] with bottom disturbance over an area no more than 10 meters wide. The site currently used for demolition of charges up to 10 pounds is approximately 38 m deep and 600 m from the nearest known historically "significant" submerged ship. No significant impacts on the nearby submerged ships from existing demolition exercises have been reported and none are expected if a 20-pound charge is used.

  Underwater explosions also cause underwater shock waves that could damage cultural resources resting on the ocean floor. Explosion of a 25-pound charge at a depth of 120 feet produces a "small risk injury range" for swimmers of ±1000 meters.[52] A 50-pound charge at the same depth has a "small risk injury range" of ±1500 meters.[53] Even though the nearest historically "significant" submerged resource is within the swimmer injury risk range for both charges, it is unknown what effects these charges would have on historically "significant" underwater resources. Given the presumed absence of voids in these vessels, the causitive agent of damage from an impulse is not apparent. Therefore, it is difficult to determine whether or not the use of 20-pound charges will significantly impact submerged cultural resources.

- *Proposed Mitigation*. To mitigate the potential impacts of deepwater demolition training in Outer Apra Harbor, detonation of charges greater than 10 pounds will not be allowed until the eligibility of the submerged historic resources in the area, particularly those adjacent to the Glass Breakwater, to the National and Guam Registers have been determined.

4.2.4.3 Tinian

There are three training locations of concern on Tinian: Unai Chulu, Unai Babui, and the former Japanese Naval Air Command Post. Unai Chulu is currently being used for LCAC landings and swimmer insertions/extractions, while Unai Babui is being used only for swimmer insertions/extractions. [Note that while LCACs only generate wind-blown ground disturbance—and only on beaches—they offload wheeled and tracked vehicles which then exit the beach to inland areas.]

- The *Augmented Alternative* would allow AAV landings at Unai Babui and TRUE training at the former Japanese Naval Air Command Post, and would allow existing training activities to continue at both Unai Chulu and Unai Babui.

[50]George A. Young (February 13, 1973) *Guidelines for Evaluating the Environmental Effects of Underwater Explosion Tests*, p. 46.

[51]George A. Young (February 13, 1973).

[52]Caused by an impulse of 110 pounds per square foot during one millisecond (psf-ms).

[53]Personal communication with EOD Detachment Guam, October 30, 1996, using unclassified information.

- The *Mitigated Alternative* would restrict vehicle movement on land at both Unai Chulu and Unai Babui and would require units training at the former Japanese Naval Air Command Post to follow certain procedures.

Existing Cultural Resources.

- *Unai Chulu and Unai Babui*. There are several intact prehistoric sites and relatively unique and significant historic sites located at both Unai Chulu and Unai Babui (see Appendix M). There is a prehistoric complex located at Unai Chulu which contains latte remains, burials, and one of the earliest habitation sites in the Marianas. This site is presently overgrown by tall grasses which may be hiding additional resources. Unai Babui has several intact prehistoric deposits and numerous human burials. During World War II, U.S. troops landed at both Unai Chulu and Unai Babui to begin the U.S. invasion of Tinian.

- *Former Japanese Naval Air Command Post*. The former Japanese Naval Air Command Post, located at Ushi Airfield, was used during World War II and was a major target for American air and naval bombardment before the invasion of Tinian.[54] It is considered part of the North Field National Historic Landmark and is a popular tourist attraction. It is a two-story concrete building with semi-intact walls and floors; bomb damage and bullet holes exist throughout the building.

Unai Chulu and Unai Babui.

- *Potential impacts*. Ongoing vehicle offloading from LCACs at Unai Chulu and proposed AAV landings at Unai Babui have the potential to affect intact historic sites, if military personnel or vehicles wander off established roads while departing the beaches. In particular, archaeological resources at Unai Chulu are obscured from view by tall grass and are vulnerable to unintentional ground disturbance. Therefore, training activities have the potential to significantly impact cultural resources at Unai Chulu and Unai Babui.

- *Proposed mitigation*. Mitigation of potential impacts to archaeological and historic sites at Unai Chulu and Unai Babui includes designation of OL and NGD areas. Movement of vehicles and equipment is restricted to designated paths and established roads in the vicinity of Unai Chulu (see Figure 2-21). At Unai Babui, vehicles may travel in unvegetated areas and on existing roadways.

Former Japanese Naval Air Command Post.

- *Potential impacts*. Training at this location involves personnel shooting at bullet traps on the outside of the building or entering a particular room of the building from the surrounding woods and shooting at bullet traps. All bullet traps are temporary and are removed following exercises. This training activity has the potential to damage the building, which is considered a significant historic resource, if bullets should directly hit the walls. The likelihood of bullets impacting the wall is small, given the short range at which firing will occur. Therefore, no significant impact to the building's structure is expected.

[54]Don A. Farrell (1992) *Tinian*.

- *Proposed mitigation*. Mitigation of potential impacts on the former Japanese Naval Air Command Post includes taking photographs of the building walls before and after exercises to determine whether any damage has occurred. The photographs will be evaluated by a Navy archaeologist, who will then allow or disallow training exercises to continue. The training unit will clean up any litter within the vicinity of the command post after exercises are completed, including litter left by civilian activities.

4.3 WASTEWATER DISPOSAL ON TINIAN

This section analyzes the impacts of disposing domestic wastewater generated by ongoing training on Tinian. This is a significant issue because improper wastewater disposal can create public health impacts from contaminated drinking water or surfacing effluent. Tinian has no public or private wastewater treatment plant, but the Municipality owns relatively large septic systems at the Field House and at the former administration/school building, both of which have been used by training organizations in the past. The issue is common to all three alternatives.

All alternatives propose continuing use of municipal facilities by small training units (defined as groups of less than 50 individuals), as well as continuing use of portable toilets (PTs) by large training groups. All three propose continued disposal of PT waste into the Municipality's two existing septic systems, although the two action alternatives propose eventual diversion of some small unit and all PT wastewater to a military septic system at the proposed base support camp.

The following sections focus on the impacts of disposing wastewater to existing or future municipal wastewater disposal facilities, including cumulative impacts resulting from activation of the VOA facility and one or more casinos planned or under construction.

4.3.1 Existing Wastewater Disposal Facilities on Tinian

The only wastewater disposal systems currently in use on Tinian are individual wastewater systems (IWSs). No collection system for wastewater from multiple sources exists. The IWSs consist of either cesspools or septic tank systems with leaching fields or seepage pits. Cesspools are subsurface pits into which wastewater is discharged directly (Figure 4-12). Septic tank systems consist of watertight anaerobic treatment tanks with discharge to soil absorption systems, such as absorption trenches or beds, or seepage pits (Figure 4-13). Naturally occurring microorganisms in the tank decompose waste, clarifying liquids and facilitating settling and volume reduction of solids. Absorption trenches and beds are relatively shallow excavations that are backfilled with drain rock and contain drain pipes. Seepage pits are physically identical to cesspools, but they are used for disposal of septic tank effluent rather than raw sewage.

Two of Tinian's larger septic systems, owned by the Municipality of Tinian and Aguijan, are at the Field House and at the former administration/school building (Figure 4-14).

- The Field House septic system has a capacity of approximately 8.6 cubic meters per day (m^3/d). The septic tank volume is 8.64 cubic meters, and the absorption field area is approximately 170 square meters.

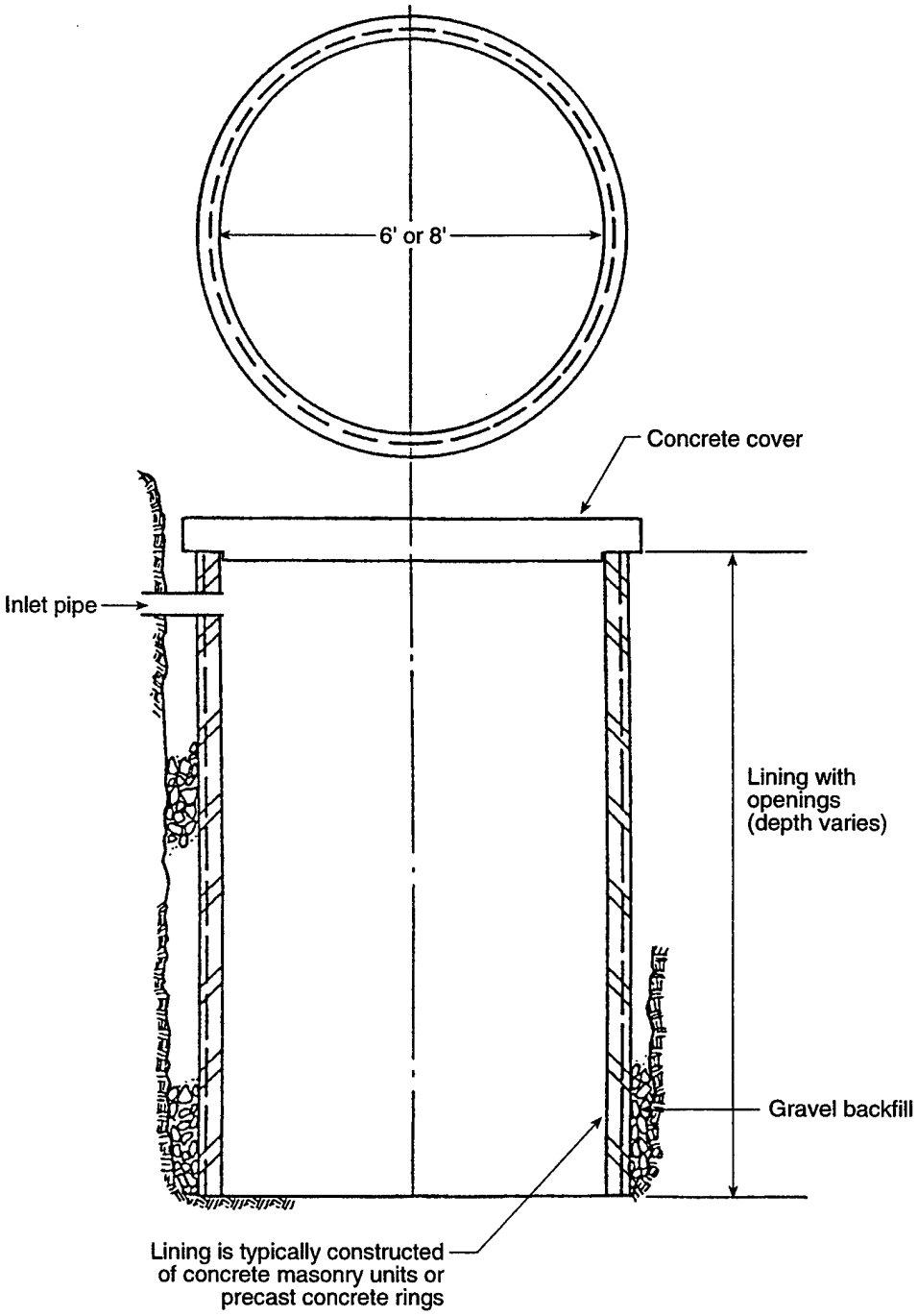
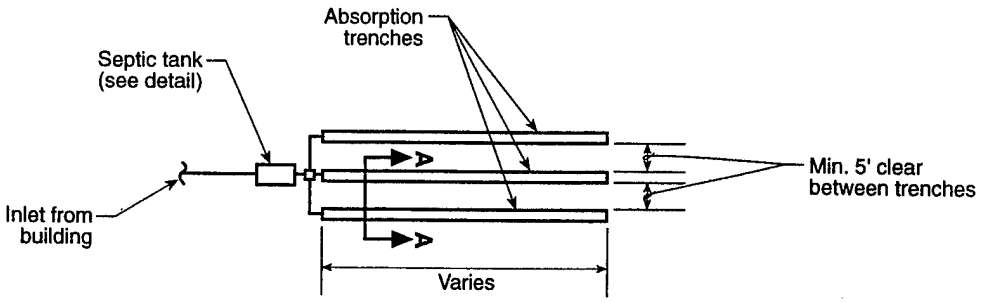
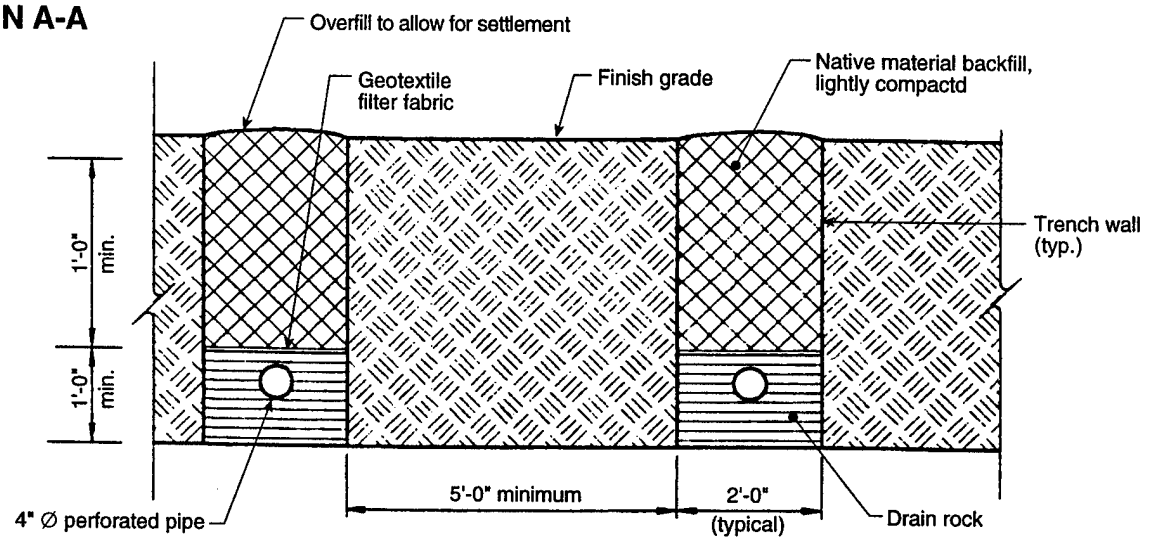


Figure 4-12
SCHEMATIC DRAWING
OF A CESSPOOL
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PLAN



SECTION A-A



SEPTIC TANK

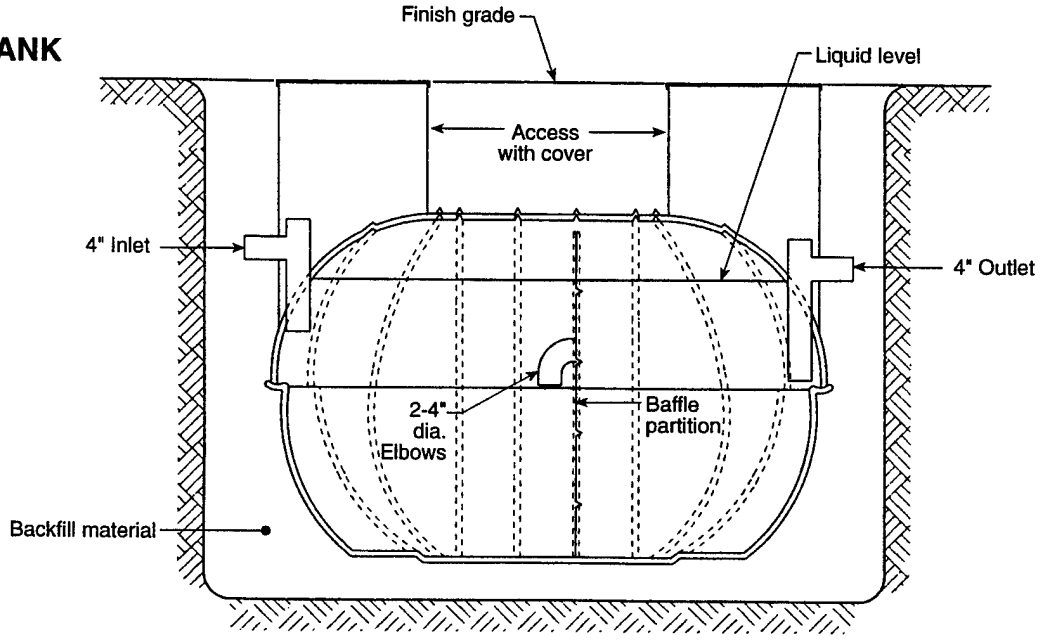
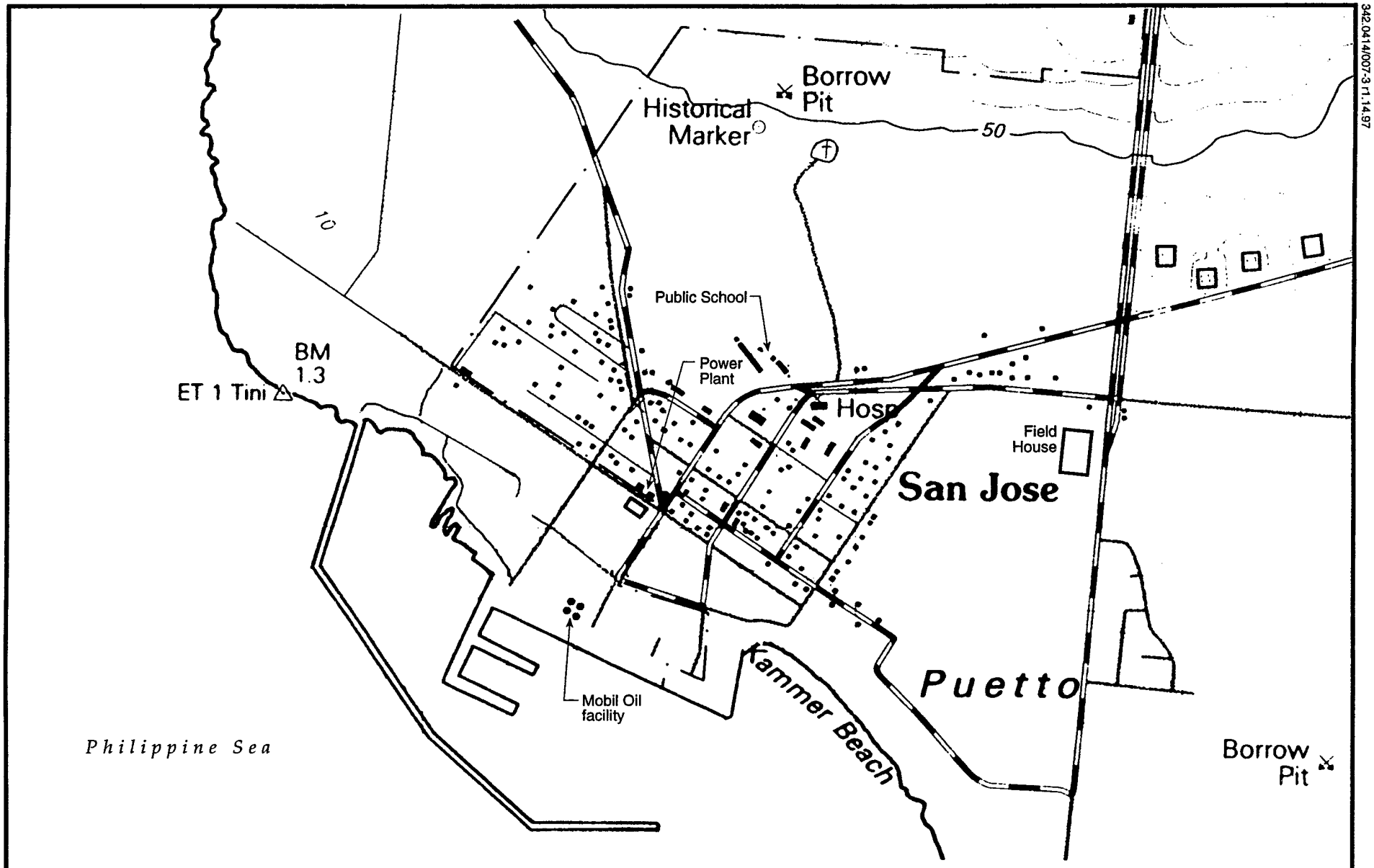


Figure 4-13
TYPICAL SEPTIC TANK SYSTEM

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997



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Figure 4-14
CLOSE-UP OF SAN JOSE

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

- The capacity of the septic system at the former administration/school building is not known. It served approximately 350 daytime staff and students during the 1970s;[55] based on a generation rate of 0.05 m^3/d per student or staff member,[56] this equates to a design flow of approximately 18 m^3/d.[57]

There are no existing wastewater disposal facilities for military or tourist use in the EMUA or LBA. Past military field sanitation practices consisted of either using PTs temporarily installed along 8th Avenue and in the EMUA, or by individual dig-and-bury ("cat holes"). Wastewater from the PTs was disposed into municipal septic tanks.

4.3.2 Overview of Potential Impacts

In general, improper wastewater disposal practices, such as discharge of untreated wastewater over land or into coastal waters, have the potential to cause public health hazards and to contaminate drinking and recreational waters. However, as no such practices are proposed, this analysis focuses on impacts of military wastewater on wastewater disposal systems.

All three alternatives propose continued military use of public restrooms and disposal of PT waste into the Municipality's septic systems. However, the two action alternatives also propose construction of a base support camp, including a small group bivouac area, toilets, showers, and a septic system. Because it is assumed that the proposed septic system will be properly designed, sited, and permitted, this section does not focus on impacts of the proposed septic system on groundwater in the EMUA.

Potential impacts of military wastewater disposal are evaluated in the following sections, using the criteria presented in Table 4-3. Impacts on wastewater systems would result from overloading or from affecting a system's ability to break down wastes.

If a septic system is overloaded on a single occasion, wastewater or septic tank effluent may surface, causing potential public health hazards in addition to nuisance odors. No long-term damage to the system is likely to result. Chronic overloading has the potential to affect the long-functioning of the system. It can impair biological activity, reducing the microorganisms' ability to reduce sludge. This can result in increased sludge accumulation and in increased solids washout into the leachfield. As a result, the tank would need more frequent maintenance to remove and dispose sludge, increasing costs to the system owner. Increased accumulation of solids would eventually deteriorate the soil absorption system, shortening the system's functional life.

A septic system's microorganisms may be damaged or destroyed if any substance lethal to them is added to the system with wastewater. Tank microorganisms are naturally occurring; if they are completely destroyed, they will reappear after approximately a month, provided that the lethal

[55]M&E Pacific, Inc. (June 1979) *Supplement B, Facilities Plan for the Island of Tinian, Mariana Islands.* Prepared for Department of Public Works, Government of the Mariana Islands.

[56]Hawaii Administrative Rules, 11-62, Table I.

[57]Note that available records do not contain specific information on the actual design capacity, septic tank and leach field sizes, and the condition of the existing system. The system was constructed before the existing IWS permitting program was established by the CNMI Department of Public Works, Division of Environmental Quality (DEQ).

Table 4-3
Evaluation Criteria for Potential Impacts of Wastewater Disposal

Wastewater Treatment System	Parameters	Significant If
Existing municipal septic systems	Capacity	Addition of military wastewater[1] would cause one or more overflow or surfacing events
		Addition of military wastewater[1] would increase maintenance requirements by 10 percent
	Toxicity	Addition of PT wastewater would damage/destroy tank microorganisms
Future municipal wastewater treatment plant (if constructed)	Capacity	Addition of military wastewater[1] would cause one or more overflow of surfacing events
	Toxicity	Addition of military wastewater[1] would increase maintenance requirements by 10 percent
Future DoD septic system	Impacts on groundwater	Contaminants could leach to drinking water source
Field disposal	Impacts on groundwater	Contaminants could leach to drinking water source

[1] i.e., combination of PT wastewater and "direct addition" by military use of showers and toilets at Field House.

substance is not persistent in the tank. During the time the microorganisms are not fully functioning, wastewater will not be fully clarified and solids will not be broken down within the tank.

4.3.3 Wastewater Disposal for Small Scale Exercises

4.3.3.1 Potential Impacts

For the purpose of this discussion, small scale exercises are defined as those involving fewer than 50 military personnel. Two distinct training situations have the potential to cause wastewater impacts. First, any military personnel housed in facilities with rest rooms and showers will generate approximately 0.1 m^3 of wastewater per person per day. Second, field sanitation practices will be employed during field exercises.

Military personnel may train in the vicinity of San Jose Village and West Tinian Airport. They will use sanitary facilities at the Field House, the airport, and other public places. Loads upon public facilities will be increased; however, due to the small numbers of personnel and the short duration

of small scale exercises, the additional loads will be within the operating capacity of properly functioning systems and impacts will not be significant.

In other areas of the island, no sanitary facilities are readily available. Common field sanitation practices, such as temporary pit toilets and small individual excavations (commonly referred to as "cat holes"), are not easily practiced on Tinian. Difficulties in controlling such procedures are exacerbated by the predominance of shallow soils over limestone bedrock and by the occurrence of compacted granular surface soils at many locations. Resulting shallow burial of human wastes could result in health hazards for future users of the sites, which would potentially be a significant impact over time, if practiced by a large number of individuals. An alternative field-sanitation practice is use of diesel-fired "burn cans" as toilets, and subsequent field burial of residual ash.[58] Burn cans would generate minimal emissions, would be more easily controlled, and would not leave potentially contaminating residues which could be a nuisance and a hazard for future users of the site.

4.3.3.2 Proposed Mitigation

Small scale use of the existing facilities at West Tinian Airport, the Field House, and other public locations will not have a significant impact upon the facilities and therefore will not require mitigative actions. Even if 50 people are housed at the Field House, they will generate a maximum of about 5 m^3/day of wastewater, which will not overload the facility's septic system (capacity of approximately 8.6 m^3/day). If public functions at the Field House preclude use of the sanitary facilities by military personnel, PTs will be used at the site; PT waste will be disposed into the Field House septic system after public functions have finished.

Proper management of field sanitation will adequately mitigate the potential for significant impacts. Dig and bury techniques on Tinian may be limited by shallow soils and surface conditions, and are only appropriate for small, disposed units. The U.S. EPA has indicated that they do not anticipate adverse air quality impacts from use of burn cans for small scale training exercises where troops are concentrated in camps. Burn cans are, therefore, the preferred method of disposal for sanitary wastes from small scale field exercises where troops are concentrated in camps. Burn cans will be properly sited and supervised to minimize potential nuisance from smoke emissions and to prevent brush fires (which could have significant impacts on endangered species, as indicated in Section 4.1).

4.3.4 Wastewater Disposal for Large Scale Exercises

4.3.4.1 Potential Impacts

For all alternatives, proper treatment and disposal of wastewater from large field exercises, for which no permanent sanitary facilities are available, will minimize the potential for significant public health hazards and pollution that can occur if sanitary waste disposal is not handled properly. The practice of contracting a number of PTs, as has been done for past Tandem Thrust exercises, significantly reduces potential health hazards. Assuming that an adequate number of PTs is provided at suitable locations, the only potential impact is overloading of municipal septic systems.

[58]No diesel residue remains in the ash.

According to the "Tandem Thrust 95 Solid Waste and Sludge Management Plan, Draft Report" by Barrett Consulting Group, Inc., approximately 30 PTs were used during Tandem Thrust 95. The plan indicates that the wastewater generation rate from the PTs averaged 0.8 to 1.5 m^3/d. This total daily volume is no more than half of the design rate of an average single family house.[59] If this average generation rate were produced for approximately 10 days, a total of no more than 15 m^3 would be generated. This would increase sludge accumulation in the tank(s) and would increase the hydraulic loading and possibly the solids loading to the soil absorption system(s). However, the septic system at the Field House, with a capacity of approximately 8.6 m^3/d, will be able to accept 1.5 m^3/d of additional wastewater if base flows from other sources do not exceed approximately 7.1 m^3/d.[60] Because the actual size and condition of the septic tank system at the former administration/school building is not known, it is not possible to predict the specific impact of the discharge of PT wastes from large scale exercises. The increased solids loading to the existing septic system(s) may require more frequent removal and disposal of the septic tank sludge.

PT wastes are highly concentrated in comparison with typical domestic wastewater. If disposed of improperly, the PT wastes could be a public health threat or could cause pollution of stormwater runoff, coastal waters, or groundwater. If deodorizing solutions in the PTs contain disinfectants (biocides), emptying PT waste into a municipal septic system could damage or destroy needed septic system microorganisms.

For field exercises in locations that are not served by PTs, the potential impacts would be similar to those for small scale exercises.

4.3.4.2 Proposed Mitigation

Portable Toilets for Temporary Facilities. Portable, self-contained toilets will continue to be used for all large scale exercises on Tinian. The use of PTs will adequately mitigate the potential for the occurrence of significant health hazards or pollution that could otherwise result from inadequate sanitation facilities. Portable toilets typically hold up to 0.23 cubic meters but are often pumped out well before they are filled to capacity. Contracts for PT services will specify that no disinfectants (biocides) may be used in the toilets. Non-disinfecting deodorizing solutions, employing bacteria and/or enzymes, are available.[61] The PT service will be provided by contract with local suppliers whenever possible.

Wastewater Disposal at Existing Municipal Septic Systems. With permission of the Municipality and proper coordination with other events at the Field House, it will be possible to dispose of PT wastes in the septic system at the Field House. If other functions at the Field House during large scale exercises preclude the use of the Field House septic system for disposal of PT wastes, it would be possible to refrain from dumping the PT wastes until use of the Field House decreased, or with permission of the Municipality, to dispose of PT wastes in the septic system at the former administration/school building. Both of these options are considered to be short term measures until a septic system for military use is constructed.

[59]Hawaii Administrative Rules, Chapters 11-62, "Wastewater Systems."

[60]For Tandem Thrust exercises, up to 50 military personnel may occupy the field house for several weeks. As indicated in Section 4.3.3.2, these personnel are expected to generate a total maximum of about 5 m^3/day.

[61]Personal communication with Fred Newmark, J & J Chemical Company, May 1996.

Septic Tank System at Base Support Camp. Potential impacts of wastewater generated at the Field House and from disposal of PT wastes will be mitigated in the long term by construction of a septic tank system at the proposed new military base support camp in the EMUA. The facility, which will include a septic tank and leach field, will be secured to prevent unauthorized use. This mitigation, which applies to all alternatives, will alleviate both municipal and DEQ concerns regarding capacity and sludge accumulation issues at the Field House and other existing municipal septic tank systems. The septic tank system will be annually inspected to determine the volume of sludge accumulation. When the accumulated sludge reaches a specified level, the tank will be pumped out. If the leach field is found to have failed, it will be reconstructed or replaced prior to the next larger-scale exercise.

Disposal of the septage is normally to a wastewater treatment plant if one is available. In the absence of treatment facilities, as is the case on Tinian, septage will be discharged to a properly designed sludge drying bed for drying and further stabilization. The dry sludge can then be land filled or used as a soil amendment under controlled conditions.

Composting Toilets for Treatment. Composting toilets have been considered as an optional method of treatment of domestic military wastes on Tinian. Although they provide more complete biodegradation of organic wastes, several characteristics of composting toilets make them undesirable for military use on Tinian. These characteristics are as follows:

- They require more maintenance than septic tank systems.
- Many models require electrical power to enhance evaporation and ventilation for both moisture control and odor control.
- They generally require the addition of a "bulking agent" to absorb moisture and facilitate aerobic conditions.
- Moisture buildup can be a problem, especially in non-electrical units.
- Control of vectors would be more difficult than with PTs and septic tank systems.
- They are more sensitive to shock loading than septic tanks.
- Although concentrated, PT wastes contain excess liquid which makes them unsuitable for discharge to composting toilets.
- They do not represent final disposal, as the composted wastes must be disposed of as a soil amendment or land filled.
- They are generally less portable and more expensive than PTs.

4.3.5 Cumulative Effects with Casino Development and VOA

4.3.5.1 Potential Impacts

Casino Development. Casino resort development on Tinian could impact wastewater management on the island significantly. However, because wastewater flows generated by military training activities would be such a small percentage of flows generated by a large casino development, the impact of the military contribution of wastewater would not be significant.

If casino development does not involve the construction of a municipal wastewater collection and treatment system, the casino developers would need to build their own self-contained wastewater treatment and disposal systems. In this case, the only cumulative impact on wastewater disposal systems in San Jose Village and other parts of the island would be due to the increased demand by

larger numbers of tourists. Assuming any new individual wastewater systems around the island were sized adequately to accept wastewater flows from additional tourist activity, the wastewater contributions from military training activities would not be expected to cause system capacities to be exceeded or system maintenance requirements to increase by more than 10% except at the Field House. (The potential for significant impacts upon the wastewater system at the Field House were discussed in the previous section). Thus, the cumulative impact of wastewater generated by military training activities would not be significant. No mitigation would be required.

In the long term, the population and economic growth resulting from large scale casino development would probably require development of a municipal wastewater collection and treatment system designed to serve a population of 20,000 or more residents and tourists.[62] A typical per capita generation rate for design of municipal wastewater collection and treatment systems is 0.4 m^3/d per person, which suggests a minimum treatment plant capacity of approximately 8,000 m^3/d. The wastewater flows generated by the proposed military training activities (approximately 5 m^3/d at the Field House plus 1.5 m^3/d of concentrated wastes from PTs during a large scale exercise) would represent less than one percent of the wastewater treatment plant design flow. This small percentage would not be expected to cause system capacities to be exceeded or system maintenance requirements to increase by more than 10%, indicating that the impact of the military contribution would not be significant. Again, no mitigation would be required.

VOA. The cumulative impact of wastewater treatment and disposal from military training activities and the VOA development will not be significant. The VOA proposes to build and operate its own IWS on the VOA site. Preliminary estimates indicate that the VOA station will generate approximately 3 m^3/d of wastewater.[63] There will be no cumulative impact upon wastewater facilities because wastewater generated by military training activities will not be discharged to the VOA facility. Also, because the VOA wastewater generation rate approximately equals the design rate for a single family house, the cumulative impact upon groundwater of wastewater disposal through leach fields from military exercises and the VOA station would not be significant.

4.3.5.2 Proposed Mitigation

If a municipal wastewater treatment plant is built as a result of future casino resort development, or for any other reason, an effort will be made to secure an agreement with the Municipality to dispose of PT wastes to the municipal treatment plant.

If the proposed military base camp and associated septic system are built on VOA property, the military septic system will be sited at least the minimal distance from the VOA system which is required by CNMI regulations and/or permits.

[62]Dames & Moore, Juan C. Tenorio and Associations, and Austin Hansen International (March 1994) *Island of Tinian Master Plan Strategy Study.*

[63]U.S. Information Agency, Voice of America (August 1995) *Public Review Copy: Final Environmental Assessment and Finding of No Significant Impact for the Voice of America Mariana Relay Station, Tinian, Commonwealth of the Northern Mariana Islands.*

4.4 DISPOSAL OF SOLID AND HAZARDOUS WASTE GENERATED ON TINIAN

This section analyzes the cumulative impacts of waste disposal from continued training on Tinian. The issue is significant for two reasons: (1) there are no approved on-island waste disposal facilities and (2) transporting waste off-island for disposal is expensive and somewhat complicated, due to federal and local regulatory requirements. Note that this issue is common to all three alternatives, as training on Tinian is an ongoing activity.

Training activities routinely generate varying amounts of solid waste (primarily cardboard and paper) and very small amounts of used oil; some ongoing training activities generate used lithium batteries, which require transport as hazardous materials, if fully expended.[64] No hazardous waste is routinely generated by military units training on Tinian. On Guam, waste disposal from ongoing training is not a significant issue, as it is routinely handled by existing military infrastructure. On Tinian, there is no such infrastructure.

The sections below are developed from information provided in a study of waste disposal practices and options generated after the 1995 Tandem Thrust (TT 95) exercise.[65] Note that all measurements quoted were originally provided in English units and have been converted to metric units for this document.

4.4.1 Existing Conditions

Solid Waste (SW) and Hazardous Waste (HW) Generated. Observations of SW disposal practices during TT95 indicated that approximately 107 m^3 of SW was generated.[66] A visual estimate of waste components indicated that at least 90 percent of the waste consisted of traypack meals and associated paper and cardboard packaging and plates. The remaining 10 percent consisted primarily of plastic eating utensils and aluminum or glass beverage containers. SW was transported to Guam by a contractor (Guahan Waste Control, Inc.) and disposed at the PWC landfill at NAVACTS Waterfront Annex, after steam sterilization and fumigation.

Solid waste generated during relatively small exercises, e.g., National Guard and Army Reserve units training on Tinian, has been backhauled to Guam by the training unit and disposed at the PWC landfill. Waste generated by other organizations training on Tinian has been backhauled to the originating unit's home location and disposed with that location's solid waste.

Assuming that the total solid waste generated by National Guard and Army Reserve units annually approximately equals the volume of TT95 waste, and that TT exercises will continue to occur every other year, the volume of waste backhauled annually to Guam from Tinian would range from about 110 m^3 to 220 m^3. No HW is routinely generated on Tinian. Small amounts of used oil resulting from unexpected vehicle repair or small releases is transported as SW. Once received by PWC or DRMO on Guam, the oil can be tested for hazardous characteristics to determine whether it should be classified as HW. All HW is managed and stored at PWC or AAFB temporary storage areas

[64]Expended lithium batteries are recyclable materials, which are returned to the U.S. mainland for recycling. If not recycled, they must be classified as HW.

[65]Earth Tech, Inc. (September 1996) *Draft Report: Tandem Thrust 95 Solid Waste and Sludge Management Plan*. Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command.

[66]Earth Tech, Inc. (September 1996).

operated in compliance with RCRA regulations. There is a potential for additional used oil to be generated if vehicles are permanently stationed at the proposed base support camp. Regular vehicle maintenance would generate used oil with the potential to be HW.

Past exercises have generated expended lithium batteries, which are used in communications equipment and are hazardous materials (HM) by virtue of their potential to rupture, causing an explosion and/or fire. Used lithium batteries can be recycled and are considered HM rather than HW. They may be transported from a simulated combat area without special packaging; once reaching a non-tactical airport, they must be transported in accordance with DOT and DoD regulations regarding HM. [67]

Solid Waste Facilities. Tinian does not have either military or civilian facilities available for disposal of solid or hazardous waste generated by training personnel. Tinian's municipal landfill is an open dump, which is not in compliance with federal solid waste regulations.[68] The dump is located downwind of San Jose, near the former leprosarium north of town. There is no public or private waste hauling service; residents bring their own trash to the dump. There are no landfills on Saipan or elsewhere in the CNMI in compliance with federal regulations. As a result, the nearest landfills available for disposing solid waste generated by training are those on Guam.

A recent solid waste study evaluated five solid waste disposal options for Tinian: constructing a landfill, recycling, composting and co-composting, mobile incineration, and export off-island.[69] The study concluded that export was the only feasible and cost-effective disposal method and recommended backhauling all waste to Guam, as there are no RCRA-approved disposal facilities in the CNMI.[70] Therefore, the resources impacted would be ocean transportation and military disposal facilities on Guam.

Guam has two military landfills and one civilian landfill:

- The Navy Public Works Center (PWC) operates a 37.6-hectare landfill in the southern portion of the NAVACTS Waterfront Annex. The landfill is currently being studied to determine its capacity and annual fill rate. The currently established maximum landfill height is about 9 m above mean sea level (MSL)[71] and the annual volume of solid waste entering the landfill is estimated to be between 60,000 m^3 and 115,000 m^3. The remaining service life is estimated

[67]Joint publication AFJMAN 24-204/TM 38-250/NAV SUP PUB 505/MCO P4030.19F/DLAM 4145.3 (25 November 1994) *Preparing Hazardous Materials for Military Air Shipments*. Chapter 3 "Tactical Contingency or Emergency Airlift", Section 3-8 "Lithium Batteries" specifies that used lithium batteries may be transported installed in electronic equipment if installed in a battery box or compartment, without additional packaging. Used lithium batteries not installed in equipment "may be airlifted from a forward area (i.e., close proximity to combat or simulated area) provided each battery is wrapped in nonconductive material to prevent short-circuit. However, at the first enroute airport before further airlift, batteries must be properly packaged (i.e., individually wrapped in nonconductive material) and placed in an outer container..."

[68]40 CFR Part 257 *EPA Regulations on Criteria for Classification of Solid Waste Disposal Facilities and Practices*, and Part 258, *EPA Criteria for Municipal Solid Waste Landfills*.

[69]Earth Tech, Inc. (September 1996).

[70]Disposal at a non-RCRA-approved facility has the potential for significant long-term impacts on groundwater quality and public health. Therefore, such disposal is not an option for units training on Tinian.

[71]Actually, 30 feet MSL.

to be between 14 and 17 years, respectively. However, a proposed vertical expansion to 14.63 m MSL [48 ft MSL] would extend the life span to between 22 and 41 years.[72]

- AAFB has a landfill that is nearing capacity and is not able to accept non-Air Force waste.

- GovGuam operates Ordot Landfill, an open dump that does not comply with RCRA regulations. Under a consent order signed with the U.S. EPA, Ordot Landfill must be closed and replaced in 1997.

Solid waste delivered to Guam from aircraft and ships arriving from all sites outside the continental U.S. and Canada must be steam sterilized prior to disposal in landfills on Guam.[73] PWC maintains pierside dumpsters in Apra Harbor and the Guam Commercial Port with approved sterilization capability.

HW Facilities. There are no RCRA-approved HW treatment, storage and disposal facilities (TSDFs) on any island in the CNMI or Guam. Hazardous waste and used oil generated by military organizations in the Marianas are managed and disposed by the Defense Reutilization and Marketing Office (DRMO), which transports HW from PWC and AAFB on Guam to the continental U.S. for disposal at a licensed facility.

HW generated on ships and at locations off Guam must be approved by GEPA prior to offloading on Guam.[74]

4.4.2 Impacts of Ongoing Training and Proposed Base Support Camp

4.4.2.1 Evaluation Criteria

Waste disposal activities resulting from ongoing training were evaluated to determine whether they would have a potentially significant impact on the environment. The criteria used are presented in Table 4-4.

4.4.2.2 Potential Impacts of Solid Waste Disposal

Transportation Availability and Controls. No significant transportation impacts are expected as there are commercial transporters in Guam and the CNMI interested in having the business. In addition, DoD ships are capable of transporting SW.

Empty SW dumpsters will be inspected for brown tree snakes in accordance with the *BTS Control/Interdiction Plan* discussed in Section 4.1. No BTS controls would be necessary to ship SW

[72]Personal communication with Michael Miyahira, GMP Associates, Inc., May 9, 1996.

[73]U.S. Department of Agriculture, Animal and Plant Health Service (3 May 1995) *Compliance Agreement for the Handling and Disposal of Foreign Garbage by the U.S. Navy Public Works Center, Apra Harbor, Naval Station, Guam.*

[74]Such waste is considered an import by GovGuam and must conform to Guam EPA regulations. A generator must be identified, must have or obtain a generator identification number from the U.S. EPA, and must initiate an import request involving a 60-day approval period.

Table 4-4
Evaluation Criteria for Potential Impacts of Solid and Hazardous Waste Generated on Tinian

Criterion	Parameter	Significant If
SW transportation	Presence	No commercial or military vessels available to transport SW containers between Guam and CNMI
	Means of controlling pest/disease import	No protocols and associated infrastructure established
	Import from CNMI to Guam	Prohibited by law
SW disposal facility	Presence	No RCRA-compliant facilities[75] available within Guam/CNMI region
	Landfill service life	SW from Tinian would shorten service life by 5 percent or more
HW and HM transportation	Presence	No DOT-compliant[76] commercial or military aircraft or vessels available
	Import from CNMI to Guam or continental U.S.	Prohibited by law
Permitted HW TSDF	Presence	No RCRA-permitted facilities[77] available within Marianas
HW Storage	Presence	No temporary (<90 day) storage facility[78] or permitted HW TSDF in Guam or CNMI
HW, HM, used oil handling and storage	Means of preventing and controlling spills	No SOPs and associated infrastructure are established or present

from Tinian to Guam. SW shipments from Tinian to Guam will continue to be inspected by the Department of Agriculture, including fumigation and visual inspection for other pests.[79]

SW shipments from the CNMI to Guam are considered imports by GovGuam, which has indicated it prefers not to approve SW imports into the territory, even for disposal at a DoD-owned and -operated facility. However, GovGuam has not attempted to prohibit such imports and has established a protocol for handling such waste. Therefore, although occasionally backhauling SW to Guam may generate increased friction between GovGuam and the Navy, it is not expected to have a significant impact on solid waste disposal resources.

[75]As defined in 40 CFR Parts 257 and 258.

[76]As defined in 49 CFR Parts 171 through 173.

[77]As defined in 40 CFR Parts 264 and 265.

[78]As defined in 40 CFR Parts 261 and 262.

[79]Fumigation and inspection are required by the Compliance Agreement between the U.S. Department of Agriculture and the Navy Public Works Center dated 3 May 1995.

Transporting SW from Tinian to Guam will require funding and coordination, impacting training organizations by diverting training funds to logistics support and diverting training planning to logistics planning.

Licensed Disposal Facilities. No significant impact is expected from lack of a licensed SW landfill with adequate capacity.

- The PWC SW landfill is located within the Marianas, is available to receive SW from military activities in and around that area, and is in compliance with RCRA regulations.

- The landfill is in compliance with federal SW regulations and has the capacity to accept additional SW without decreasing its service life by 5 percent or more. To be conservative, an estimate of 500 m^3 of solid waste per year was assumed to be generated by exercises on Tinian (although about half that amount is a more likely estimate). This represents less than 1 percent of the waste annually accepted by the PWC landfill.[80] This means that the backhauled Tinian solid waste would potentially shorten the service life of the PWC landfill by a maximum of 21 days in seven years, its minimum anticipated service life.[81] This reduction of less than 1 percent in the landfill service life does not meet the volume criterion for significant impact to the landfill capacity.

4.4.2.3 Potential Impacts of Used Oil and Hazardous Waste Disposal

Transportation. All HW and HM will be transported by DoD aircraft or watercraft in accordance with RCRA, U.S. Department of Transportation (DOT), and GEPA regulations regarding HW transport, handling, and storage. Commercial HW shipping concerns may also be contracted to ship HW from Tinian to Guam or Saipan for transshipment to the continental U.S.

Permitted Disposal Facilities. HW and HM (i.e., expended lithium batteries) will be transported either to Guam or directly to the continental U.S. by the generating units. HW transported to Guam will be managed and temporarily stored by PWC or by DRMO, prior to shipping to the continental U.S. for disposal at a licensed TSDF.

Spill Prevention Measures. No significant impact from an unexpected release is expected on Tinian, as all units operating on Tinian must be in compliance with military orders regarding spill

[80] 500 m^3/60,000 m^3 = 0.008 = 0.8% <1%
where 500 m^3 = volume generated annually on Tinian
and 60,000 m^3 = lowest estimate of annual volume entering PWC landfill at the present time.
500 m^3/115,000 m^3 = 0.004 = 0.4% <1%
where 115,000 m^3 = highest estimate of annual volume entering PWC landfill at the present time.

[81] 0.8% x 2555 days = 20.4 days
where 2555 days = 7 years, the minimum estimated service life.
0.8% x 5110 days = 40.9 days
where 5110 days = 14 years (maximum estimated service life without proposed expansion)

prevention and response.[82] Storage and handling of HW, HM, and used oil is managed in accordance with federal regulations and associated military instructions.[83]

4.4.3 Proposed Mitigation

Solid Waste. The impact on GovGuam-Navy relations from backhauling solid waste from Tinian cannot be entirely mitigated without providing for solid waste disposal on Tinian, which would be extremely costly and difficult to control, in the absence of any staffed DoD base on Tinian. The Navy will continue to work closely with GovGuam, to allay concerns regarding imported SW.

The funding and logistical impacts on training organizations may be mitigated by implementing waste minimization measures, in accordance with current Navy policy.

Used Oil and Hazardous Waste. To reduce the amount of used oil generated on Tinian, no scheduled vehicle maintenance will be permitted during exercises on Tinian. All vehicle refueling will occur on paved/impervious surfaces or with spill containment equipment in place. Used oil backhauled to Guam will be periodically tested for HW characteristics.[84] If the used oil is determined to be HW by the toxicity characteristic, future shipments of used oil from Tinian to Guam will be managed in accordance with federal and Guam regulations regarding HW shipping and import.

Any release of petroleum, oil or lubricant during a training exercise on Tinian will be contained and absorbed with clay particles (cat litter), in accordance with existing SOPs. The resulting waste will be placed in a secure container and backhauled with the generating unit for disposal at its home location.

4.5 IMPACTS OF AVIATION TRAINING ON PUBLIC SAFETY

This section analyzes the potential for public safety hazards resulting from ongoing and increased aviation training. Strict compliance with military safety procedures and guidelines (as well as with FAA requirements) is routine for military aviators.

Most active military and civilian airfields have established safety zones surrounding their operating surfaces, to ensure safe operation during ground support activity and flight operations. These zones constrain adjacent land use, particularly for lands overflown during aircraft approach and departure. Manmade obstructions to flight are generally prohibited within these zones. Each airfield also has established flight tracks, intended to minimize the potential for interference among approaching and departing aircraft. Aviation safety is regulated by FAA and military air traffic control stationed at individual airports.

[82]U.S. Department of the Navy, Commander, Naval Forces, Marianas (16 February 1993) COMNAVMARIANAS Instruction 5090.2 *Oil and Hazardous Substance (OHS) Pollution Contingency Plan.*

[83]e.g., RCRA solid waste regulations at 40 CFR Parts 240 and 250, RCRA hazardous waste regulations at 40 CFR Parts 260 and 270, OPNAVINST 5090.1B *Environmental and Natural Resources Protection Manual,* COMNAVMARIANAS INST 5090.2 *Oil and Hazardous Substance (OHS) Pollution Contingency Plan,* and various site-specific OHS (oil and hazardous substances) Spill Contingency Plans.

[84]See 40 CFR 261.20-261.24, *Characteristics of Hazardous Waste.*

4.5.1 Existing Conditions at Civilian Airfields

The only aviation training proposed for a new location is NVG training on Rota. However, the proposed addition of certain aviation activities in various ongoing training locations creates a cumulatively greater risk of accident.

Civilian airfields which may be affected by military training are the Rota, Saipan, and Tinian airports. The Rota International Airport, which operates under visual flight rules (VFR), has navigational lights and a radio beacon but does not have a control tower. Approaching aircraft are requested to contact the terminal via the common terminal area frequency, to verify weather, visibility, and traffic conditions. Rota provides air service to Guam and Saipan; most traffic occurs during daylight hours, with the last regular flight at 7:30 PM.[85] Aircraft approaching on instrument flight rules (IFR) must communicate with the FAA's Guam Center Radar Approach Control (C-RAP).

The West Tinian Airport is a VFR facility with a navigational light system but no control tower. A number of small commuter planes fly between Tinian and Saipan on roughly an hourly turn-around basis during daylight hours. During the time when the first casino was open on Tinian, commuter flights from Saipan arrived roughly every 20 minutes from dawn to midnight. Under prevailing tradewind and calm conditions, aircraft approach and depart on an ENE heading along an informally-defined track which intersects the southeastern portion of the EMUA, including North Field and the airspace potentially affected by the firing range (Figure 4-15). Aviation activities at West Tinian Airport and North Field are overseen by the FAA office at Saipan's International Airport (Isley Field).

The west to east approach track into Saipan International is on the same approximate heading and about three miles to the northeast of the approach and departure at Tinian's North Field (used only by the military)(see Figure 4-15). The altitude of international carriers (e.g., DC-10 and C-747 aircraft) approaching Isley Field is about 730 meters above Tinian's North Field #1. Saipan terminal is equipped with an airport terminal information system (ATIS) on which aviation information, including NOTAMS, is posted on repetitive UHF broadcasts.

4.5.2 Potential Impacts of Ongoing and New Aviation Training

Evaluation Criteria. The potential for aviation training activities to significantly impact public safety was evaluated according to the criteria in Table 4-5.

Training Activities With Potential to Impact Public Safety. The proposed action includes ongoing fixed-wing aviation training at Orote Point, AAFB, and Tinian, and rotary-wing operations at Apra Harbor, the Ordnance Annex, AAFB, Tinian, and FDM. The only new aviation training proposed is NVG training at Rota International Airport.

Public safety is anticipated to be potentially at risk from aviation training only under certain conditions. Those conditions are:

- Locations where civilian aircraft have access to training airspace. Civilian aircraft are prohibited from overflying AAFB and the NAVACTS Ordnance Annex. Civilian aircraft are also prohibited

[85]Personal communication with Willis Cannon, Saipan FAA, May 16, 1996.

from flying within 5 km [3 miles] of FDM when exercises are announced. Therefore, the only locations where air space may be shared are on Tinian and Rota.

- Locations with no on-site military or civilian air traffic control. The only aviation training locations accessible by civilian aircraft and having no control tower are Rota International Airport, West Tinian Airport, and North Field in Tinian's EMUA.

- Locations where civilians (on foot or in land vehicles) have access to training airfields, LZs, or DZs. This includes Orote Point, the DZ east of West Tinian Airport, and North Field in the Tinian EMUA.

Table 4-5
Evaluation Criteria for Potential Aviation Training Impacts on Public Safety

Training Location	Parameter	Significant if
Landing zones and drop zones on all islands, government and private lands	Interference with/interference by civilian aircraft	Civilian aircraft overfly these training areas
		Absence of established public notification (NOTAM) and area clearance protocol
Tinian North Field, Orote Point runway	Hazards to civilians on ground	Tourists enter military training areas during air operations
Tinian North Field, West Tinian Airport, Orote Point runway	Interference with civilian aircraft activities	Communication with FAA is non-existent AND Absence of established public notification (NOTAM) and area clearance protocol AND Military and/or civilian flights do not follow established flight tracks
Rota International Airport	Interference with civilian aircraft activities	Military aviation training commences prior to last daily commercial flight
FDM airspace	Interference by, or potential damage to commercial aircraft and vessels	Absence of established public notification and area clearance protocol
		Lack of NOTAM and NOTMAR publication in advance of training events

No conflicts with civilian aviation on Guam are expected, due to well-established communication and compliance with existing FAA and military regulations and compliance with orders from air traffic control personnel. No interference with civilian aviation is expected on Rota, as commercial flights normally cease after 7:30 PM, and the proposed NVG training will commence one hour after sunset or after the last commercial flight, whichever is later, and will end by 10:00 PM. No interference with civilian aviation is expected from operations on FDM, as the airspace is restricted

for a radius of five km around the island (Restricted Area 7201) and NOTAMS (including notification of the FAA on Saipan) are published prior to any exercise occurring in the vicinity of FDM.

Conditions on Tinian have the potential to generate significant impacts. Training in Tinian's EMUA will occur in air space used by commercial aviation. The proposed action includes low altitude fixed-wing cargo drops and paradrops, fixed-wing and rotary-wing landings, and NVG training at North Field. It also includes administrative air traffic in and out of West Tinian Airport and parachute operations due east of the airport. All of these activities have the potential to interfere with civilian aviation in and out of Saipan International Airport and West Tinian Airport (see Figure 4-15). Civilian flights in and out of Tinian Airport do not follow established flight tracks and frequently overfly the North Field area. Aviation training may occur throughout the day and night, concurrent with civilian flight operations. If Tinian's casinos bring increased numbers of tourist flights in the future, potential hazards would increase.

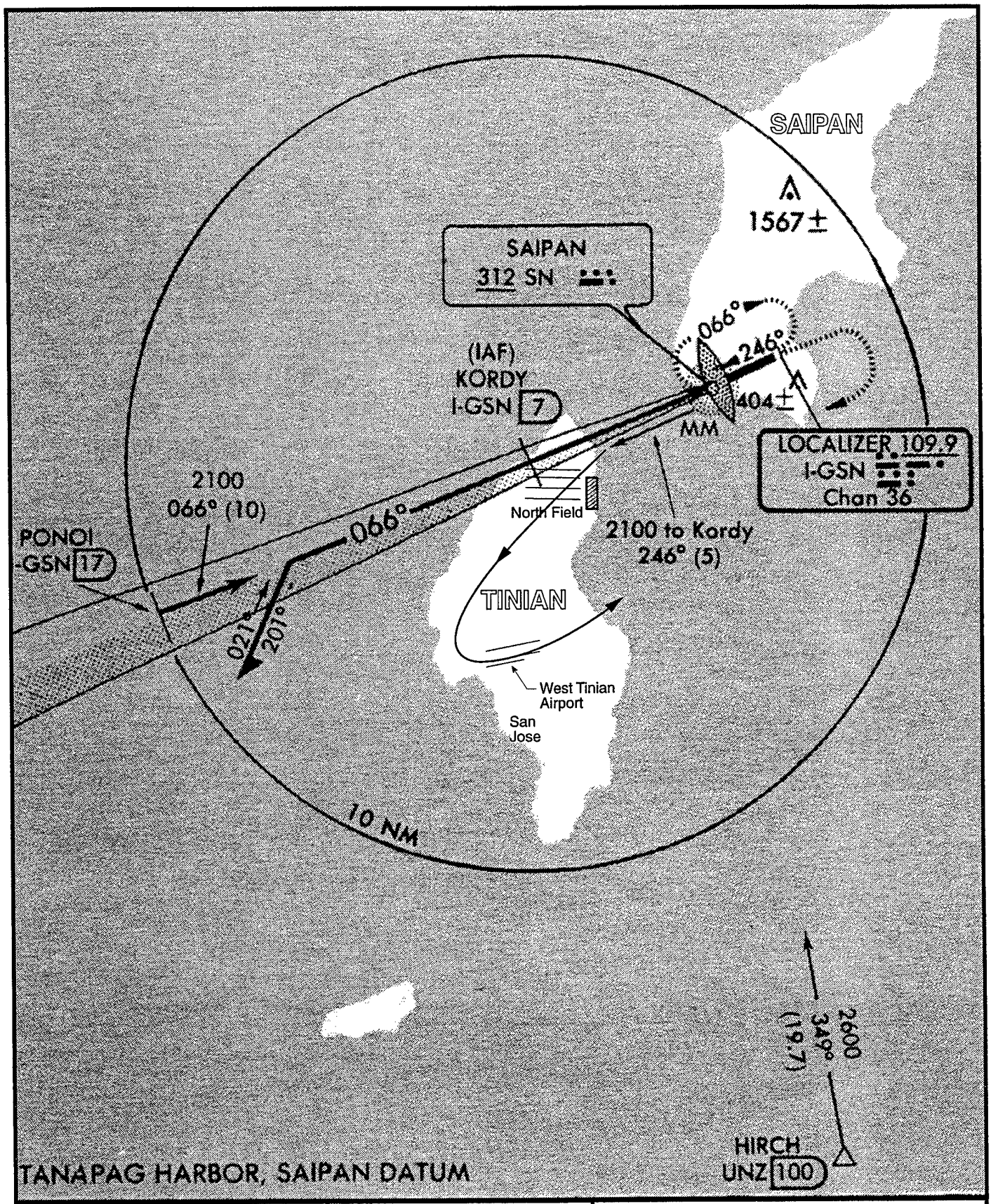
Aviation training may also pose hazards to civilians on the ground in areas accessible to the public. The airfield at Orote Point and North Field on Tinian both contain historic trails that allow public use. The historic trail established at NAVACTS Waterfront Annex provides visitor access to portions of Orote Point Road, Spanish Steps, and other features at the end of Orote Point. Tinian has an established historic trail with 14 points of interest in the LBA and EMUA (see Figure 4-9). The EMUA has a variety of paved roadways, former runways, and taxiways that allow tourists broad access within the training area. Persons who inadvertently intrude onto aviation operating surfaces during aviation operations may cause or suffer from aviation hazards.

4.5.3 Proposed Mitigation

In general, potential impacts of aviation training on public safety will continued to be managed by military SOPs and area-specific constraints. Safety criteria and related operational/training procedures are published by responsible government agencies. These criteria and military SOPs mitigate most potential impacts of aviation activities. For example, an Airfield Installation Compatibility Use Zone (AICUZ) study for AAFB is being updated to include Northwest Field and the accident potential zones, clear zones, and safety buffers designated for each runway. These zones impose restrictions on adjacent land uses. For small unit paradrops using DZs on private property such as Dandan, permission will be obtained in advance from the landowner to ensure no conflict with other land uses.

Any type of military activity (flight operations and weapons training) within or near commercial airspaces or the VOA site will be coordinated with the FAA, CNMI Emergency Management Office (EMO), and Tinian Mayor's Office with sufficient lead time to perform public notification. A NOTAM will be published 72 hours in advance of any such activity, to inform both military and civilian aircraft of the time frames for planned aviation activities within shared or restricted airspace. A zone of restricted airspace between Tinian and Saipan may be established and activated for scheduled training via the NOTAM process.[86] During training activities at both North Field Runway #1 and West Tinian Airport, communication will be maintained between the military (USAF CCT/ALCE (Airlift Control Element) or USMC Arrival/Departure Airfield Control Group) and the Saipan Air Control Tower. The same requirement will be met with AAFB air traffic control when exercising on its runways.

[86]Federal Aviation Administration, U.S. Department of Transportation (September 16, 1993) *7400.2D Procedures for Handling Airspace Matters.*



Source: *High and Low Altitude Pacific, Australasia and Antarctica*, DOD Flight Information Publication (terminal), June 24, 1993

NOT TO SCALE

LEGEND

Approximate track of Saipan-Tinian commuter flights

Proposed firing range

Figure 4-15
SAIPAN FLIGHT APPROACHES AND DEPARTURES
DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

Road blocks, security posts, and area inspections will be implemented to counter civilian encroachment into aviation training areas.

4.6 IMPACTS OF FIRING RANGES ON PUBLIC SAFETY

This section addresses potential public access conflicts and public safety measures in place for proposed weapons training.

4.6.1 Existing Conditions at Existing and Proposed Range Areas

The proposed action includes continued use of existing small arms ranges at AAFB and NCTAMS Finegayan, expansion of two small arms ranges at Orote Point to include sniper rifle training and a fire and maneuver capability, addition of a new sniper range at the Ordnance Annex, and addition of a fire and maneuver range and mortar range in the EMUA on Tinian. Each existing range has a Surface Danger Zone (SDZ)[87] configured to include aiming errors of range and deflection, plus ricochets, for the types of weapon and ammunition authorized. The SDZ identifies the area kept clear of all personnel during firing.

Guam: The proposed sniper range site in the Ordnance Annex is not officially accessible to the public (see Figure 2-7). However, a hiking trail enters the southwest boundary of the Annex and connects Mount Lamlam, Mount Jumullong Manglo, and Imong. This trail is used for religious processions to Mount Jumullong Manglo at Easter. NAVACTS personnel have respected this traditional practice. (Existing natural and cultural resources in the proposed range are separately addressed in Sections 4.1 and 4.2, respectively.)

When in use, the existing small arms range areas at Orote Point are not accessible to the public, and access roadways are blocked and marked. Proposed expansion and range construction at Orote Point will not alter this existing safety condition.

Tinian: The proposed site for a new range on Tinian (see Figure 2-12 and 2-13) is the approximate location of a former range, the use of which has been suspended pending SDZ validation and control, and resolution of other safety issues. The weapons that were used on this range included rifles, crew- served light machine guns, 60 mm mortars, and 40 mm grenades. The impact area is known to contain unexploded ordnance (UXO) resulting from past training use, and UXO density and characterization have not been formally investigated. The area proposed as a reconfigured range is bisected north to south by a paved road frequented by persons visiting North Field and the blowhole. Access between North Field and the blowhole is an east to west dirt road that enters North Field between runways 1 and 2. The coastline east and south of North Field, including portions of the former impact area, contains native plants sometimes gathered by local residents for ethno-botanic uses.

FDM: Civilians do not have access to this uninhabited island. Nearby ocean areas are used by commercial and sports fishermen. The airspace is restricted for a radius of five kilometers [three miles] around the island. Water space is restricted when a NOTMAR is published for scheduled training.

[87] See Appendix B.

4.6.2 Proposed Activities and Potential Impacts of Firing Ranges

4.6.2.1 Evaluation Criteria

Live fire training is inherently dangerous and has resulted in generation of volumes of rules and regulations to be followed by those conducting, and by those participating in, firing and demolition range training. A major concern is that unauthorized persons may inadvertently enter a range area. Therefore, the pertinent criterion is the potential to cause injury or death to civilians in the vicinity of live-fire training activities. The criteria used to identify significant potential impacts are presented in Table 4-6.

4.6.2.2 Potential Impacts

No live fire training is proposed to occur on non-DoD lands and no safety hazards to civilians are expected to result from proposed activities on such lands.

Guam and Tinian Small Arms Requalification and Fire and Maneuver Ranges: Certain existing and proposed ranges have SDZs which extend over water bodies accessible to the public (see Figures 2-2, 2-3, 2-7, 2-8, and 2-10), creating the potential for hazards to navigation within the SDZs. Large warning signs are posted facing seaward at Orote Point and NCTAMS Finegayan to warn recreational and commercial water vessels to avoid the over-water SDZs. In addition, civilians have access to historic trails in areas adjacent to ranges and SDZs on Guam's Orote Point and within the Tinian EMUA. Tourists will lose access to the EMUA during range use, with potential economic impacts to tour operators (see Section 4.7). Regardless of warning signs, civilians can encroach SDZs over water, the area behind the Orote Point range's firing line, and enter Tinian's EMUA through a variety of roadways. Therefore, there is the potential for significant impacts at all of these locations, if civilians ignore warnings.

Shooting and Breaching Houses: The existing Orote Point shooting house is located to the rear of the small arms range, along a former taxiway that connects to roads traveled by tourists on the NAVACTS historic trail. It is possible for civilian visitors to leave the historic trail and inadvertently enter the range area while urban training/breaching activities may be occurring. The same risk will exist for the shooting house proposed for Tinian since it, too, will be near roads, taxiways, and runways used by tourists visiting cultural sites in the EMUA. The risk is slight to non-existent at the proposed Ordnance Annex breaching house, due to its controlled access.

All Guam and Tinian Ranges: Civilian aircraft overflight of firing ranges is possible at the Guam and Tinian existing and proposed ranges, if aircraft disregard published warnings and no-fly zones. The potential for impacts on overflying aircraft—particularly from mortar fire—is greatest on Tinian, since the proposed range area lies near the approach path to Saipan's International Airport (Isley Field) and routes used by aircraft approaching West Tinian Airport.

Ordnance Annex Proposed Sniper Range: Although the SDZ for the proposed sniper range will not extend outside the military installation (Figure 4-16), civilians are able to enter the southwest border of the Annex on a hiking trail connecting Mount Lamlam, Mount Jumullong Manglo, and Imong. If civilian access is not formally coordinated with NAVACTS Guam, trail control during range use will be difficult, with potentially significant impacts to public safety.

Table 4-6
Evaluation Criteria for Potential Impacts of Range Training on Public Safety

Training Location	Parameter	Significant if
Known distance small arms ranges: AAFB, NCTAMS Finegayan, Orote Point	Risk of injury to unauthorized personnel in range area	Lack of range SOP, range safety personnel, and range observers for ocean SDZ areas
		Lack of ability to sweep and secure a range prior to training
Fire and maneuver ranges: Orote Point, Tinian	Risk of injury to unauthorized personnel in range area and within range fan at sea	Lack of range SOP, range safety personnel, and range observers over ocean SDZ areas
		Lack of NOTMAR publications and other established public notifications in advance of firing activities
		Lack of ability to screen and secure a range prior to training
Underwater demolition ranges, Waterfront Annex	Risk of injury to civilian divers and watercraft	Lack of public notification and range sweep to clear the training area of unauthorized personnel and vessels
		Lack of ability to sweep and secure a range prior to training
Sniper range, Ordnance Annex	Risk of injury to unauthorized personnel on trails in range fan	Lack of range SOP, range safety personnel, observation of adjacent hiking trail, and established communication protocol with Mayors' Council
Mortar range, Tinian	Risk of injury to unauthorized personnel in range area and on nearby trails	Lack of range SOP, range safety personnel, and observation for hikers and visitors
		Lack of ability to sweep and secure a range prior to training
		Lack of roadway gates and sentries to stop vehicular traffic in range areas during training
	Risk of injury caused by UXO	Lack of observation during firing to identify dud rounds; lack of range sweep prior to commencing firing, range fence line, and warning signs to stop impact area access

Training Location	Parameter	Significant if
Mortar range, Tinian *(continued)*:	Risk of injury caused by UXO *(continued)*:	Lack of ability to sweep and secure a range prior to training
	Risk of injury to civilian aircraft	Lack of NOTAM publication and FAA notification in advance
Shooting/breaching houses, Orote Point, Ordnance Annex, Tinian	Risk of injury to unauthorized personnel in range area	Lack of range SOP and range control to keep SDZ clear of unauthorized personnel
FDM	Risk of injury to nearby boaters	Lack of NOTMAR in advance of naval gunfire and aerial bombardment
		Lack of pre-exercise visual sweep within 5 km (3-mile) radius of island

Apra Harbor Underwater Demolition Areas: Existing and proposed underwater demolition training by NSWU and EODMU-5 in Inner and Outer Apra Harbor, south of Orote Point, and 3.2 km north of Apra Harbor generates limited shock waves with the potential to affect civilian and military swimmers and watercraft. (Potential impacts to marine animals are discussed in Section 4.1). Underwater demolition training may also interfere with commercial and pleasure boating and scuba diving which occur in these areas.

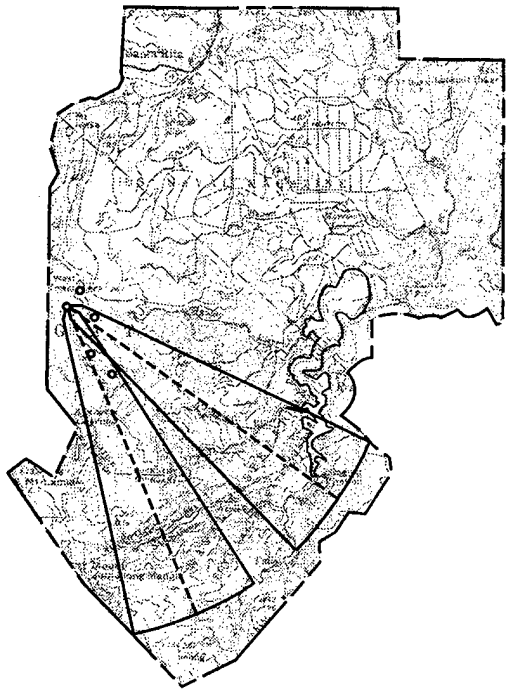
Tinian's Proposed Mortar Range: The 60 mm mortar has the potential for causing dud (UXO) contamination in the range impact area. Although the impact area can be swept, fenced, and posted with warning signs, such measures cannot guarantee that the mortar impact area will not be entered. The limestone terrain and heavy underbrush in the proposed impact area would make post-training dud clearing by EOD personnel extremely risky. UXO will accumulate in the designated impact areas, constraining future land use.

FDM Aerial Bombardment and Naval Gunfire Range: UXO will accumulate in the designated impact areas. As civilians cannot access the island, this will not generate an impact to general public safety.

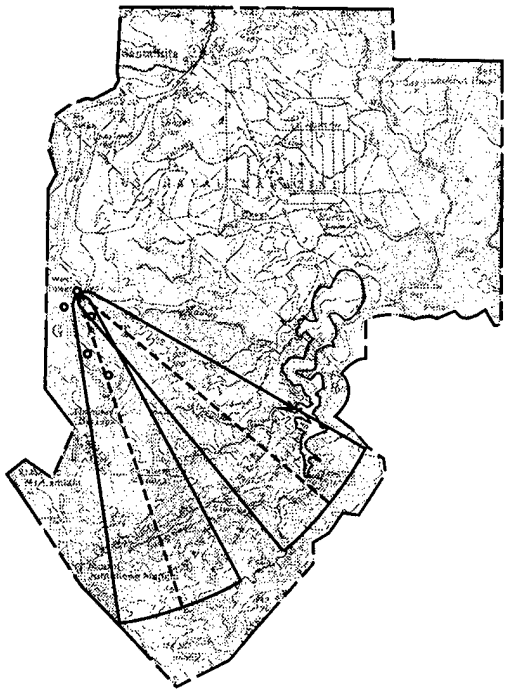
4.6.3 Proposed Mitigation

Regulations: Potential impacts caused by weapons and demolition training will be managed by SOPs and area-specific constraints. Safety criteria and related operational/training procedures are published by the responsible government agencies. These criteria and military SOPs will mitigate most potential impacts of live fire activities. Range regulations define range boundaries, firing lines and SDZs, permissible live fire training activities, required supervision and observation on the range and within the surrounding area, and necessary logistic support such as medical and fire fighting response.

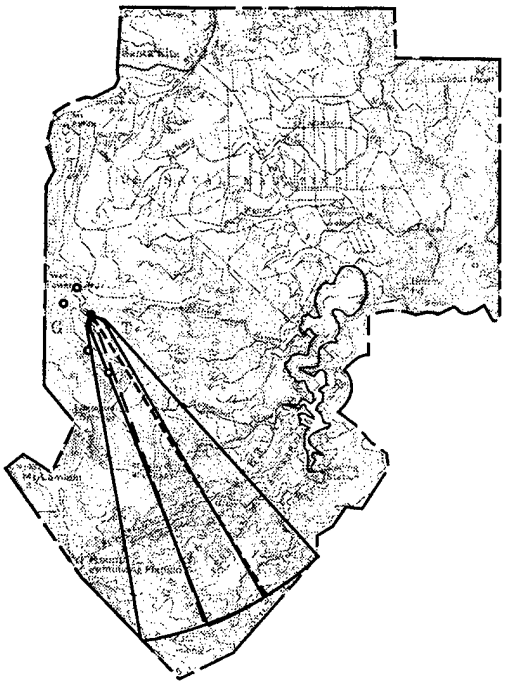
Range regulations will be published and distributed to all units requesting the use of training areas and live fire ranges. Prior to live-fire training, the designated officers-in-charge and range safety



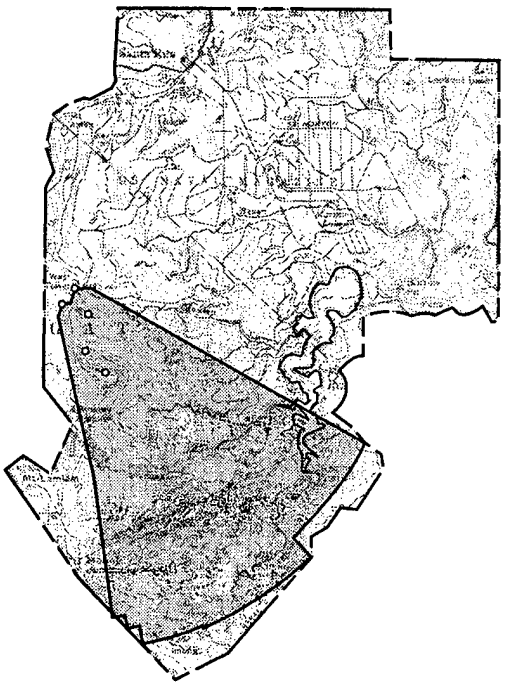
A. To keep the safety fan within the boundaries of the Ordnance Annex, the limit of fire from the western firing position is restricted to an approximate direction of 125° to 158° east of north.



B. The limit of fire from the northern firing position is restricted to an approximate direction of 130° to 162° east of north.



C. The limit of fire from the breaching house is restricted to an approximate direction of 147° to 158° east of north.



D. This is a composite of all the safety fans.

Source: Marianas Training Plan Briefing Booklet

NORTH

0 1000 2000 (Meters)

0 4000 8000 (Feet)

LEGEND

——— Safety fan boundary

— — — Limit of fire

Figure 4-16
SAFETY FAN LIMITS

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

officers will be required to demonstrate knowledge of range regulations and restrictions. Prior to introducing live-fire training to Tinian, ranges will be designed and certified by the Naval Facilities Engineering Command. In addition, air space Restricted Areas and SDZs may be established. These restrictions will be processed with the FAA and USCG.

Notifications: FAA and USCG regulations define required NOTAM and NOTMAR publication and notice procedures, to warn the public to avoid certain areas at published times. NOTMARS will be broadcast on marine bands by the USCG in advance of any training activity. To ensure that coverage includes the Marianas, early notification will be provided to the CNMI Emergency Management Office for marine band broadcasting simultaneously with USCG NOTMAR broadcasting from Guam. COMNAVMARIANAS and AAFB are responsible for public announcements for newspaper, radio, and television dissemination as needed.

Prior to underwater demolition training in or near Apra Harbor, the training unit will coordinate with Guam EPA in accordance with existing protocol. The Apra Harbor Survey Plan will be implemented to ensure that the training area is clear of civilian divers and watercraft, as well as turtles and large schools of fish. A NOTMAR will be submitted and generated along with a press release, via COMNAVMARIANAS. (Mitigation of potential impacts to marine animals is discussed in Section 4.1).

Warning Signs and Observation: To ensure tourist and resident safety within training areas that are accessible to the public, military traffic control and range safety observation posts (including oversight of SDZs) will be established, with positive communication to officers-in-charge of training and range safety personnel. Warning signs will be posted to warn those approaching an SDZ and training range area on foot, in vehicles and water craft. When necessary, roadblocks and sentries will be used to ensure traffic is delayed as necessary. Gates, range flags and sentry posts will be established as necessary to provide security at ranges and SDZs.

On Orote Point, barriers and a sentry station will be used to stop unauthorized traffic from entering the ammunition pier area; similar safeguards will be used to block entry to the Orote Point firing range and shooting house, as deemed necessary.

For the Ordnance Annex, NAVACTS personnel will coordinate with the Mayors' Council to identify dates of important annual religious festivals using the trail to Mount Jumullong Manglo, and the sniper range will not be used on those dates. Access to the trail will be prohibited at all other times, as the range will be used by Navy personnel during the week and by the National Guard and Army Reserve personnel on weekends. Signs will be installed on the trail at the boundaries of the Ordnance Annex, indicating that the area is government property and may not be safely entered by hikers or hunters.

On Tinian, multiple temporary roadblocks will be established during training activities, due to the number of former runways, taxiways, and roadways that allow access to the training area. Depending on the nature of a particular exercise, alternate routes may be established within the EMUA to provide access to tourist attractions that may be reached without exposure to personal danger during training events. Advance warning of Tinian operations will be provided to commercial air carriers through FAA and EMO, to avoid airspace conflicts. The Tinian Mayor's Office and Marianas Visitor Bureau will be informed at least one week in advance if access to tourist destinations must be closed due to range use. A water observation sentry post will be established for use of the fire and maneuver range overlooking the SDZ.

Bombing, strafing and naval gunfire exercises at FDM will receive media coverage in advance, aimed at advising commercial fishermen of impending exercises.

Impact Area Management. The impact area for the proposed range will be swept by EOD teams after every training session. Pre-use clearing and maintenace with non-persistent herbicides such as Roundup will facilitate such routine dud sweeps. In addition, the impact area will be fenced off and warning signs will be posted at regular intervals along the fence. Because the proposed impact area includes a portion of a public roadway, either the roadway will be diverted around the impact area or the impact area will be modified to exclude the road. In either case, the public roadway will be carefully swept by the EOD team following every training session. However, warning signs and fences will not guarantee that the mortar impact area will not be entered. Therefore, this potential hazard cannot be entirely eliminated.

4.7 SOCIOECONOMIC IMPACTS ON TINIAN

Tinian is the only populated island in the Marianas which has not experienced dramatic economic development over the past ten years. Residents of the island have identified the presence of the Military Lease Area—approximately two-thirds of the island—as the possible cause of this disparity. The MLA was leased to the U.S. Department of Defense as part of the CNMI's responsibilities under the 1976 Covenant establishing the Commonwealth. The Covenant provided all CNMI residents with full U.S. citizenship and provided the Commonwealth with substantial extended financial support from the U.S. Although access to the MLA is generally unrestricted, its land area may not be privately owned or developed. This has resulted in less land available for homesteading and a perceived shortage of land available for tourism-related development.

To determine socioeconomic conditions on Tinian, the firm of Ernst & Young reviewed available government records and interviewed individuals on Tinian and Saipan. Their report is summarized below and included in total as Appendix P.

4.7.1 Existing Conditions

This section identifies both the current situation on Tinian and the conditions which might result if proposed casinos are constructed and operated successfully.

Demographics. The published population of Tinian was 2,118 in 1990 (U.S. Census) and 2,553 in 1992, with an estimated 1995 year-end population of 3,718, based on records of airport activity between January 1992 and December 1995. Interviews with residents indicated that the majority of this increase is due to arrival of alien contract workers, matching a trend throughout the CNMI.

Population density was calculated on the basis of the extrapolated 1995 population and the land area available for use by the local population, i.e., the area outside the MLA (approximately 13.0 square miles). This provided a population density of approximately 285 persons per square mile (in comparison to 60 persons per square mile, if the entire island area of 39 square miles were available). By contrast, Saipan's density is approximately 1,062 persons per square mile.

Economy. In 1990, the mean annual family income on Tinian was $33,651,[88] which is relatively affluent. Although no statistical information is available, it is widely agreed that most of the resident labor force—approximately 75 percent—is employed by the local government.

Tinian does not currently have any significant industry, natural resources, or exports. Tourism has increased in recent years and is anticipated to expand dramatically if major casinos are successful on the island (see below). Available information indicates that an average of 1,200 to 2,000 tourists per month (roughly 60 per day) visit Tinian, mostly on day-trips from Saipan. These are primarily Japanese and Korean visitors, with occasional groups of war veterans, eco-tourists, hikers, and cyclers. All tourists arrive by air, with the exception of one tour boat based on Saipan. Most day-trip tours are scheduled months in advance and include a half day at a beach in San Jose, lunch, and a tour of World War II sites in the EMUA. Tourists wishing to spend the night may be accommodated in 30 rooms at three small motels; two companies offer rental cars at the airport.

Commercial agriculture on Tinian consist of small-scale vegetable and fruit cultivation (marketed locally and also shipped to Saipan). Although there are no commercial fishing operations on Tinian, most families practice subsistence fishing. Commercial tuna fishing and transport ships sporadically dock in the harbor, providing substantial business for the local stevedore companies, nightclubs, and dockside fueling facility.

Commercial cattle grazing has dwindled from the Bar K's 10,000 head of cattle several years ago to a herd of 1,000 in 1995. The Bar K is equipped with a slaughterhouse and cold storage facility; it supplies beef to Saipan and Guam as an alternative to more expensive U.S. and Australian beef. Tinian also has three smaller family-owned ranches, and many families raise cattle or pigs for their own consumption.

Retail establishments on Tinian consist of six nightclubs; several convenience stores, hardware stores, and gas stations; several small restaurants and bakeries; and assorted other small businesses. There are also branches of the Bank of Guam and Bank of Saipan, two part-time insurance agents, one certified public accountant (CPA), and several manpower agencies supplying alien contract workers. Potential casino operations are discussed in the next section.

Air service is provided by Freedom Air and Pacific Island Aviation at the West Tinian Airport. Most Tinian residents travel to Saipan at least once a month, averaging 265 passengers a day (96,725 passengers a year) in 1995. Substantial renovation of the airport is planned by the Commonwealth Ports Authority if major hotel/casino construction occurs on Tinian.

Casino Industry. Tinian has worked for 10 years to develop a casino industry, overcoming differences between political parties and opposition from the Catholic church. Casinos will be regulated by the Tinian Casino Gaming Control Commission (TCGCC), created in 1990.

The first casino to open was the Lone Star, which operated in a converted small office building from May through December 1995. The Lone Star's license was revoked in 1996. Two licenses have been awarded to Hong Kong companies (currently fully financed) and one has been awarded to a Taiwan-Saipan company which has not yet paid the full licensing fee. A memorandum of understanding has been signed for a luxury casino ship to be berthed in the harbor area. In

[88]CNMI Department of Commerce and Labor (1993) *1993 Commonwealth of the Northern Mariana Islands Statistical Yearbook.*

addition, the governor has announced a floating casino/hotel, but no license application or fee has been filed.

The first resort, the Dynasty Casino and Hotel, is currently under construction in San Jose, in the area between Taga and Tachogna Beaches. The casino resort will include a hotel with over 400 rooms, a casino, entertainment theater, night club, restaurants, and fitness center, as well as an employee village for an estimated 800 employees. The casino is scheduled to open in April 1997. The governor has pledged funding for public infrastructure to support the casino resort, but not all infrastructure requirements are currently available (e.g., wastewater disposal).

The Commonwealth Ports Authority has planned expansion of the West Tinian Airport, to be completed before the first casino opens. The expanded airport would have a 2,438-meter (8,000-foot) runway to accommodate 747 wide-body aircraft. An estimated 515,520 passengers per year are projected to travel to Tinian once a 400-room hotel/casino is in operation (see Appendix P).

4.7.2 Proposed Activities and Potential Impacts

Both positive and adverse impacts on Tinian's economy are expected to result from the proposed action. Known impacts of the ongoing training activities include positive impacts, such as training planners visiting the island in advance of and during exercises, filling every hotel room, and patronizing local restaurants, hotels, and rental car agencies. Known adverse impacts of ongoing activities are inconvenience to local authorities due to poor communication (see Appendix P), temporary loss of use of the municipal gym (Field House) during Tandem Thrust exercises, late payment to local contractors, and lost revenue from closure of the EMUA.

Temporary restriction of public access to the EMUA has the potential to affect tourism in several ways. First, revenue may be lost to airlines, rental car companies, and tour guides on days when the EMUA is closed. Second, Tinian's reputation as a tourist attraction may suffer if many Asian tourists or tour companies have trips (scheduled months ahead) canceled with only one or two days' notice. Interviews with local businesses indicate the second impact is of greater concern.

Evaluation Criteria. Impacts were evaluated for significance according to criteria presented in Table 4-7. These criteria essentially identify notification periods required in order to keep socioeconomic impacts from being significant.

Proposed firing range and shooting house in EMUA. For the Augmented and Mitigated Alternatives, the only newly proposed training activity likely to adversely affect the local economy is reconfiguration of the firing range and addition of a mortar range, which might result in additional restrictions on public access to the EMUA. Civilian access to all or portions of the EMUA would necessarily be denied during range use, possibly increasing the number of days per year on which public access will be denied to EMUA tourist destinations. Use of the proposed shooting house for urban training is not expected to increase the number of days on which the EMUA would be closed to the public. Shooting houses have very localized SDZs (approximately 50 m) and would not require general closure of the EMUA.

Table 4-7
Evaluation Criteria for Potential Socioeconomic Impacts on Tinian

Resource	Activity	Significant if
Tourism revenues	Access to EMUA	EMUA closed with less than 7 days prior notice OR EMUA closed for more than 10 percent of each year (36 days) OR EMUA closed for more than 5 days sequentially without one month's prior notice
	Military aircraft landing and parking at West Tinian Airport	Requires cancellation of civilian flights
Local authorities (Tinian Mayor's Office, Commonwealth Port Authority, Emergency Management Office [Saipan], FAA [Saipan])	Agency oversight and coordination	Notice not provided 7 days prior to exercise

Proposed AAV landings at Unai Babui. The proposed AAV landings (in both the Augmented and Mitigated Alternatives) are not expected to impact the local economy. AAVs will be transported on military ships and will land and remain in the EMUA. They will not pose hazards to navigation and do not require closure of the EMUA. No mitigation is required.

Construction of base support camp in EMUA. The proposed base support camp is not expected to adversely impact the local economy or government resources. Proposed construction projects have the potential to positively impact the local economy on a short-term basis, as construction workers or commercial transportation firms may be hired to assist with these projects. In addition, outside contractors would patronize local hotels and restaurants. No mitigation is required.

Cumulative Impacts With Casino Development. There is a potential for military exercises to interfere with air and water traffic associated with the casinos. Military barges and landing craft periodically load and offload equipment and materiel in Tinian Harbor. Depending upon the location of any casino ships which may be permanently anchored in the harbor, some interference with civilian navigation may result when military craft are docked or entering/leaving the harbor. Similarly, the entry of numerous fixed- and rotary-wing military aircraft and use of the DZ east of West Tinian Airport for a Tandem Thrust exercise has the potential to interfere with the more intense civilian air traffic which would result from a successful casino industry.

4.7.3 Proposed Mitigation

The primary mitigation for impacts on tourism and on local authorities is to maintain good communication with local authorities, specifically the Commonwealth Ports Authority, the Marianas Visitors Bureau (Tinian Field Office), the West Tinian Airport Manager, and the Mayor's Office. These officials will be notified of any planned closure of the EMUA and of any military use

of the airport and/or harbor 30 days in advance of such activities. Units planning aviation exercises, aviation support, or use of the proposed firing range on Tinian will notify the FAA one week in advance, to allow publication of NOTMARs and NOTAMs 72 hours in advance of the activities.

To minimize impacts on tourists, exercises will be scheduled to avoid the following annual tourist-intense events, to the extent possible:

Cliff Fishing Derby	3rd weekend in February
San Jose Fiesta	1st weekend in May
San Isidro Fiesta	4th weekend in May
Agri-Food Fair	1st weekend in June
MVB 10K Fun Run	4th Saturday in September

The EMUA will not be closed for a total of more than 36 days of any calendar year. In addition, exercise planners will attempt to limit EMUA closures or will arrange for partial access during exercises (this has been accomplished successfully in past Tandem Thrust exercises). If a casino ship is permitted for construction and anchoring in Tinian Harbor, COMNAVMARIANAS will initiate discussions with the Mayor's Office to coordinate military use of the harbor so as not to interfere with related civilian navigation.

To avoid late payments to local contractors, each exercise utilizing local contractors will have a designated finance officer to whom reimbursement billings may be submitted. COMNAVMARIANAS will provide the Mayor's Office with documentation on reimbursement procedures.

4.8 SUMMARY OF IMPACTS

A variety of potentially significant and non-significant impacts were identified in association with the proposed action and all alternatives. The significant issues were analyzed in detail (see preceding sections) and are summarized in section 4.8.1 below. Non-significant issues were also analyzed, although the analysis is not presented in detail in this text. Potential non-significant impacts were identified and mitigations have been proposed. Table 4-8 includes all potential impacts of the proposed action for which mitigative measures and parties responsible for implementing mitigations have been identified.

4.8.1 Summary of Significant Issues

Analysis of potentially significant issues presented in this chapter has led to the following conclusions:

Impacts on Biological Resources. The Augmented Alternative has the potential to significantly impact endangered Mariana crows, Mariana fruit bats, and Micronesian megapodes, as well as large areas of coral in Apra Harbor and at Unai Babui. Under the Mitigated Alternative, the following impacts may occur:

- damage a maximum of 24 m^3 coral at Unai Babui
- temporarily disturb endangered Mariana crows during nonbreeding season at AAFB and Rota
- disturb fruit bats during night foraging at AAFB
- disturb sea turtles in Apra Harbor

- disturb or take Micronesian megapodes on FDM

The potential for BTS export from Guam will be strictly controlled by adherence to the *BTS Control/Interdiction Plan.*

Impacts on Archaeological and Historic Resources: The Augmented Alternative would allow offroad vehicles and ground-disturbing activities in areas of the EMUA (Tinian) and the Ordnance Annex (Guam) with many potentially significant archaeological and historic resources. This is expected to result in damage or destruction of some resources.

The Mitigated Alternative is not expected to have adverse impacts on known cultural resources and is unlikely to impact as-yet-unidentified resources.

Wastewater Disposal on Tinian: Analysis indicates that only the "no action" alternative has the potential to adversely affect existing municipal wastewater systems.

Disposal of Solid and Hazardous Waste Generated on Tinian: Analysis indicates that no significant impacts are expected under any alternative. Solid and hazardous waste generated during exercises on Tinian will continue to be removed to Guam and the continental U.S. for appropriate disposal; the expected volumes are too small to significantly affect landfill service life.

Impacts of Aviation Training on Public Safety: Potential exposure of the public to aviation hazards is possible at the Orote Point airstrip (Waterfront Annex, Guam) and at North Field (Tinian). No impacts are expected under any alternative, due to routine compliance with FAA and military airfield regulations and orders.

Impacts of Firing Ranges on Public Safety: Under all alternatives, potential impacts to public safety will occur in nearshore ocean areas within range SDZs, which will be mitigated by use of warning notices and signs, and posted range guards and observers during firing. On Tinian, there is a potential for injury to persons entering the existing UXO contaminated area and a new 60 mm mortar impact area. Although these areas can be swept for UXO and fenced, the potential hazard cannot be completely eliminated.

Under the both action alternatives, there is some potential for civilians on the Mount Jumullong Manglo ridgeline to be exposed to range fire in the safety fan for the proposed new sniper range.

Socioeconomic Impacts on Tinian: Analysis indicates that the primary potential impact of all alternatives is the impact on tourism of temporarily closing the EMUA during exercises. In addition, there is a potential for cumulative impacts on civilian air and water traffic if the new casino industry greatly increases the number of tourists traveling to Tinian.

4.8.2 Cumulative Impacts

The No Action Alternative—i.e., continuation of ongoing training—has the potential to generate a variety of cumulative impacts. Those identified as potentially significant are discussed in detail in Sections 4.1 through 4.7 of this chapter. Many of the potential impacts on endangered species (Section 4.1), cultural resources (Section 4.2), and public safety (Sections 4.5 and 4.6) are cumulative in nature. Some of these cumulative impacts consist of an increased likelihood of a certain effect occurring, due to the repetition of various training activities. For example, repeated

travel by tracked vehicles over a certain ground area is likely to increase the probability of damage to cultural resources in the soil, if such an activity is not mitigated. Other cumulative impacts consist of a changed effect due to repetition of a particular training activity. An example is repetition of certain aircraft exercises in areas populated by endangered bird species. A single such event might cause a bird to temporarily leave its nest but would have no permanent effect, whereas repeated events might cause the bird to abandon its nest site altogether, possibly resulting in failure to brood and raise young.

Cumulative impacts on infrastructure (waste disposal facilities) result from the simple accumulation of more waste over time. For example, repetition of large joint-service training exercises on Tinian will generate additional solid waste every other year, adding a periodically increasing volume of solid waste to the PWC landfill on Guam.

Cumulative impacts identified as significant as well as non-significant are included in Table 4-8, together with proposed mitigation.

4.8.3 Unavoidable Adverse Impacts and Unresolved Issues

There are no unavoidable adverse impacts or unresolved issues associated with the Mitigative Alternative, which is the preferred alternative, other than UXO contamination in specific locations, which cannot be completely cleared.

4.8.4 Relationship of Short-Term Uses and Long-Term Productivity

Use of existing military sites for proposed training activities is not generally expected to detract from long-term productivity, given the precautions in place to prevent contamination of soil or groundwater at any location. No large-scale building is proposed which would pave over potentially arable or otherwise useful undeveloped land. In the event that any of the existing military-controlled land areas were to be declared excess, such areas would not be rendered unable to be productive as a result of the proposed action. In fact, the military need for large undeveloped training areas has tended to result in long-term protection of natural and cultural resources from the effects of commercial development.

The exception is the proposed creation of a mortar range on Tinian. Such a range would result in long-term UXO contamination in a limited area, indefinitely removing that land area from future human use for other purposes.

4.8.5 Irreversible and Irretrievable Commitments of Resources

The proposed action will involve periodic commitment of resources for individual exercises and for the few proposed construction projects.

4.8.6 Environmental Justice

Under Executive Order 12898, dated February 11, 1994, federal agencies are required to address the potential for disproportionately high and adverse environmental effects of their actions on minority and low-income populations. Agencies are required to ensure that their programs and activities that affect human health or the environment do not directly or indirectly use criteria,

methods, or practices that discriminate on the basis of race, color, or national origin. NEPA documents are specifically required to analyze effects of federal actions on minority and low-income populations and, whenever feasible, to develop mitigation measures to address significant and adverse effects on such communities. In addition, the Executive Order requires provision of opportunities for community input in the NEPA process. It states that the public, including minority and low-income communities, should have adequate access to public information relating to human health or environmental planning, regulation, and enforcement.

Anticipated impacts of the proposed actions—training on military-controlled lands in the Marianas—are expected to impact primarily military personnel working and living on the affected bases, with the exception of the civilian population of Tinian. The population of those working and living on military bases is not comprised of any particular minority, since the Navy must comply with U.S. Equal Employment Opportunity Commission regulations designed to implement Public Law 88-352. The population of Tinian will be affected as a whole; no particular minority population will be more or less affected by the proposed action. Therefore, the proposed action is not expected to impose disproportionately high or adverse effects on any minority population. With regard to impacts on low income populations, it is reasonable to assume that the populations of Guam military installations are not "low income" (below the poverty line, as defined by the U.S. government). In general, Navy and Air Force bases provide a source of highly technical jobs, which in turn command better-than-average salaries. The socioeconomic study performed as part of this DEIS determined that the population of Tinian is not economically disadvantaged or low income on the average. Therefore, proposed action is not anticipated to cause adverse impacts to low income populations.

Table 4-8 (continued):

DRAFT ENVIRONMENTAL IMPACT STATEMENT
MILITARY TRAINING IN THE MARIANAS

CHAPTER FOUR
ENVIRONMENTAL CONSEQUENCES

Table 4-8
Comprehensive Table of Significant and Non-Significant Potential Impacts and Mitigations

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Natural Resources			
All natural resources, generally	• Fire damage in training areas	• Restrict use of open fires and aerial pyrotechnics to paved or low fire hazard areas only.	• Unit Commanders
		• Curtail use of fire-causing objects during periods when fire hazard is high.	• Unit Commanders
		• Brief troops on potential for fire and contingency reactions.	• Unit Commanders
		• Have appropriate fire fighting equipment readily available for response to tent camps, firing ranges, landing zones, airfields, and vehicle maintenance and refueling areas.	• Unit Commanders
		• Plan camp layouts with fire lanes; provide fire extinguishers in accordance with regulations.	• Unit Commanders
		• Incorporate fire fighting response drills into area security plan.	• Unit Commanders
	• Depletion of vegetation by clearing for tactical exercises and bivouacs	• Use and maintain established, surveyed DZs and LZs only.	• Unit Commanders
		• Select already cleared areas for administrative camp sites.	• Unit Commanders
		• Cut no vegetation larger than wrist size.	• Unit Commanders
		• Minimize degree of vegetation clearing when preparing fighting positions and firing lanes.	• Unit Commanders

Table 4-8 (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Natural Resources *(continued)*:			
Threatened or endangered species, migratory birds	• Introduction of invasive species to training areas and ports of entry for units training in the Marianas	• Implement the *BTS Control/Interdiction Plan* to inspect equipment and cargo originating from or transiting through Guam.	• COMNAVMARIANAS CO AAFB USDA C7F Unit Commanders
	• Disturbance of endangered species and endangered species habitat by noise or by physical interference from offroad vehicles and vegetation clearing	• Restrict training dates, times, and types of training activity to avoid loud noises or physical disturbance of nests by vehicles, aircraft, or personnel during breeding seasons in designated areas. • Designate areas off limits or "no wildlife disturbance" (primary habitat areas and turtle nesting sites), as necessary. • Direct personnel to avoid collecting or disturbing wildlife for any reason. • Conduct training area (land and water) inspections prior to demolition training, to ensure area is clear of wildlife.	• COMNAVMARIANAS CO AAFB • COMNAVMARIANAS CO AAFB • Unit Commanders • EOD and NSWU Unit Commanders
	• Mortality of fish or sea turtles due to shock wave from underwater demolition	• Follow SOPs requiring "scare charge" prior to demolition.	• EOD and NSWU Unit Commanders
Wetlands	• Potential loss of wetland function	• Restrict training access within wetlands.	• COMNAVMARIANAS
Coral reef and sand beach	• Damage to coral reefs from AAV landings at Unai Babui	• Designate restricted lane of approach, maximum of 15 m wide. • Conduct landings at high tide; remain within designated lane.	• COMNAVMARIANAS • C7F MEU

Table 4-# (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Natural Resources *(continued)*:			
Coral reef and sand beach (continued):	• Damage to coral reef from underwater EOD exercises	• Avoid underwater demolition within 100 m of reef.	• EOD and NSWU Unit Commanders
	• Beach vegetation and sand dispersion caused by landing vehicles, landing craft, and embarked vehicles	• Select routes to minimize vegetation impacts; use beach matting to reduce erosion caused by disembarking vehicles traversing soft sand beaches; restore beach topography upon completion of exercise.	• Unit Commanders
Primary habitat	• Damage to habitat by clearing DZs and LZs	• Use and maintain surveyed DZs only.	• Unit Commanders
	• Blast and fire damage to habitat	• Restrict open fires and demolition or pyrotechnics in areas near primary habitat, to prevent spreading fire.	• COMNAVMARIANAS CO AAFB Unit Commanders
Insects and disease	• Introduction of new/noxious insects or weeds	• Adhere to existing quarantine procedures for cargo and equipment inspections. Inspect for presence of noxious weeds in any construction materials imported for training structures.	• COMNAVMARIANAS CO AAFB Unit Commanders
		• Transport all solid waste from Tinian in containers designed for steam sterilizing, and sterilize according to standard procedures upon arrival on Guam.	• COMNAVMARIANAS

Table 4-8 (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Cultural Resources			
Archaeological features, historic structures, National Historic Landmarks	• Damage or data loss from ground disturbance by offroad vehicles or logistics support activities, excavation of fighting positions or latrines, impacts from weapons fire, rapid runway repair, or vandalism	• Publish information and maps identifying known historic and cultural areas for exercise planning.	• COMNAVMARIANAS CO AAFB CO NAVACTS Guam CO NCTAMS
		• Restrict potentially damaging activities from cultural resources. Designate areas as off limits, administrative transit only, no vehicular traffic, no open fires, or no ground disturbance, as appropriate, to provide sufficient levels of protection.	• COMNAVMARIANAS CO AAFB CO NAVACTS Guam CO NCTAMS
		• Physically mark off limits boundaries (that can be identified both day and night) of areas lacking natural boundaries.	• COMNAVMARIANAS CO AAFB CO NAVACTS Guam CO NCTAMS
		• Monitor training activities for adherence to restrictions.	• COMNAVMARIANAS CO AAFB CO NAVACTS Guam CO NCTAMS
		• Document condition of former Japanese Naval Air Command Post (Tinian) before and after use of proposed temporary bullet traps; cease live fire training if damage to walls occurs.	• COMNAVMARIANAS Unit Commanders
		• Provide education handouts for exercise participants to understand and protect resources prior to training on Tinian or at the Ordnance Annex.	• COMNAVMARIANAS

Table 4-8 (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Cultural Resources *(continued)*:			
Visual resources	• Damage to scenic resources (tourist sites) from demolition or weapons fire	• Avoid demolition and weapons training in proximity to scenic areas.	• COMNAVMARIANAS CO AAFB CO NAVACTS Guam CO NCTAMS Unit Commanders
Environmental Quality			
Air quality	• Increased amounts of training activity-generated smoke and dust	• Do not use smoke or tear gas in areas with civilians present. • Use sanitary waste burn cans in locations downwind of camps and visitor locations.	• COMNAVMARIANAS Unit Commanders • COMNAVMARIANAS Unit Commanders
Climate	• Increased potential for fire within training areas during droughts	• Curtail training as necessary, particularly in areas with rudimentary or non-existent fire-fighting capabilities.	• COMNAVMARIANAS Unit Commanders
Geologic features	• None	• Not applicable.	
Groundwater and soil	• Contamination from improper field sanitation or improper disposal of portable toilet waste • Contamination from accidental release of fuel during vehicle/aircraft refueling, maintenance, or repair activities	• Comply with field sanitation SOP; remove and dispose of solid wastes, grey and black water; ensure contractors dispose of waste appropriately. • Refuel only on paved surfaces or using standard spill containment measures. • Avoid overfilling vehicle fuel tanks to allow for fuel expansion. • Avoid performing scheduled maintenance during field exercises.	• COMNAVMARIANAS Unit Commanders • Unit Commanders • Unit Commanders • Unit Commanders

Table 4-8 (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Environmental Quality *(continued)*:			
Groundwater and soil *(continued)*:	• Soil erosion and rutting from ground excavation, construction activities, grey water disposal to ground, amphibious vehicles traversing beaches, or projectile impacts at firing ranges	• Restore training areas to original grade and revegetate, as necessary, upon completion of training activities.	• COMNAVMARIANAS CO NAVACTS Guam CO AAFB CO NCTAMS
Surface water quality (marine and fresh)	• Potential contamination by fuel and petroleum products	• Comply with SOPs and environmental regulations. • Maintain on-hand spill containment and collection and disposal.	• Unit Commanders • Unit Commanders
	• Siltation of surface water bodies due to increased erosion	• Minimize ground disturbance in areas adjacent to bodies of water.	• Unit Commanders
	• Degradation from runoff of grey water or ROWPU brine	• Direct grey water or ROWPU residual water away from bodies of fresh (and salt) water.	• Unit Commanders
Flooding	• None	• Not applicable.	
Noise	• Disturbances to immediate environment and neighboring communities from fixed- and rotary-wing landings and takeoff	• Establish LZs and conduct flight training where noise nuisance does not extend off of government property or airfield noise zones. • Use established flight tracks.	• COMNAVMARIANAS CO AAFB Aircraft Commanders • Unit Commanders

Table 4-8 (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Environmental Quality *(continued)*:			
Noise *(continued)*:	• Disturbances to Tipalao residents from LCAC landings at Dadi Beach	• Perform landings during daylight hours only.	• CO NAVACTS Guam
Manmade Hazards and Constraints			
Weapons ranges and demolition pits firing	• Safety hazards to civilians or endangered marine animals	• Publish specific range regulations and distribute to all units planning training activities. • Adhere to all safety requirements prior to and during live fire and demolition activities, particularly required range area sweeps/surveillance to ensure no danger to others. • Restrict public access. • Publish NOTAMS and NOTMARS, as necessary.	• COMNAVMARIANAS CO NAVACTS Guam CO AAFB • Unit Commanders CO NCTAMS • COMNAVMARIANAS CO NAVACTS Guam CO AAFB • COMNAVMARIANAS CO NAVACTS Guam CO AAFB
	• Presence of UXO in existing and proposed mortar range impact areas	• Publish UXO procedures prior to exercises. • Fence and post impact areas. • Sweep impact areas. Maintain clear vegetation using approved herbicides.	• COMNAVMARIANAS CO NAVACTS Guam CO NCTAMS CO AAFB • COMNAVMARIANAS • COMNAVMARIANAS

Table 4-8 (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Manmade Hazards and Constraints *(continued)*:			
Weapons ranges and demolition pits firing *(continued)*:	• Public access restriction	• Notify public prior to range use. Prohibit public access to SDZs and approaches to live fire areas. • Fence off Tinian Range Impact areas	• COMNAVMARIANAS CO NAVACTS Guam CO NCTAMS CO AAFB • COMNAVMARIANAS
Commercial aviation facilities and traffic	• Interference with commercial aircraft	• Coordinate with FAA during planning and have direct communication with air traffic control officials during military flights in proximity to commercial airfields. • Issue NOTAM for weapons training and use of Northfield on Tinian and FDM. • Maintain lateral safety clearances from active runways and landing zones; avoid conflicts between training activities and accident potential zones at ends of runways. • Restrict training dates/times to avoid major holidays.	• COMNAVMARIANAS CO NAVACTS Guam CO NCTAMS Unit Commanders ALCE • COMNAVMARIANAS CO NAVACTS Guam CO AAFB • COMNAVMARIANAS CO NAVACTS Guam CO AAFB • COMNAVMARIANAS CO NAVACTS Guam CO AAFB

Table 4-8 (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Manmade Hazards and Constraints *(continued)*:			
Aviation hazards	• Disturbance of endangered species and habitat	• Avoid sanctuary overflights. • Restrict flight tracks/hours, as needed.	• Aircraft Commander • Unit Commander
	• Risk of fire due to mishap	• Have crash, fire, rescue equipment readily available.	• Unit Commander
	• Spills during refueling/mechanical repair	• Have spill response kits on hand. • Perform tasks on hard surfaced areas.	• Unit Commander • Unit Commander
Electromagnetic radiation (EMR)	• EMR hazards to personnel, fuel operations, and ordnance (HERP, HERF, HERO)	• Adhere to operational SOPs • Provide EMR hazard overlays to training units as necessary	• Unit Commander • COMNAVMARIANAS CO NAVACTS Guam CO AAFB
	• EM interference (EMI)	• Establish physical barriers and markers to maintain mandatory safety clearances between emitter sites and personnel, fueling, and ordnance operations.	• Unit Commanders
Hazardous materials storage	• Potential for spills and area contamination	• Establish and comply with spill prevention and response plan.	• COMNAVMARIANAS Unit Commanders
Infrastructure			
Potable water supply	• Depletion of local water supply (Tinian only)	• Conduct advance planning with municipality to identify requirement, times, and places for issue.	• COMNAVMARIANAS

Table 4-8 (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Infrastructure *(continued)*:			
Waste collection and disposal (stormwater, wastewater, solid, and hazardous waste)	• Depletion of capacity of the local landfills	• Haul trash to DoD facility for proper disposal.	• COMNAVMARIANAS C7F
	• Disposing of ships' waste near-shore	• Adhere to COMNAVMARIANAS/ C7F directives.	• Ships' Captains
	• Lack of hazardous waste disposal facility (Tinian)	• Haul waste to DoD facility on continental U.S. for proper disposal.	• COMNAVMARIANAS Unit Commanders
Floodwater storage	• None	• Not applicable.	
Electricity and communications	• Increased demand for electricity (Tinian)	• Communicate and coordinate with appropriate local agencies. • Supplement commercial power with field generators.	• COMNAVMARIANAS • Unit Commanders
Airports	• Increased volume of air traffic	• Communicate/coordinate with FAA and civil authorities in advance of any exercise. • Issue NOTAMS and NOTMARS 72 hours prior to any exercise. • Plan Tinian military helicopter activity outside of commercial flight tracks and Saipan approach and departure altitudes. • Reduce parking ramp tieups by military aircraft.	• COMNAVMARIANAS CO AAFB • COMNAVMARIANAS CO AAFB • Unit Commanders • Unit Commanders ALCE
	• Increased demands on Customs and Immigration	• Identify time frames and locations for Customs and Immigration support in advance of the exercise.	• Unit Commanders COMNAVMARIANAS CO AAFB

Table 4-8 (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Infrastructure *(continued)*:			
Harbors	• Interference with civilian ports of entry	• Schedule shipments in advance. Coordinate with civilian authorities in advance of any exercise. • Minimize time necessary to be alongside in port.	• COMNAVMARIANAS C7F CO NAVACTS Guam • Ship's Captain
	• Increased demands on Customs and Immigration	• Provide advance notice.	• COMNAVMARIANAS C7F CO NAVACTS Guam
Roadways and traffic	• Road damage by tracked vehicles	• Limit to rubber padded track laying vehicles. • Inspect tracked vehicles for serviceable track pads. • Avoid neutral steer/pivot turns. • Use equipment haulers for tracked vehicles with all-steel tracks.	• Unit Commanders • Vehicle Commanders • Vehicle Commanders • Unit Commanders
	• Interference with civilian traffic	• Establish military traffic control and security within training areas accessible to others. • Notify civilian authorities 7 days in advance of troop transport on public roads.	• Unit Commanders • COMNAVMARIANAS CO AAFB CG National Guard
Public services	• Increased demands on public safety departments (Tinian)	• Coordinate with the local fire and police departments; augment civilian forces as appropriate.	• COMNAVMARIANAS Unit Commanders

Table 4-8 (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Social Environment			
Land use	• Interference with/encroachment on neighboring land use/property	• Monitor activity within training area to identify potential encroachments.	• Unit commanders
	• Safety risks to neighboring areas and inhabitants from use of firing ranges and established EOD sites on land, in and near Apra Harbor	• Establish buffer zones, traffic control, and area monitors/umpires, as necessary, to avoid encroachment.	• COMNAVMARIANAS NAVACTS Guam CO AAFB CG National Guard Unit Commanders
	• Conflicts with civilian activities	• Schedule/coordinate potentially conflicting activities with appropriate local agencies. Publish NOTAM and NOTMAR.	• COMNAVMARIANAS NAVACTS Guam CO AAFB CG National Guard
	• Noise disturbance for aircraft near residential areas	• Schedule/coordinate potentially conflicting activities with appropriate local agencies. Publish NOTAM and NOTMAR.	• COMNAVMARIANAS NAVACTS Guam CO AAFB CG National Guard
	• Danger to civilians from training on non-DoD lands	• Obtain permission from property owner prior to exercise.	• COMNAVMARIANAS NAVACTS Guam CO AAFB CG National Guard
	• Disfigurement of publicly accessible land areas by littering or effects of bivouacs and logistics support activities (Tinian, Rota)	• Clean and inspect all training areas. Do not bury paper trash or other training residue.	• COMNAVMARIANAS NAVACTS Guam CO AAFB CG National Guard

Table 4-8 (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Social Environment *(continued)*:			
Land use	• Economic impact from commercial watercraft periodically denied access to areas of Apra Harbor or ocean areas within range SDZs during underwater demolition or use of firing ranges.	• Publish advance notification; observe impact areas during live fire training.	• COMNAVMARIANAS CO NAVACTS Guam CO AAFB CG National Guard • Unit Commanders
	• Danger to civilians inadvertently entering ranges and runways	• Establish traffic control points and observation stations to observe road, air and sea traffic in the vicinity of range training and flight activities.	• Unit Commanders
Socioeconomic conditions	• Increase in demand on various commodities	• Give notice to local officials and merchants so they can prepare for increase in demand and avoid shortages.	• COMNAVMARIANAS CO AAFB
		• Contract locally for required services.	• COMNAVMARIANAS CO AAFB
	• Closure of areas to local residents and tourists	• Give 30 days advance notice before curtailing access to tourist sites within training areas.	• COMNAVMARIANAS
		• Establish an access corridor to accommodate civilian visitors, when possible.	• Unit Commanders
Local government and agencies	• Inconvenience regarding joint use of civilian facilities (West Tinian Airport, field house)	• Notify Mayor's office at least 30 days prior to exercises.	• COMNAVMARIANAS CO AAFB

Table 4-8 (continued):

Resource	Possible Impact	Proposed Mitigation	Responsible Parties
Environmental justice	• Disappropriate hardship on local minority or economically disadvantaged population	• Design training activities to eliminate conflict, promote mutual understanding, and enhance local economy.	• COMNAVMARIANAS CO NAVACTS Guam CO AAFB

Note: ALCE = Airlift control element
C7F = Commander, 7th Fleet
CG = Commanding General
CO = Commanding Officer
EOD = Explosive Ordnance Disposal unit
NSWU = Naval Sea Warfare Unit (SEALs)
USDA = U.S. Department of Agriculture

CHAPTER FIVE
LIST OF PREPARERS

This Draft Environmental Impact Statement was prepared for the Department of the Navy, Commander, Naval Forces Marianas by Belt Collins (Hawaii) Ltd. The following were involved in preparation of this document:

Preparer	Education	Contribution
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Amy Yamakawa; Graphic Designer	BFA in Graphic Design	Prepared maps and other figures.

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_____ (March 1992) *Preliminary Report Cultural Resources Management Overview Survey Naval Station, Mariana Islands, Territory of Guam*. Prepared for the Department of the Navy, Pacific Division, Naval Facilities Engineering Command.

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Personal communication with Bob Beck, Guam DAWR, May 16, 1996.

Personal communication with Rick Boice, Ernst & Young, May 29, 1996.

Personal communication with Gil Borja, CNMI Department of Public Safety, May 21, 1996.

Personal communication with Mel Borja, Guam EPA, August 1996.

Personal communication with Edna Buchan, CNMI DEQ, March 5, 1996.

Personal communication with Jennings Bunn, NAVACTS Guam Ordnance Annex, September 17, 1996.

Personal communication with Willis Cannon, Saipan FAA, May 16, 1996.

Personal communication with Gerry Davis, Guam DAWR, January 8, 1997.

Personal communication Steve Dollar, Marine Research Consultants, December 12, 1996.

Personal communication with EOD Detachment Guam, October 30, 1996, using unclassified information.

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Personal communication with Calistro Falig, CNMI Fish and Wildlife, June 1994.

Personal communication with Historic Preservation Office Personnel, February 8, 1996.

Personal communication with Henry King, CNMI Fish and Wildlife, August 1996.

Personal communication with Michael Lusk, USFWS, December 9, 1996.

Personal communication with Michael Miyahara, GMP Associates, Inc., May 9, 1996.

Personal communication with J.M. Morton, Ph.D., USFWS, December 24, 1996.

Personal communication with Lesley Morton, NAVACTS Guam Ordnance Annex, September 17, 1996.

Personal communication with Michael Muña, Saipan FAA, August 8, 1996.

Personal communication with Fred Newmark, J & J Chemical Company, May 1996.

Personal communication with Thao N. Nguyen, Darby & Associates, August 22, 1996.

Personal communication with Arnold Palacios, CNMI Fish and Wildlife Service, September 2, 1992.

Personal communication with Mike Ritter, Guam Fish and Wildlife Service, August 22, 1996.

Personal communication with Lt. Commander Scott , Guam HC-5 Unit, August 8, 1996.

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U.S. Department of the Navy, Pacific Division, Naval Facilities Engineering Command (July 1995) *Marianas Training Plan for DoD Facilities and Activities.*

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Whistler, Art (December 1996) *Botanical Survey of Farallon de Medinilla, CNMI.* Prepared for Belt Collins Hawaii.

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Appendix A

A-1—Notice of Intent;
A-2—Distribution List for Notice of Intent;
A-3—Announcement of Scoping Meetings;
A-4—Scoping Meeting Attendance Records;
A-5—Scoping Meeting Group Memory;
A-6—Written Scoping Comments;
A-7—Distribution List for DEIS

Appendix A-1

Notice of Intent

ervice Corps, what can the Corporation do to further the mission, vision, and goals that engage Americans of all ages and backgrounds in community-based ice?

2. Price of national service—How can we deliver national service in a way that costs less but that is as, or more, effective? For instance, for AmeriCorps programs, think in light of common aspects such as direct service, living allowance and benefits, education award, diversity, community-driven partnerships, non-federal match, and national identity.

3. Increasing the non-federal share of the budget—What functions and activities might be the most attractive to outside funders? What kinds of incentives might be necessary? What is a realistic time table for increasing the percentage of funds from the private and independent sectors?

4. Corporation structure—What is an effective and efficient field structure? What are the appropriate roles for state commissions and the Corporation, including the state offices?

5. Politicization—How can we guard against the politicization of national service? Are there any aspects of current Corporation programs and practices that create a perception of politicization?

6. Partnership relations—What products, assistance, information do you need from the Corporation? What services would make the partnerships more effective?

In order to contribute in a timely manner to the discussions concerning the reauthorization of the Corporation and its programs, the Corporation invites public commentary on any aspect of the Corporation for National Service, its policies, and its programs, including the issues presented above. Specific statutory references are preferred, but are not necessary to the submission of comments. All comments will be considered but the Corporation will not be able to reply individually to each submitter.

Dated: November 22, 1995.

Terry Russell,

General Counsel, Corporation for National and Community Service.

[FR Doc. 95–29045 Filed 11–27–95; 8:45 am]

BILLING CODE 6050–28–P

DEPARTMENT OF DEFENSE

Office of the Secretary

Notice of Intent To Prepare an Environmental Impact Statement for Proposed Military Training in the Territory of Guam and Islands of Rota, Tinian, and Farallon de Medinilla, Commonwealth of the Northern Mariana Islands

AGENCY: U.S. Pacific Command, DOD.

ACTION: Notice of intent.

SUMMARY: Pursuant to section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality regulations (40 CFR parts 1500–1508), the U.S. Pacific Command announces its intent to prepare an Environmental Impact Statement (EIS) for proposed military training in the Territory of Guam on the Islands of Rota, Tinian, and Farallon de Medinilla, Commonwealth of the Northern Mariana Islands (CNMI).

The actions to be covered in the EIS consist of training activities required to maintain military combat readiness. The EIS will analyze reasonable alternatives to meet this objective and assess their separate and cumulative environmental impacts. The U.S. Pacific Command will initiate a scoping process to identify significant related issues for study in the EIS and to identify and notify parties interested in and affected by the EIS.

The meetings will open with a short presentation of the purpose of the proposed action and alternatives to be evaluated, followed by a period for public comment. It is important that interested agencies, individuals, and organizations take this opportunity to identify environmental concerns that should be addressed in the EIS. To allow time for all views to be shared, each speaker will be limited to five minutes for oral comments.

Interested parties are also invited and encouraged to provide written comments in addition to, or in lieu of, oral comments at the public meetings. Scoping comments should clearly describe specific issues or topics that the EIS should address.

DATES: Three public scoping meetings will be held.

Guam: December 4, 1995, 7–10 pm.
Rota: December 6, 1995, 7–10 pm.
Tinian: December 7, 1995, 7–10 pm.

ADDRESSES: The scoping meetings will be held in the following locations:

Agaña, Guam: Governor's Cabinet Room, Adelup Complex.
Sinj Song Village, Rota, CNMI: The Round House.
San Jose, Tinian, CNMI: Tinian School Cafeteria.

FOR FURTHER INFORMATION CONTACT: Written statements and/or questions regarding the scoping process should be mailed no later than December 22, 1995 to Mr. Fred Minato (Code 238), Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, HI 96860–7300; telephone (808) 471–9338; fax (808) 474–4890.

SUPPLEMENTARY INFORMATION: The proposed action consists of future military training activities in Guam and CNMI within existing military installations, public lands, and waters, including large-scale joint military exercises. Training will involve organizations from the U.S. Army, U.S. Marine Corps, U.S. Navy, U.S. Air Force, U.S. Army Reserve, Guam Army National Guard, and allied nations. Federal and Guamanian law enforcement agencies also train on these lands. The proposed training will take place on Tinian, primarily in the Military Lease Area, on Rota, primarily at Sand Island and the public airport, and on Guam, primarily at Andersen Air Force Base, Naval Activities Guam Ordnance Annex, and Apra Harbor. The proposed action also includes continued use of the island of Farallon de Medinilla for naval gunfire training and aerial bombardment.

Proposed training activities include tactical maneuver on foot and by wheeled and tracked vehicles, beach landings with boats, air-cushioned landing craft, and tracked amphibian vehicles, paradrops, fixed- and rotary-wing aircraft operations, underwater explosive ordnance training, military weapons and munitions training, and various logistical support activities.

Alternatives consist of: (1) The no action alternative, (2) the limited training activities alternative, (3) the proposed training activities alternative, and (4) alternate training locations. The "no action" alternative consists of continuing present training activities under present conditions, with no adjustment to planned future military needs. The "limited training activities" alternative consists of a sub-set of proposed training activities, based on constraints including the limitation of certain activities to avoid significant impacts to the environment. The "proposed training activities" alternative consists of implementing all proposed activities at the designated training locations. The use of alternate training locations is not applicable to this project.

Environmental issues to be addressed will include, but not be limited to, effects on cultural resources, terrestrial and aquatic habitats, threatened or endangered species, water quality, infrastructure, traffic, noise, and socioeconomic environment. Direct, indirect, and cumulative impacts will be analyzed, and mitigation measures will be developed as required.

Dated: November 22, 1995.

L.M. Bynum,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

[FR Doc. 95–29003 Filed 11–27–95; 8:45 am]

BILLING CODE 5000–04–M

Department of the Air Force

Privacy Act of 1974; Amend and Delete Systems of Records.

AGENCY: Department of the Air Force, DOD.

ACTION: Amend and delete systems of records.

SUMMARY: The Department of the Air Force proposes to delete one and amend two systems of records notices in its inventory of systems of records notices subject to the Privacy Act of 1974 (5 U.S.C. 552a), as amended.

DATES: The deletion is effective November 28, 1995. The amendments will be effective on December 28, 1995, unless comments are received that would result in a contrary determination.

ADDRESSES: Send comments to the Assistant Air Force Access Programs Officer, SAF/AAIQ, 1610 Air Force Pentagon, Washington, DC 20330–1610.

FOR FURTHER INFORMATION CONTACT: Mr. Jim Gibson at (703) 697–3491 or DSN 227–3491.

SUPPLEMENTARY INFORMATION: The complete inventory of Department of the Air Force system of records notices subject to the Privacy Act of 1974 (5 U.S.C. 552a), as amended, have been published in the Federal Register and are available from the address above.

The deletion and amendments are not within the purview of subsection (r) of the Privacy Act (5 U.S.C. 552a), as amended, which requires the submission of an altered system report. The specific changes to the systems of records notices are set forth below followed by the systems notices, as amended, published in their entirety.

Dated: November 14, 1995.

Patricia L. Toppings,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

DELETION

F168 ACC A

SYSTEM NAME:

Physician Retention Program *(March 11, 1993, 58 FR 13460).*

Reason: System is no longer needed and was discontinued in 1993. There are no plans to reinstate this system in the future. Records maintained in the system have been destroyed.

* * * * *

AMENDMENT

F050 ACC B

SYSTEM NAME:

Instructional Systems Development (ISD) Evaluation *(March 11, 1993, 58 FR 13454).*

CHANGES:

SYSTEM NAME:

Delete entry and replace with 'Operations Training Development Evaluation'.

SYSTEM LOCATION:

Delete entry and replace with 'Detachment 13, Air Combat Command Training Support Squadron, 41 Orville Wright Avenue, Suite 001, Barksdale Air Force Base, LA 7110–3000.'

CATEGORIES OF INDIVIDUALS COVERED BY THE SYSTEM:

Delete entry and replace with 'Air Combat Command aircrew members, pilots, copilots, navigators, radar navigators, electronic warfare officers, who are attending, or have attended a course of instruction conducted by the 11 Bomb Squadron, Barksdale Air Force Base, LA 7110–3000.'

CATEGORIES OF RECORDS IN THE SYSTEM:

Delete entry and replace with 'Computerized information file compiled from questionnaires about training accomplished while attending a course of instruction; to include the responder's name, Social Security Number, base of assignment and subjective assessment of the training received.'

AUTHORITY FOR MAINTENANCE OF THE SYSTEM:

Delete entry and replace with '10 U.S.C. 8013, Secretary of the Air Force: powers and duties; delegation by; Air Force Manual 36–92234, Instructional Systems Development; Air Combat Command Instruction 36–92350, Operations Training Development Program, and E.O. 9397.'

* * * * *

SYSTEM MANAGER(S) AND ADDRESS:

Delete entry and replace with 'Education Training Officer, Detachment 13, Air Combat Command Training Support Squadron, 41 Orville Wright Avenue, Suite 001, Barksdale Air Force Base, LA 7110–3000.'

NOTIFICATION PROCEDURE:

Delete entry and replace with 'Individuals seeking to determine whether this system of records contains information on themselves should address inquiries to the Education Training Officer, Detachment 13, Air Combat Command Training Support Squadron, 41 Orville Wright Avenue, Suite 001, Barksdale Air Force Base, LA 7110–3000.

Requests to determine existence of record should include full name, and grade, Social Security Number and approximate dates individual attended a course of instruction.'

RECORD ACCESS PROCEDURES:

Delete entry and replace with 'Individuals seeking to access records about themselves contained in this system should address requests to the Education Training Officer, Detachment 13, Air Combat Command Training Support Squadron, 41 Orville Wright Avenue, Suite 001, Barksdale Air Force Base, LA 7110–3000.

Requests should include full name, and grade, Social Security Number and approximate dates individual attended a course of instruction.'

* * * * *

F050 ACC B

SYSTEM NAME:

Operations Training Development Evaluation.

SYSTEM LOCATION:

Detachment 13, Air Combat Command Training Support Squadron, 41 Orville Wright Avenue, Suite 001, Barksdale Air Force Base, LA 7110–3000.

CATEGORIES OF INDIVIDUALS COVERED BY THE SYSTEM:

Air Combat Command aircrew members, pilots, copilots, navigators, radar navigators, electronic warfare officers, who are attending, or have attended a course of instruction conducted by the 11 Bomb Squadron Barksdale Air Force Base, LA 7110–3000.

Appendix A-2

Distribution List for Notice of Intent

MILITARY TRAINING IN THE MARIANAS EIS
DISTRIBUTION LIST FOR THE NOTICE OF INTENT

Attn: G-3t
Commanding General
III Marine Expeditionary Force FMF
Unit 35601
FPO AP 96606-5601

Attn: S-3
Commanding Officer
31st Marine Expeditionary Unit FMF
Unit 35821
FPO AP 96606-5621

Attn: N45
Commander
Naval Forces Marianas
FPO AP 96536-0051

Commanding Officer
U. S. Naval Station Guam
PSC 456 Box 152
FPO AP96540-1000

Commanding Officer
Explosive Ordnance Disposal Mobile Unit Five
Unit NR 25499
FPO AP96601-4591

Commanding Officer
Navy Special Warfare Unit One
PSC 455 Box 182
FPO AP96540-1182

Commanding Officer
U.S. Naval Mobile Construction Battalion 40
Unit 25306
FPO AP96601-4981

Commanding Officer
U.S. Naval Computer and Telecommunications
Area Master Station
WESTPAC
PSC 488 Box 101
FPO AP96540-5039

Attn: CES/CEX/SG/OSS
Commanding Officer
36th Air Base Wing PACAF
Unit 14003
APO AP 96543-4003

Attn: LGTX-CME
Commanding Officer
374th Trans
Unit 5120
APO AP 96328-5120

Attn: DOT/CEV
Commanding General
Headquarters Pacific Air Force
Hickam Air Force Base, Hawaii 96853-5001

Attn: APIX-EN
Commanding General
IX Corps (RINF) 9th Army Reserve Command
2058 Maluhia Road Fort DeRussy
Honolulu, Hawaii 96815-1997

Lt. Commander James Loeffler
CINCPACFLT Code N328
250 Makalapa Drive
Pearl Harbor, Hawaii 96860-7000

Commanding Officer
Headquarters 1st Battalion 24th Infantry (Light)
Guam Army National Guard
622 East Harmon Industrial Park Road
Fort Juan Muña, Tamuning, Guam 96911-4421

Attn: GU-ARO-T
Commander
Guam Territorial Area Command
Guam Army National Guard
622 East Harmon Industrial Park Road
Fort Juan Muña, Tamuning, Guam 96911-4421

Commanding General
Headquarters U.S. Army Pacific
APOP-TR
Fort Shafter, Hawaii 96858-5100

Mr. Robert Andersen and Mr. Robert Beck
Division of Aquatic and Wildlife Resources
Deparment of Agriculture
Government of Guam
P.O. Box 2950
Agana, Guam 96910

Guam EPA
D-107 Harmon Plaza
130 Rojas Street
Harmon, Guam 96911

USEPA
Region IX
75 Hawthorne Street
San Francisco, CA 94105-3901

Attn: Brooks Harper
U.S. Department of the Interior
Fish and Wildlife Service
300 Ala Moana Boulevard, Room 6307
P.O. Box 50167
Honolulu, Hawaii 96850

Division of Fish and Wildlife
Deparment of Natural Resources
CNMI Government
Saipan, MP 96950

Attn: Dennis Geiser
CNMI
Division of Environmental Quality
P.O. Box 1304
Saipan, MP 96950

Director Elizabeth Sala-Balajadia
Government of the Northern Mariana Islands
Officer of the Director
Department of Public Works
Lower Base
Saipan, MP 96950

Officer of the Lieutenant Governor
Commonwealth of the Northern Mariana
Islands
Capitol Hill
Saipan, MP 96950

George Baldwin
Coastal Resources Management
CNMI
Morgen Building 2nd Floor
San Jose Village
Saipan, MP 96950

CWO-2 Dave Koegel
NSWU-1 PSC 455
FPO AP96540-1182

R 30215
Commanding Officer
EODMU-5
Unit NR 25491
FPO AP96601-4591

Lt. Chris Fassero
NCTAMS
PSC 488
Box 107
FPO AP96537-1805

Richard K. Boice
Ernst & Young
Orlean Pacific Plaza , Suite B 201
865 South Marine Drive
Tamuning, Guam 96911

Mark O. Rudo
Archaeologist
National Park Service: Western Region
600 Harrison Street, Suite 600
San Francisco, CA 94107-1372

Carmen Sanchez
Tinian Historic Preservation
Office of the Mayor of Tinian & Aguigan
San Jose Tinian, MP 96952

Edwin M. Hofschneider
Tinian Coastal Resources Management
P.O. Box 108
San Jose Tinian, MP 96952

Attn: Deborah Clark
Department of Land & Natural Resources
Division of Public Land
San Jose Village Tinian, MP 96952

Attn: Heidi Hirsh
Andersen AFB
36 CES/CEV
Unit 14007
APO AP 96543-4007

Attn: Timothy Villagomez
CNMI Commonwealth Utility Commission (CUC)
P.O. Box 1220 Lower Base
Saipan, MP 96950

Department Head
CNMI Deparment of Fish & Wildlife
Lower Base
Saipan, MP 96950

Ike Cabrera, Acting Chief
CNMI Division of Environmental Quality
P.O. Box 1304 (Morgan Building) 3rd Floor
Saipan, MP 96950

Attn: Scott Russell
CNMI Division of Historic Preservation
Department of Community & Cultural Affairs
Office of The Governor
Saipan, MP 96950

Attn: Elizabeth (Liz) Salas-Balajadia PE
CNMI DPW
Government of The Northern Mariana Islands
Office of The Director Dpw
Lower Base Saipan, MP 96950

Attn: Ron Barrineau
CNMI Council for the Humanities
AAA 3394 Box 10001
Saipan, MP 96950

Ben Sablan
Director
CNMI Department of Natural Resources
Lower Base Saipan, MP 96950

Attn: Connie Fleming-Power
Office of the Mayor
Women's Affairs Office
P.O. Box 59
Tinian, MP 96952

Attn: R. Jeffery Schorr
U.S. Department of the Interior
Territorial & International Affairs
P.O. Box 2622 Saipan, MP 96950

Stephen Stouter
Environmental Coordinator
Naval Station Guam
PSC 455 Box 152
FPO AP96540-1000

Randel Sablan
Planner Environmental Review
Guam Environmental Protection Agency
Harmon Plaza Complex Unit D-107
130 Rojas Street
Harmon, Guam 96911

Pedro Dela Cruz
Director
Department of Commerce & Labor
CNMI
Capitol Hill
Saipan, MP 96950

Mike Fitzgerald
Tinian Mayor's Office
San Jose Village
Tinian, MP 96952

John S. Sanchez
U.S. Fish & Wildlife Service
P.O. Box 8134 MOU-3
Dededo, Guam 96912

Daniel S. Yeatts
USGS Water Resources Division
P.O. Box 59
Tinian, MP 96952

Richard Davis
Historic Preservation Officer
Deparment of Parks & Recreation
Historic Resources Division
490 Chalan Palasyo
Agana Heights, Guam 96919

Michael Ham
Administrator
Guam Coastal Management Program
Bureau of Planning
P.O. Box 2950
Agana, Guam 96910

Mike Pitzler
District Supervisor/Wildlife Biologist
USDA Aphis Animal Damage Control
1060 Route 16 Suite 103C
Barrigada Heights, Guam 96921

Priscilla Dela Cruz
Deputy Managing Director
Marianas Visitors Bureau
P.O. Box 861
Saipan, MP 96950

Commanding Officer
Headquarters Headquarters Company
USAR Marianas
56 Ammon Avenue
Barrigada Heights, Guam 96913

Deparment of Parks & Recreation
Historic Resources Division
P.O. Box 2950
Agana, Guam 96910

Commander
SOCPAC
Box 64046
Camp H.M. Smith, Hawaii 96861-4046

Lt. Harshburger or Lt. Commander S. Jean Dumlao-Hurst
Commander POC
PSC 489 Box 6
FPO AP96536-0051

Jeff Barr
CNMI Commonwealth Utility Corp (CUC)
P.O. Box 431
Tinian, MP 96952

Herman Guerrero
CNMI Office of The Governor
Executive Assistant
P.O. Box 10007
Saipan, MP 96950

Senator Hope A. Cristobal
Chairperson
Committee on Federal and Foreign Affairs
Suite 210 Quan Building
326 West Soledad Avenue
Agana, Guam 96910

Senator Don Parkinson
Speaker/Chairman
Committee Electrical Power & Consumer Protection
Suite 222 Julale Shopping Center
424 West Obrien Drive
Agana, Guam 96910

Mayor's Council of Guam
Adelup Complex
P.O. Box 786
Agana, Guam 96910

Mr. Eugene Nitta
Protected Species Program Coordinator
National Marine Fisheries Service
U.S. Deparment of Commerce
2570 Dole Street
Honolulu, Hawaii 96822

Ms. Machelle Leon Guerrero
Chief Planner
Bureau of Planning
P.O. Box 2950
Agana, Guam 96910

Mr. Joseph M. Borja
Administrative Director
Chamorro Land Trust Commission
P.O. Box 2950
Agana, Guam 96910

Mr. Juan B. Rosario
Director
Civil Defense/Guam Emergency Service Office
P.O. Box 2877
Agana, Guam 96910

Mr. John M. Quinata
Director
Customs & Quarantine
1503 Central Avenue
Tiya,n Guam 96913

Mr. Michael W. Kuhlmann
Director
Deparment of Agriculture
192 Dairy Road
Mangilao, Guam 96923

Ms. Gayle Hendricks
Interim Director
Deparment of Education
P.O. Box DE
Agana, Guam 96910

Mr. J.A. Martinez
Director of Land Management
P.O. Box 2950
Agana, Guam 96910

Mr. A.J. Shelton
Director
Deparment of Parks and Recreation
Building 13-8
Tiyan, Guam 96913

Mr. Dennis Rodriguez
Director
Deparment of Public Health and Social Services
P.O. Box 2816
Agana, Guam 96910

M.r Gil A. Shinohara
Director
Deparment of Public Works
542 North Marine Drive
Tamuning, Guam 96911

Mr. Darryl Taggerty
Director
Disaster Recovery Office
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Adjutant General
Guam National Guard
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Tamuning, Guam 96911-4421

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GMF Guam 96921

Mr. Richard Young
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Agana, Guam 96910

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Guam Public Library
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Agana, Guam 96910

Mr. Vicente M. Camacho
General Manager
Guam Telephone Authority
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Tamuning, Guam 96931

Mr. Eulogio C. Bermudes
General Manager
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Mr. Frank Camacho
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Mr. Richard Underwood
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Mr. Vince Leon Guerrero
District Director
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Ms. Teresita P. Schroeder
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Rep.. Robert A Underwood
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PAC Daily News Building. Suite 905
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Superintendent
War in the Pacific
National Historic Park
P.O. Box FA
Agana, Guam 96910

Executive Director
Advisory Council On Historic Preservation
1100 Pennsylvania N. W., Room 809
Washington, D. C. 20004

Director
Western Office Project Review
Advisory Council on Historic Preservation
730 Simms Street, Room 450
Golden, CO 80401

Appendix A-3

Announcement of Scoping Meetings

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DEPARTMENT OF DEFENSE

Office of the Secretary

Notice of Intent to prepare an Environmental Impact Statement for Proposed Military Training in the Territory of Guam and Islands of Rota, Tinian, and Farallon de Medinilla, Commonwealth of the Northern Mariana Islands.

AGENCY: U.S. Pacific Command
ACTION: Notice of Intent

SUMMARY: Pursuant to Section 102 (2)(c) of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality regulations (40 CFR Parts 1500-1508), the U.S. Pacific Command announces its intent to prepare an Environmental Impact Statement (EIS) for proposed military training in the Territory of Guam and on the islands of Rota, Tinian, and Farallon de Medinilla, Commonwealth of the Northern Mariana Islands (CNMI).

The actions to be covered in the EIS consist of training activities required to maintain military combat readiness. The EIS will analyze reasonable alternatives to meet this objective and assess their separate and cumulative environmental impacts.

The U.S. Pacific Command will initiate a scoping process to identify significant related issues for study in the EIS and to identify and notify parties interested in and affected by the EIS.

The meetings will open with a short presentation of the purpose of the proposed action and alternatives to be evaluated, followed by a period for public comment. It is important that interested agencies, individuals, and organizations take this opportunity to identify environmental concerns that should be addressed in the EIS. To allow time for all views to be shared, each speaker will be limited to five minutes for oral comments.

Interested parties are also invited and encouraged to provide written comments in addition to, or in lieu of, oral comments at the public meetings. Scoping comments should clearly describe specific issues or topics that the EIS should address.

DATES: Three public scoping meetings will be held.
Guam: December 4, 1995, 7:00-10:00 PM
Rota: December 6, 1995, 7:00-10:00 PM
Tinian: December 7, 1995, 7:00-10:00 PM

ADDRESSES: The scoping meetings will be held in the following locations:
Agana, Guam: Governor's Cabinet Room, Adelup Complex
Sing Song Village, Rota, CNMI: The Round House
San Jose, Tinian, CNMI: Tinian School Cafeteria

FOR FURTHER INFORMATION CONTACT: Written statements and/or questions regarding the scoping process should be mailed no later than December 22, 1995 to Mr. Fred Minato (Code 238), Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, HI 96860-7300; telephone (808) 471-9338; (808) 474-4890.

SUPPLEMENTARY INFORMATION: The proposed action consists of future military training activities in Guam and CNMI within existing military installations, public lands, and waters, including large-scale joint military training exercises. Training will involve organizations from the U.S. Army, U.S. Marine Corps, U.S. Navy, U.S. Air Force, U.S. Army Reserve, Guam Army National Guard, and allied nations. Federal and Guamanian law enforcement agencies also train on these lands. The proposed training will take place on Tinian, primarily in the Military Lease Area, on Rota, primarily at Sand Island and the public airport, and on Guam, primarily at Andersen Air Force Base, Naval Activities Guam Ordnance Annex, and Apra Harbor. The proposed action also includes continued use of the island of Farallon de Medinilla for naval gunfire training and aerial bombardment.

Proposed training activities include tactical maneuver on foot and by wheeled and tracked vehicles, beach landings with boats, air-cushioned landing craft, and tracked amphibian vehicles, paradrops, fixed- and rotary-wing aircraft operations, underwater explosive ordnance training, military weapons and munitions training, and various logistical support activities.

Alternatives consist of: 1) the no action alternative, 2) the limited training activities alternative, 3) the proposed training activities alternative, and 4) alternate training locations. The "no action" alternative consists of continuing present training activities under present conditions, with no adjustment to planned future military needs. The "limited training activities" alternative consists of a sub-set of proposed training activities, constraints including the limitation of certain activities to avoid significant impacts to the environment. The "proposed training activities" alternative consists of implementing all proposed activities at the designated training locations. The use of alternate training locations is not applicable to this project.

Environmental issues to be addressed will include, but not be limited to, effects on cultural resources, terrestrial and aquatic habitats, threatened or endangered species, water quality, infrastructure, traffic, noise, and the socioeconomic environment. Direct, indirect, and cumulative impacts will be analyzed, and mitigation measures will be developed as required.

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IN THE SUPERIOR COURT OF GUAM
TERRITORY OF GUAM
IN THE MATTER OF THE ESTATE OF
DAVID JOSEPH PEREDA PEREZ,
Deceased.
PROBATE CASE NO. PR0069-95
NOTICE TO CREDITORS

notice is hereby given by the undersigned, Administrator of the ESTATE OF DAVID JOSEPH PEREDA PEREZ, Deceased, to the creditors of, and all persons having claims against the said estate or against said deceased, that within two (2) months after the first publication of this notice, they either file them with the necessary vouchers in the office of the Clerk of the Superior Court of Guam, or exhibit them with necessary vouchers to the Law offices of Cabot & Perez, Suite 109, Capitol Plaza, 120 Father Duenas Avenue, Agana, Guam, 96910, the same being the place for the transaction of the said estate.

Dated this 15th day of November, 1995.
/s/Gregory J. Perez
GREGORY J. PEREZ

StayWell Seeks

Appendix A-4

Scoping Meeting Attendance Records

ATTENDANCE RECORDS for Three Public Scoping Meetings and one CNMI Government Meeting:

1. ADELUP, GUAM — DECEMBER 4, 1995

Edward Chargualaf	Fort San Juan Muna 622 E. Harmon Ind Park Road Tamuning, Guam 96911-4421	Guam Army National Guard
Robert D. Anderson	Dept of Agriculture P.O. Box 2950, Agana 96910 735-3979	Division of Aquatic and Wildlife Res.
Stan Kot	Guam National Wildlife Refuge 355-5096	National Biological Survey
Thomas R. Sharp	Guam National Wildlife Refuge 355-5096	National Biological Survey
Richard K. Boice	865 S. Marine Dr. Suite B 201 Tamuning, Guam 96911 671-649-3700	Ernst and Young
Mike Linnell	1060 Rte 16, Ste 103C Barrigada Heights Guam 96921 635-4407	USDA-Animal Damage Control
Steve Bellrichard	Tamaning Guam 96521 646-2591	
John Morton	P.O. Box 8134, Dedeo, Guam 96921	USFWS, MOU-3
Frank Chibrera	647-7882	PUAG
Ken Aguilar	120 FT R (indecipherable) Agana 96910	Delegate Robt Underwood's Office
Andrew Torres	PO Box 2950 Agana 96910 735-3986	DAWR-Fisheries Section
Melissa Finney		KUAM
Michael Ritter	PO Box 8134, MOU-3 355-5096/92	USFWS
Bryant Burnett	Tygan 477-9394	GEPA
Bob Beck	PO Box 2950 Agana 96910 735-3992	DAWR-Wildlife
Willis Cannon	PO Box 1055, Saipan 96950	CNMI CPA (FAA)
Larry Toves	PO Box 23821 477-5931 Ext 256	PAG

Senator Hope Alvarey Cristobal	Committee on Federal nd Foreign Affairs, Guam Bldg, Suite 201, 326 W. Soledad Ave., Agana 96910 472-3581/2/3 Fax (671) 472-3585	Chairperson (Did not sign in. Address and title obtained from C/S COMNAVMAR)
Mike Gawel	101 N. Satiyan Gu 96929	TPC
Jordan Kaye	472-8863	GEPA
Michael Cruz	Box 2950 Agana 477-5931 Ext 256	BRAC 95 Steering Committee (Provided a Prepared Statement)
Government (DOD) Representatives: Lt Jean Dumlao Hurst	COMNAVMAR N-45	CNM
Roy Tsutsui	COMNAVMAR N-451	CNM
Lt Greg Harshberger	COMNAVMAR N-45 349-5241	CNM
LtComdr Carole Gaasch	CINCPACFLT (N465), 250 Makalapa, Pearl Harbor, 808-471-4951	CPF Legal
Karen A. Verkennes	CINPACFLT (N4654) 471-5455	CPF Conservation
Frederick A. Minato	PACDIVNAVFACENGCOM 474-5914	PACDIV
David Stefansson	680 Ala Moana Blvd Honolulu HI 96813-5406 (808) 521-5361	Belt Collins Hawaii
Cheryl Vann	680 Ala Moana Blvd Honolulu HI 96813-5406 (808) 521-5361	Belt Collins Hawaii
Dee Dee Letts	220 S. King, Suite 1460 Honolulu (808) 537-6062	Resolutions, Hawaii
Peter Waddell	173 Aspinall, Suite 201, Agana 96910 (671) 472-8472	Peter G. Waddell A.V. Services

2. SONGSONG, ROTA — DECEMBER 6, 1995

Joseph Mundo Santos	PO Box 1356 Rota MP 96951-1356 670-532-9456 (O), 532-3426 (H)	Veterans Affairs/Rota U.S. Army Reserve 442 Radio Barrigada
Barry C. Toves	PO Box 1279 Rota MP (670) 532-9451-3, Fax (670) 532-9454	Mayor's Office
David S. Manglona	Rota MP 96951	Office of Personnel Mgmt
George Baldwin	Box 10007 Saipan MP 96950 670-234-6670/7320/3907	Coastal Resource Management
Mariano Sahlan	P.O. Box 949 Rota 532-9412	Public Works
Tim Bruce	P.O. Box 1506, Rota 532-0209	Mayor's Office
Andrew M. Ramos	P.O. Box 1277 Rota 532-0329	Mayor's Office
Fermina M. Atalig	P.O. Box 1045 Rota 532-4003 work /0578 Home	Dept of Labor and Immigration
Estanistro (Stan) M. Taisacar	P.O. Box 1381, Rota	DLNR Div of Fish and Wildlife
Dave Worthington	Box 1436 Rota 532-9095	
Kelly Brock	Box 27008, GMF Guam	
Richard K. Boice	See Guam Listing	Ernst and Young
William Pendergast		
Manases Manglona	532-0464	Coastal Resource Management Office
Representing DOD: Frederick M. Minato Lt Jean Dumlao Roy Tsutsui LtCmdr Carole Gaasch Karen Verkennes David Stefansson Cheryl Vann Dee Dee Letts Peter Waddell	See Guam Meeting	PACDIV COMNAVMAR COMNAVMAR CINCPACFLT CINCPACFLT Belt Collins Hawaii Belt Collins Hawaii Resolutions Inc Recorder

3. CNMI GOVERNMENT REPRESENTATIVES, SAN JOSE, SAIPAN, DECEMBER 7, 1995

George Baldwin	Box 10007	Coastal Resources Management CNMI
Eric Gilman	654-2238	Governor's Office
John Furey	234-6627	CRM
Peter Peshut	234-1011	DEQ
Pete Palacio	234-6114	DEQ
Chuck (Indecipherable)	234-6623	CRM
Joe Guerrero	664-2120	Historic Preservation Office
John Manglona	322-9627	DFW
David Meyers	322-9627	DFW
Representing DOD: Lt Jean Dumlao-Hurst LtCmdr Carole Gaasch Karen A. Verkennes David Stefansson Cheryl Vann Dee Dee Letts	See Guam Listing	See Guam Listing

4. SAN JOSE, TINIAN, DECEMBER 7, 1995

Ellen Ikehara	Box 209 Tinian 96952	Marianas Visitors Bureau
Benedicto Decena	Box 138	Customs Office
Mike Fitzgerald	Box 47	Mayor's Office
Connie Power	Box 10 433-0300	Tourism (Fleming Hotel Gift Ship proprietor)
Don Power	Box 10 433-0422	F.P.A. Pacific
Jarred Power	"	"
Paul Palmer	Box 281	Self (TCGCC)
Susan Cruz	San Jose Village 433-0973	Ampat Corp
George Baldwin	See Rota and Saipan List	CRM
Melvin Cruz	San Jose Village 433-0220	Historical Preservation (CCA)
Edwin M. Hofschneider	Tinian, 433-0494	CRMO
Carmen Dela Cruz Farrell	Tinian (670) 433-3082	Tinian Chamber of Commerce

Representing DOD: Lt Jean Dumlao-Hurst Karen Verkennes Lt Cmdr Carole Gaasch Frederick A. Minato David Stefansson Cheryl Vann Dee Dee Letts Peter Waddell	See Guam Listing	See Guam Listing

Appendix A-5

Scoping Meeting Group Memory

EIS Scoping Meeting
Marianas Training Activities
Guam, December 4, 1995

The following issues were raised by attendees at the meeting concerning issues that they felt needed to be addressed in the Draft EIS.

- Solid waste that may be generated by training activities needs to be properly disposed of. This has not been the case in the past as when bags of garbage drift ashore from ships.
- A serious assessment needs to be made regarding the suggested 20 lb size for explosives. Much smaller charges kill fish and this may be too large.
- When assessing socio-economic impact, Guam Government's ability to reuse the property after training needs to be assessed, not just the immediate impact on neighbors.
- Those areas identified for base closure should not be adversely impacted in a way that would limit the reuse.
- The notice mentioned "waived alternatives". This should not be used as a reason to not look at alternative areas/locations for identified training activities within the Marianas. For example, if a certain training type is suggested for area x, it should be evaluated through this process as to whether it is more appropriate in area y.
- When addressing mitigation measures they need to be assessed not just in the immediate time frame, but also as to the impact on the end user - whether through reuse or lease. This also needs to be looked at in relation to the scheduling question.
- The socio-economic impact of the implementation of BRAC '95 should be addressed in the EIS.
- The DEIS needs to look at impacts on the final landing approach at Saipan Airport of these training activities. There is a concern because this airport runs over 100,000 operations a year.
- Establishing a controlled firing area at North Field has been a problem in the past. This needs to be addressed if this training activity is going to occur in this area.
- The clean up of training areas needs to be addressed, especially as to costs and responsibility.
- There needs to be a discussion of by what authority the U.S. military has the right to conduct training activities in the Marianas.
- FDM has never had any major NEPA work done. There are major seabird colonies including nesting areas. Good baseline data needs to be collected and assessed in the DEIS. Inventory work should be done.
- The DEIS should look at moving all training activities off Rota so as to do away with the possible introduction of brown tree snakes to the island.
- DEIS needs a discussion as to why Rota was even considered as a training area.
- DEIS needs a discussion of surface danger zones and their impact on other activities that would take place in these areas (i.e. fishing).
- DEIS needs to address why any live fire is being considered.
- Need a discussion as to the destructive force of 20 lbs. of explosives.
- Look at the graving dock as a possible alternative area for demolition training activities.
- Recognize that this needs to be a dynamic document, that conditions will always be changing, so it needs an end point or a mandatory periodic review.
- There needs to be a full discussion on radiation hazards including laser, etc.
- There needs to be early and close coordination with the Guam Natural Wildlife Refuge.
- If you're talking actual landings at NW field, need to assess which runways and impacts.
- The DEIS should also address the training activities of the Guam National Guard, etc.
- Noise levels of activities need to be addressed, especially around schools during regular school hours.
- Individual agencies need to be met with during this process.
- The DEIS team should get together with the National Fish and Wildlife folks as soon as possible.
- What is "NBC"? Be sure to define your terms.

- Are the training activities proposed allowed in the continental USA? If they aren't, then why are they being proposed for Guam?

- FDM needs protected airspace and discussion of offshore use.

- Many offshore users of the proposed training areas are on Saipan. Please consider holding a meeting on Saipan next time public meetings are held. Besides government entities, fishermen need to be consulted.

Marianas Training Environmental Impact Statement
Scoping Meeting
December 6, 1995
Rota

The following issues were raised by attendees at the meeting concerning issues that they felt needed to be addressed in the Draft EIS.

- Consider doing engineering training over here to assist with local projects.

- Discuss size and type of training and whether or not based on the size and type it is appropriate for the area.

- In the interest of not introducing brown tree snakes to Rota bring your training missions here first instead of running them through Guam.

- Why is training being considered on Rota at all.

- The EIS needs a limit or timeframe to it. Things change over time and any discussions in the EIS concerning constraints, appropriateness, and mitigating measures would need to be reviewed or updated periodically.

- Noise considerations need to be looked at especially as concerns the impact on residential areas of the use of the airport and medivac activities.

- Impact on regular air traffic needs to be addressed.

- Frequency of training and public notification of training activities need to be addressed.

- Can other local agencies such as the local reserves, Department of Public Safety and the Fire Department use training facilities or participate in some training activities.

- Noise impact on fauna especially the Marianas Crow, the Fruit Bat and the entire Bird Sanctuary.

- An assessment of the impact of training activities on the tourism industry needs to be done.

- Assurance that the training activities will be limited to only those described.

- Can these training activities provide experiences for the Junior ROTC students from the High School.

- Need to take into account conditions where it is difficult to follow the rules and that they may not be followed at all times. Need to anticipate and mitigate this if possible.

- More social events need to happen between the military and the local population.

- Need a discussion on what the airport approaches are and the need to minimize them over populated areas.

- Need to see a risk assessment for introduction of the brown tree snake through navy SEAL activities. If the assessment shows a high risk then these activities should be moved.

- Public needs adequate notice of activities - no surprises.

- Military should leave behind some civil works projects in exchange for training opportunities.

- Discussion of mitigation plans for any potential environmental damage.

- Can the military help with the restoration and maintenance of the veteran memorial park on Rota.

- Consider diverting an engineering unit from Guam to Rota and using it to build a road around the Island and other projects.

- If inspection of activities or clean up after activities is required by non-military personnel then the military should pay these costs.

- Military needs to pick up the cost of customs and immigration overtime as a result of their activities.

- There should be a discussion of why we need military training.

Notes
Meeting with CNMI
Saipan 12/7/95

- Commonwealth should be consulted for agency review as the DEIS moves forward especially Environment, Fish and Wildlife, Historic Preservation and Coastal Program.

- Look at and use the Tandem Thrust document - it was pretty good for Tinian.

- Need to discussion on length of time the EIS will be valid - will there be periodic reviews, updates and process for amending the document.

- Individual exercises in the future might deviate from the DEIS if so separate them out and write them up don't try to cover them with the document if it is not appropriate.

- Develop a protocol for coordinating with local agencies for each exercise so as to avoid potential sensitivities such as landing exercises when green sea turtles are nesting.

- Advance notice of and an opportunity to participate in the monitoring and evaluation of training activities.

- Evaluation should be done pre and post training activities to monitor effects - we need advance notice for this.

- This should be set up so that we can learn for the future what real impacts are if they differ from those identified.

- Coral reef sensitivity needs to be recognized.

- DEIS should be aware of possible marine sanctuary area at Tachogna Beach. This beach should be out of consideration. Talk to Dr. Mike Crosby at NOAA and co-ordinate with the American Coral Reef Initiative.

- Rota is a marine protected area and fish reserve these need to be discussed.

- CNMI is currently in a habitat conservation process for Rota. It is a 2 year project which is just starting and will be working with Fish and Wildlife and local community groups.

- How does training impact on the port improvement project on Rota which includes dredging and expansion. Some permits have been obtained others are pending.

- Navy SEAL operations are seen as having minimal impact on an area.

- Is one of the goals of this DEIS to have a Commonwealth consistency determination or will it stay individual.

- A changing condition should trigger a new EA or other action the only time this document should cover is if conditions stay the same as those described in the document.

- The Commonwealth would like pre-notice of each action requested.

- CZM consistency is it the intent to look for a way to handle this all at one time under a general consistency and to amend or change only the exercise deviates from the EIS or conditions change.

- If Tachogna Beach is considered the channel would have to be marked and strand vegetation concerns would have to be addressed.

- Training must avoid wetland areas and Lake Hoyoi.

- Kitchen waste and shower run off need to be addressed for ground water protection.

- Public notice of training activities needs to be provided for commercial fishermen.

- Rapid runway repairs have not been satisfactory in the past, i.e. bomb holes have been left on Tinian. Need to make sure this doesn't happen in the future.

- Proposed amphibious landings on WWII landing sites we need to have more detail on these as these sites are also cultural sites on Tinian.

- Need to know the status of section 106 on Tinian - also the status of the ongoing archeological studies on Tinian.

- Need to see a discussion on forward fueling exercises.

- Solid waste disposal needs a thorough discussion.

- All agencies should have a copy of the document sent directly to them.

- Restrictions need to be in place that insure that no Brown Tree Snakes come with training exercises. This can be addressed through vehicle storage, dogs, etc..

- Look at DLNR's current restriction on Brown Tree Snakes.

- Junk cargo coming in from Guam may be a bigger problem then the military because there is no inspection of such shipments.

- Can the Navy assist in developing a Brown Tree Snake control program for the Islands as a whole - or at least put some pressure on politically to speed up the implementation of controls on the civilian side.

- Some suggestions would be to put a quarantine on cargo for seven days and double ring the area with traps - use sniffer dogs when containers are opened or look at an air capsulation project.

Marianas Training Environmental Impact Statement
Scoping Meeting
December 7, 1995
Tinian

The following issues were raised by attendees at the meeting concerning issues that they felt needed to be addressed in the Draft EIS.

- Be sure to discuss and take into account the U.S. History with Tinian especially the WWII impacts.
- The military already has control of two thirds of Tinian - this in itself may be too much but why are you now looking at public beach areas.
- Need to see a discussion as to whether the military can prohibit access to the areas of the Island they control by local people and visitors. This is not something we want to see happen.
- Discussion on the sensitivity training exercise must pay to turtle nesting times and feeding areas.
- Consider assisting with the development of an environmentally acceptable dumpsite that both the military and community can use. Preferably located in the military area of the Island.
- Impacts on vegetation in general both land and marine with special attention to medicinal plants.
- Provide assistance to the community in building and maintaining roads.
- Who will be responsible for the upkeep and maintenance of the trails and cultural sites identified in the military area.
- A brochure on military sites has been produced by Belt Collins will access to this sites still be allowed if training takes place or will there be times when access is denied?
- What is the military's position on upkeep in the exclusive area.
- Discussion of upkeep, identification and protection of cultural sites within the military area.
- If the military is going to use our port facilities can they improve these areas and clean them up.
- Discussion of the status on the latest Latte Village discovery.
- Discussion of post training environmental and clean up concerns.
- Discussion of impact on natural wildlife.
- Look at social issues, including communication on what is taking place before it happens.
- Improve economic rewards to Tinian of training activities, i.e. procure services such as meals etc. supplied here by local businessmen.
- A discussion on types of exercises i.e. medical and educational that could be jointly done between the military and the community.
- Provide medivac services to Tinian.
- Discuss impact of training activities on growing tourist industry.
- Discuss impact on growing gaming activity.
- Discussion of any radiation impacts of any training activities.
- Get us copies of the DEIS at least 1 month before the meeting - this should be true of any information.
- Since Tinian doesn't have a newspaper can the military find a way to involve us in all federal bidding activities.
- The community appreciates the military's presence in the area.
- The DEIS should identify problems and proposed solutions for us to review.
- The document must recognize that cleanup and protection of vegetation and wildlife are important.
- Reassess the use of public beach areas as mentioned before it is too much.
- Anticipate and prevent the introduction of all alien species not just the brown tree snake.
- Discussion of safety issues on refueling and transporting fuel.

- Impact on roads of military vehicles especially tanks or track vehicles.

Appendix A-6

Written Scoping Comments

BRAC '95 STEERING COMMITTEE
GOVERNMENT OF GUAM
AGANA, GUAM 96910

COMMENTS ON THE NOTICE OF INTENT
TO PREPARE AN ENVIRONMENTAL IMPACT STATEMENT
FOR PROPOSED MILITARY TRAINING

December 4, 1995

My name is Michael J. Cruz and I am the Acting Executive Director of the BRAC '95 Steering Committee, established by Governor Carl T. C. Gutierrez to oversee and develop plans for the reuse of military properties affected by the Base Realignment and Closure Commission's 1995 decision. The comments I am providing tonight should be considered as preliminary comments as they were developed in advance of knowing specifically where the military plans to conduct training activities, the nature of these activities and their effects on GovGuam's ability to reuse areas for economic recovery. After this scoping meeting, I expect that the BRAC '95 Steering Committee Chairman, Governor Carl Gutierrez, will transmit formal comments to the address listed in the notice published in the Pacific Daily News.

The following preliminary comments are submitted:

- I recognize the need to ensure military combat readiness through the provision of sites for military training. However, use of training sites within the Apra Harbor Complex will have significant impacts on the socioeconomic environment which must be thoroughly addressed in the draft EIS. Given the specific nature of these training activities, they will either prevent civilian reuse of training areas or they would adversely affect civilian operations. The draft EIS must address these concerns.

- The Notice indicates that "The use of alternate training locations is not applicable to this project". Please clarify this statement. If it means that no other locations on Guam possess the site characteristics of the selected training sites, the draft EIS must justify this statement by comparing site characteristics, costs and benefits of other possible locations on Guam.

- Mitigation measures that may be proposed in the draft EIS to accommodate civilian reuse needs must be evaluated in terms of the additional cost burden transferred to the civilian users of the property. Scheduling of training activities may be a viable option however, scheduling will incur additional costs. Such costs and benefits to both the military and civilian users must be evaluated in the draft EIS.

- The socioeconomic environment assessed in the draft EIS must be the environment that will exist after the BRACC '95 decision is fully implemented and not the environment that exists at the time the draft EIS is developed. In obtaining Presidential and Congressional approval of the BRACC recommendation, there was recognition that the BRACC recommendation would result in certain costs and savings. The fact that the BRACC decision has yet to be fully implemented should not deter the military from using this information in the draft EIS.

In my view, the proposed training plan will have significant adverse impact on the prospect for Guam's economic recovery. Therefore, an EIS must be developed by the military and submitted for public review and comment. In this fashion, we can ensure that both military and civilian needs for Apra Harbor can be accommodated.

Thank you for the opportunity to provide preliminary comments.

MICHAEL J. CRUZ

Public Comment Mail-In Form

This form offers a convenient way for you to provide comments on the scope of the environmental impact statement being developed for military training activity in the Marianas. Write your comments, and mail or fax this form to the address below (must be postmarked by January 7, 1996).

To: Commander, Pacific Division, Naval Facilities Engineering Command
Attn: Mr. Fred Minato (Code 238)
Pearl Harbor, HI 96860-7300
(Telephone (808) 471-9338; Fax (808) 474-4890)

Subj: ENVIRONMENTAL IMPACT STATEMENT: MILITARY TRAINING IN THE MARIANAS

Comment or Concern: We are concerned with several aspects of the EIS process on this project. Because of the variety of types of training and number of sites to be used, it seems unlikely that all particular environmental concerns can adequately be addressed for each training exercise in a single document. Perhaps the best thing to do is to make the EIS a broad document and to fill in the various details later as each exercise is in the initial stages of planning. Secondly, a thorough inventory of the natural resources on Farallon de Medinilla has never been done. This needs to be done as part of the EIS process for this particular island.

Signed: Jan M. Shenkey
Date: 8 December 1995

Name and Address (please print): JAN M. Shenkey
MARIANAS AUDUBON SOCIETY
PO BOX 4425
AGANA, GU 96910

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

PRESILAN C. TENORIO
Governor

JESUS C. BORJA
Lt. Governor

Caller Box 10007
Saipan, MP 96950
Telephone: (670) 664-2200
Fax: (670) 664-2211

DEC 13 1995

Commander, Pacific Division, Naval Facilities Engineering Command
Attn: Mr. Fred Minato (Code 238)
Pearl Harbor, HI 96860-7300

Dear Mr. Minato:

Thank you for holding the informational meeting on Saipan on 7 December concerning the planned Environmental Impact Statement on military training exercises in the Marianas. I would like to offer three comments.

Please send separate copies of the DEIS and FEIS to Eric Gilman at the Governor's Office, the Division of Environmental Quality, Coastal Resources Management Office, Division of Fish and Wildlife, and the Historic Preservation Office. In the past, you provided only one copy of the Tandem Thrust FEIS for review by all of the Commonwealth of the Northern Mariana Islands' (CNMI's) resource agencies.

Considering the CNMI's priority of avoiding the introduction of the Brown Tree Snake, the military should prepare separate Brown Tree Snake interdiction plans for each proposed exercise. The Division of Fish and Wildlife and U.S. Fish and Wildlife Service should be provided with the opportunity to comment on draft interdiction plans.

The EIS should make an explicit provision for coordinating with CNMI natural resource agencies during planning and implementation stages for each individual training exercise. The military should not only provide advanced notifications, but should meet with representatives of CNMI natural resource agencies to solicit specific comments and recommendations for conducing each exercise.

Thank you for the opportunity to provide input at this incipient stage.

Sincerely,

FROILAN C. TENORIO

cc: CNMI Director, CRM
CNMI Director, DFW
CNMI Director, DEQ
CNMI Director, HPO
Brooks Harper, USFWS

17

Public Comment Mail-In Form

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To: Commander, Pacific Division, Naval Facilities Engineering Command
Attn: Mr. Fred Minato (Code 238)
Pearl Harbor, HI 96860-7300
(Telephone (808) 471-9338; Fax (808) 474-4890)

Subj: ENVIRONMENTAL IMPACT STATEMENT: MILITARY TRAINING IN THE MARIANAS

Comment or Concern:

Interested in the use and impacts on the three protected areas at:

1. Haputo Ecological Reserve
2. Orote Ecological Reserve
3. Pati Point Nature Preserve

Signed: David T. Lotz
Date: 12/18/95

Name and Address (please print): DAVID T. LOTZ, Parks Administrator
Department of Parks and Recreation
P.O. Box 2950
Agana, GU 96910

Commonwealth of the Northern Mariana Islands
Department of Lands & Natural Resources
Coastal Resources Management
Caller Box 10007 2nd Floor Morgen Building,
San Jose, Saipan MP 96950
FACSIMILE

COASTAL RESOURCES MANAGEMENT
CABLE ADDRESS:
GOV'T NMI SAIPAN
TEL.S. (670) 234-6623/7310
FAX: (670) 234-0007

December 22, 1995

Mr. Fred Minato (Code 231FM)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300
Telephone: (808) 471-9338
Facsimile: (808) 474-4890

Dear Mr. Minato:

Please refer to the Director of Environmental Planning Division, Mr. Melvin N. Kaku's facsimile (11010 Ser 23/5454) of November 15th concerning public scoping meetings and comments for the preparation of an Environmental Impact Statement for future military exercises in the Territory of Guam and the Commonwealth of the Northern Mariana Islands.

We have no comments to express pertaining to future military operations within the Territory of Guam. We have already commented extensively during the public scoping meetings on Rota and Tinian and during meetings with United States military personnel here on Saipan.

In our opinion, you already have a good base for beginning your Environmental Impact Statement in the "ENVIRONMENTAL ASSESSMENT, Military Exercise, Island of Tinian; Tandem Thrust 95" prepared for the Commander, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawaii (Contract: N62742-93-D-0028) which was appeared by Belt Collins in November, 1994.

I am sending you via facsimile the first two pages of Chapter 1 of the "COASTAL RESOURCES MANAGEMENT PROGRAM FEDERAL CONSISTENCY DETERMINATION, Voice of America, Mariana Relay Station, Tinian, Commonwealth of the Northern Mariana Islands" which was prepared by the United States Information Agency, Voice of America, Washington, D.C. 20547 in August, 1995 and submitted to the Division of Coastal Resources Management.

These two pages give a good summary of the Federal and Commonwealth laws, rules and regulations, and procedures for the preparation of a Federal Consistency Determination.

The primary concerns of the Division of Coastal Resources Management are:

That you follow proper laws, rules, and regulations in the preparation of your Environmental Impact Statement (EIS) and Federal Consistency Determination (FCD);

That you and your consultants coordinate with both our agency and other relevant Commonwealth agencies during the preparation of the EIS and FCD;

That your EIS and FCD address ALL concerns we have expressed in the public scoping meetings and meetings here on Saipan.;

That your EIS and FCD provide a process for coordination and cooperation with Commonwealth agencies;

That your EIS and FCD provide a process for changing, amending, and even rewriting of the entire documents over time to meet changing conditions, etc.;

That your EIS and FCD provide a process for the Division of Coastal Resources Management and other relevant Commonwealth agencies to have a voice in the decision as to when and how the EIS and FCD should be changed, amended, or rewritten;

That the Division of Coastal Resources Management and other relevant Commonwealth agencies be provided with detailed information on all proposed military activities or exercises within the Commonwealth in a timely manner, so we can determine if the activities or exercises are consistent with the EIS and FCD;

That any military activity or exercise carried out within the Commonwealth which is not entirely consistent with the EIS and FCD be either made consistent with these documents or that the United States military prepare an Environmental Assessment (EA) and/or a Federal Consistency Determination for the activity or exercise;

That your EIS and FCD provide a process for preparing an EA and/or a FCD for activities or exercises that are not consistent with these two documents.

We have noticed that the Department of Defense, the U.S. Navy, the U.S. Army, and other military commands have certainly improved their cooperation and coordination with the government of the Commonwealth of the Northern Mariana Islands, and we appreciate that.

Thank you for the opportunity to provide comments on the preparation of your Environmental Impact Statement. If we can be of further assistance, please feel free to contact us at any time.

Sincerely yours,

for: MANUEL C. SABLAN
Director

xc: Ombudsman

CHAPTER 1

INTRODUCTION

1.1 Consistency Determination

1. In accordance with the Federal Coastal Management Act of 1972, as amended, the National Oceanic Atmospheric Administration implementing regulations contained within 15 CFR Part 930, and the Coastal Resources Management Office Rules and Regulations, as amended through September 8, 1994, the United States Information Agency Voice of America (VOA) finds that the proposed action, construction and operation of the Mariana Relay Station, Tinian, Commonwealth of the Northern Mariana Islands (CNMI), is consistent with and will be conducted in a manner which is consistent to the maximum extent practicable with the CNMI Coastal Resources Management (CRM) Program, as amended.

2. The required environmental documentation has been prepared for the Mariana Relay Station project by the Department of the Army, Pacific Ocean Division, Corps of Engineers in accordance with the Council on Environmental Quality Regulations (40 CFR 1500-1508) and the Department of the Army Regulation (AR) 200-2.

1.2 Purpose

1. A Federal Consistency Determination is required for Federal activities in accordance with the Federal Coastal Zone Management (CZM) Act of 1972, as amended, Section 307(c)(1), and with the National Oceanic Atmospheric Administration (NOAA) Regulations set forth in the Code of Federal Regulations (CFR) Part 930. Under the CZM Act and CFR Part 930, Federal agencies are required to ensure that their activities, including development projects, directly affecting the coastal zone are undertaken in a manner consistent to the maximum extent practicable with the approved state coastal management plan. The CNMI Coastal Zone Management Program and the establishment of the CNMI coastal zone, have been approved by NOAA.

2. The purpose of this Federal Consistency Document is to determine the consistency of the VOA Mariana Relay Station project with the CNMI Coastal Zone Management Plan, as amended.

1.3 Scope

1. The CZM Act of 1972, as amended, defines the coastal zone as the coastal waters and adjacent shorelands strongly influenced by each other and in proximity to the shorelines of coastal states. The coastal zone extends inland from the shoreline only to the extent necessary to control shorelands, the uses of which have a direct and significant impact to coastal waters.

2. The CZM Act defines the CNMI as a coastal state. In the CNMI, the coastal zone inlcudes all land and water areas of the Commonwealth extending seaward to the extent of the territorial waters, execpt for Federally-owned lands as defined by the U.S. Coastal Zone Management Act of 1972, as amended. The Relay Station project site is located within lands leased by the U.S. Government for defense purposes. However, notwithstanding the exclusion of Federal government lands, the CNMI Coastal Resources Management (CRM) program provides that proposed projects on Federally excluded lands which have a direct and significant impact on areas subject to the CRM program shall be consistent with the CRM Rules and Regulations and applicable Federal and CNMI laws.

1.4 Organization

1. The contents of this Consistency Determination have been prepared in compliance with requirements of 15 CFR Section 930.39, Content of a Consistency Determination, and Coastal Resources Management Office Rules and Regulations, Section 21, Federal Consistency, and Section 21 C., Federal Activities and Development Projects. CRM Office Rules and Regulation Section 21 C. states, the Consistency Determinations must include:

(a) a detailed description of the proposed project;
(b) the project's associated facilities;
(c) the combined, cumulative coastal effect of the project; and
(d) data and information sufficient to support the Federal agency's conclusion.

2. In compliance with these requirements, this Consistency Determination contains the requisite information and is organized as follows:

1.0 Introduction, Consistency Determination
2.0 Detailed Description of the Proposed Project
3.0 The Project's Associated Facilities
4.0 The Combined, Cumulative Coastal Effect of the Project
5.0 Data and Information Sufficient to Support the Federal Agency's Conclusion
6.0 References

SENT BY: 1-11-96 ; 13:05 ; PACDIV USP→ 808 538 7819:# 2/ 2

Public Comment Mail-In Form

This form offers a convenient way for you to provide comments on the scope of the environmental impact statement being developed for military training activity in the Marianas. Write your comments, and mail or fax this form to the address below (must be postmarked by January 7, 1996).

To: Commander, Pacific Division, Naval Facilities Engineering Command
Attn: Mr. Fred Minato (Code 238)
Pearl Harbor, HI 96860-7300
(Telephone (808) 471-9338; Fax (808) 474-4890)

Subj: ENVIRONMENTAL IMPACT STATEMENT: MILITARY TRAINING IN THE MARIANAS

Comment or Concern: 1. Operations at the North Tinian Airport lie directly under the ILS final approach course to Runway 7 at Saipan International Airport. Traffic crosses over the airport at 2100 descending. Operations should be conducted below 1100 feet whenever possible.
Combat Control Teams or similar units should establish and maintain contact with Saipan Tower preferably on local control frequency 256.9 mHz and they should have a back up cellular phone contact number in order to coordinate with both Saipan Tower and Guam CERAP.

2. As a matter of information there are about 95,000 aircraft operations annually in the vicinity of North Tinian. Many of these are single engine aircraft that must fly the shortest over water distances for safety reasons. They cannot wander out over the ocean to avoid North Field.

3. Any weapons activity other than R-7201, that is planned must be handled as a Controlled Firing ARea and meet the requirements of FAA Order 7400.2D, Chapter 33.

4. Notice to Airman and Mariners must be issued in sufficient time to allow for dissemination to the public. Suggest at least 72 hours in advance.

5. All activity involving airspace must be coordinated with the IFR control facility, FAA Guam CERAP.

Signed: Willis S. Cannon Jr.
Date:

Name and Address (please print): WILLIS S. CANNON, JR.
Air Traffic Manager
Commonwealth Ports Authority
Saipan Air Traffic Control Tower
P.O. Box 1055
Saipan, MP 96950

Carl T.C. Gutierrez
Governor

Madeleine Z. Bordallo
Lt. Governor

DEPARTMENT OF PARKS AND RECREATION
GOVERNMENT OF GUAM
BUILDING 13-8, TIYAN
Post Office Box 2950
Agana, Guam 96910
Telephone: (671) 475-6296/7
Facsimile: (671) 472-9626

RECEIVED
1996 FEB 12 P 2:21
BELT COLLINS HAWAII

A.J. Sonny Shelton
Director

Franklin J. Gutierrez
Deputy Director

FEB 07 1996

Ms. Amy Sheridan
Belt Collins Hawaii
680 Ala Moana Boulevard, 1st Floor
Honolulu, Hi 96813

Dear Ms. Sheridan:

Thank you for the opportunity to comment on the proposed military training activities in the Marianas. The Environmental Impact Statement for this undertaking will cover Guam, Rota, Tinian, and Saipan but our comments will specifically concern Guam and not the Northern Marianas.

At this planning stage of the undertaking we have very little information on the project. We do not know the areas and sizes of land being proposed for use in military training activities. However, as you may already know, cultural resources should be an important part of an EIS. I would like to advise ahead of time that before any archaeological work is conducted to fulfill the requirement for an EIS, consultation with the Guam State Historic Preservation Officer should be arranged. Appropriate identification efforts may vary substantially, depending on the proposed alternative areas of potential effect. Scope of work for the survey should be prepared and submitted for comment prior to any field work.

Until we know more about this undertaking, our comments will be very general. If we can be of further assistance, please write or call at (671) 475-6290/91.

Thank you.

Sincerely,

Richard D. Davis

RICHARD D. DAVIS
State Historic Preservation Officer

The Way Forward!

Appendix A-7

Distribution List for DEIS

MILITARY TRAINING IN THE MARIANAS EIS
DISTRIBUTION LIST FOR THE DEIS

CHIEF USARG GUAM DIVISION
BLDG 50 AMMON AVE
BARRIGADA GUAM 96913

COMMANDER
GUAM TERRITORIAL AREA COMMAND
GUAM ARMY NATIONAL GUARD
ATTN GU ARO T
FORT JUAN MUÑA
622 EAST HARMON INDUSTRIAL PARK
TAMUNING GUAM 96911-4421

COMMANDER
SOCPAC J3, J4
BOX 64046
CAMP HM SMITH HAWAII 96861-4046

COMMANDER
US ARMY PACIFIC
ATTN APEN
FORT SHAFTER HI 96858-5100

COMMANDER
US ARMY PACIFIC
ATTN APOP
FORT SHAFTER HI 96858-5100

COMMANDER IN CHIEF
US PACIFIC COMMAND
ATTN CODE J35
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CAMP HM SMITH HI 96861-5025

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US PACIFIC COMMAND
ATTN CODE J44
BOX 28
CAMP HM SMITH HI 96861-5025

COMMANDER IN CHIEF US PACIFIC FLEET
ATTN CDR CAROLE GAASCH
CINCPACFLT CODE N465J
250 MAKALAPA DRIVE BLDG 352
PEARL HARBOR HAWAII 96860

COMMANDER IN CHIEF US PACIFIC FLEET
ATTN CDR MARK SEELEY
FLEET EXERCISE OFFICER
CINCPACFLT CODE N328
250 MAKALAPA DRIVE BLDG 352
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COMMANDER IN CHIEF US PACIFIC FLEET
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MS KAREN A VERKENES
CPF ENVIRONMENTAL
250 MAKALAPA DR
PEARL HARBOR HI 96860-7000

COMMANDER US NAVAL FORCES MARIANAS
ATTN REAR ADMIRAL MARTIN E JANCZAK
PSC 489
FPO AP 95636-0051

COMMANDER US NAVAL FORCES MARIANAS
ATTN COMMANDER EDWARD J LYNCH
FORCE JUDGE ADVOCATE
PSC 489
FPO AP 96536-0051

COMMANDING GENERAL
HEADQUARTERS PACIFIC AIR FORCE
ATTN DOT/CEV
HICKAM AIR FORCE BASE HAWAII 96853-5001

COMMANDING GENERAL
HEADQUARTERS US ARMY PACIFIC
APOP TR
FORT SHAFTER HAWAII 96858-5100

COMMANDING GENERAL
IX CORPS (RINF) 9TH ARMY RESERVE
COMMAND
ATTN APIX-EN
2058 MALUHIA ROAD FORT DERUSSY
HONOLULU HAWAII 96815-1997

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III MARINE EXPEDITIONARY FORCE FMF
ATTN G 3T
UNIT 35601
FPO AP 96606-5601

COMMANDING OFFICER
EXPLOSIVE ORDNANCE DISPOSAL MOBILE
UNIT FIVE
UNIT 25499
FPO AP 96601-4591

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DEPARTMENT OF MILITARY AFFAIRS
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FIVE
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NAVY SPECIAL WARFARE UNIT ONE
ATTN CWO 2 DAVE KOEGEL
PSC 455 BOX 182
FPO AP 96540-1182

COMMANDING OFFICER
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UNIT 35821
FPO AP 96606-5621

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UNIT 14003
APO AP 96543-4003

COMMANDING OFFICER
374TH TRANS
ATTN LGTX-CME
UNIT 5120
APO AP 96328-5120

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TELECOMMUNICATIONS AREA MASTER
STATION WESTPAC
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BATTALION 40
CAMP COVINGTON GUAM
FPO AP 96601-4921

COMMARFORPAC
CODE G3, G4, G5
BOX 64118
CAMP HM SMITH HI 96861-5025

ANDERSEN AFB
36 CES/CEV
ATTN MS HEIDI HIRSH
UNIT 14007
APO AP 96543-4007

ANDERSEN AFB
36 CES/CEV
MSGT HIDEYA OSADA
UNIT 14007
APO AP 96543-4007

MR EDWARD CHARGUALAF
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36 ABW
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APO AP 96542-4003

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PNB BLDG SUITE 905
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SENATOR FRANCIS SANTOS
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SENATOR ELIZABETH BARRETT-ANDERSON
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DIVISION OF AQUATIC AND WILDLIFE
RESOURCES
192 DAIRY ROAD
MANGILAO GUAM 96923

MR ROBERT BECK
DIVISION OF AQUATIC AND WILDLIFE
RESOURCES
192 DAIRY ROAD
MANGILAO GUAM 96923

MR MICHAEL W KUHLMANN
MR JOSEPH G SABLAN
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FIRE CHIEF
BLDG 1-1301
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MR MICHAEL HAM
ADMINISTRATOR
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GUAM ENVIRONMENTAL PROTECTION AGENCY
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GUAM MAIN FACILITY
BARRIGADA GUAM 96921

MR JORDAN KAYE
GUAM ENVIRONMENTAL PROTECTION AGENCY
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GUAM MAIN FACILITY
BARRIGADA GUAM 96921

MR MARK PETERSON
GUAM ENVIRONMENTAL PROTECTION AGENCY
PO BOX 22439 GMF
BARRIGADA GUAM 96921

MR JESUS T SALAS
ADMINISTRATOR
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GMF GUAM 96921

MR H VICTOR WUERCH
GUAM ENVIRONMENTAL PROTECTION AGENCY
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GUAM MAIN FACILITY
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MR JAY W SPRAGUE
EXECUTIVE MANAGER
GUAM INTERNATIONAL AIRPORT AUTHORITY
PO BOX 8770
TAMUNING GUAM 96931

MR JACK S SHIMIZU
CHIEF OF POLICE
GUAM POLICE DEPARTMENT
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CENTRAL AVE
TIYAN GUAM 96913

MR RICARDO S UNPINGCO
GENERAL MANAGER
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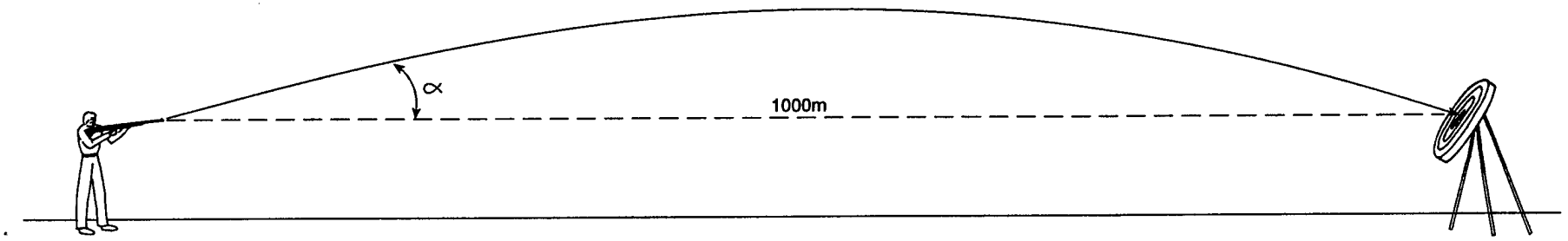
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Appendix B

Technical Descriptions

342.0414/007-18 r1.7.97



∝ = Angle of fire

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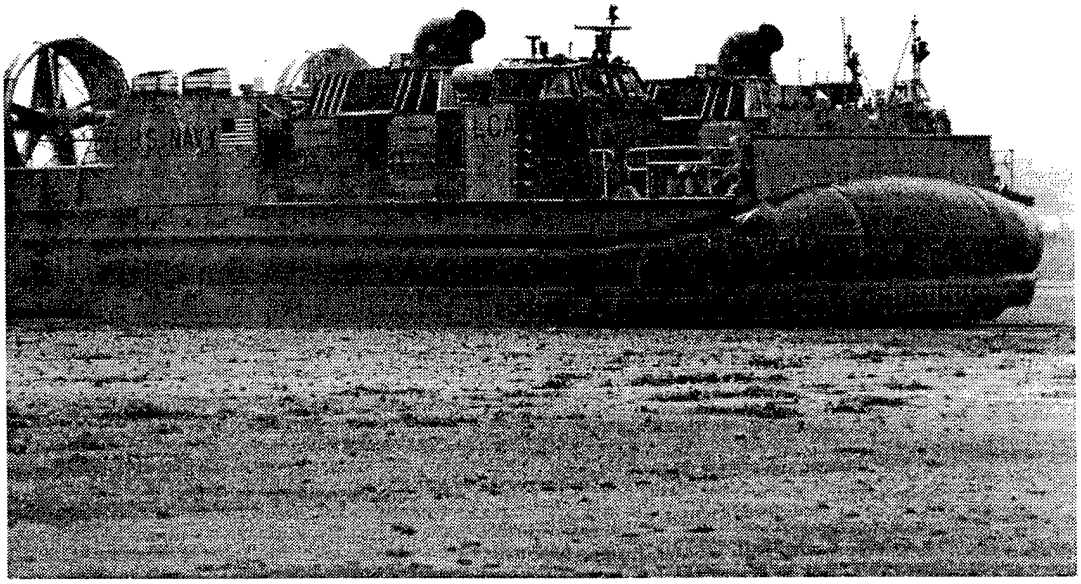
Appendix B
BALLISTIC TRAJECTORY

DEIS: Military Training in the Marianas
Belt Collins Hawaii, 1997



The AAV is designed to carry 21 combat-equipped troops or 4500 kg of cargo. Using an eight cylinder, multi-fuel engine, the vehicle can cruise at 30-50 kilometers per hour (kph) on land, and at about 10 kph on water. Its maximum speed is 70 kph on land and 13 kph on water. Armament consists of a turret mounted M2 .50 caliber machine gun, and MK19 40 mm machine gun.

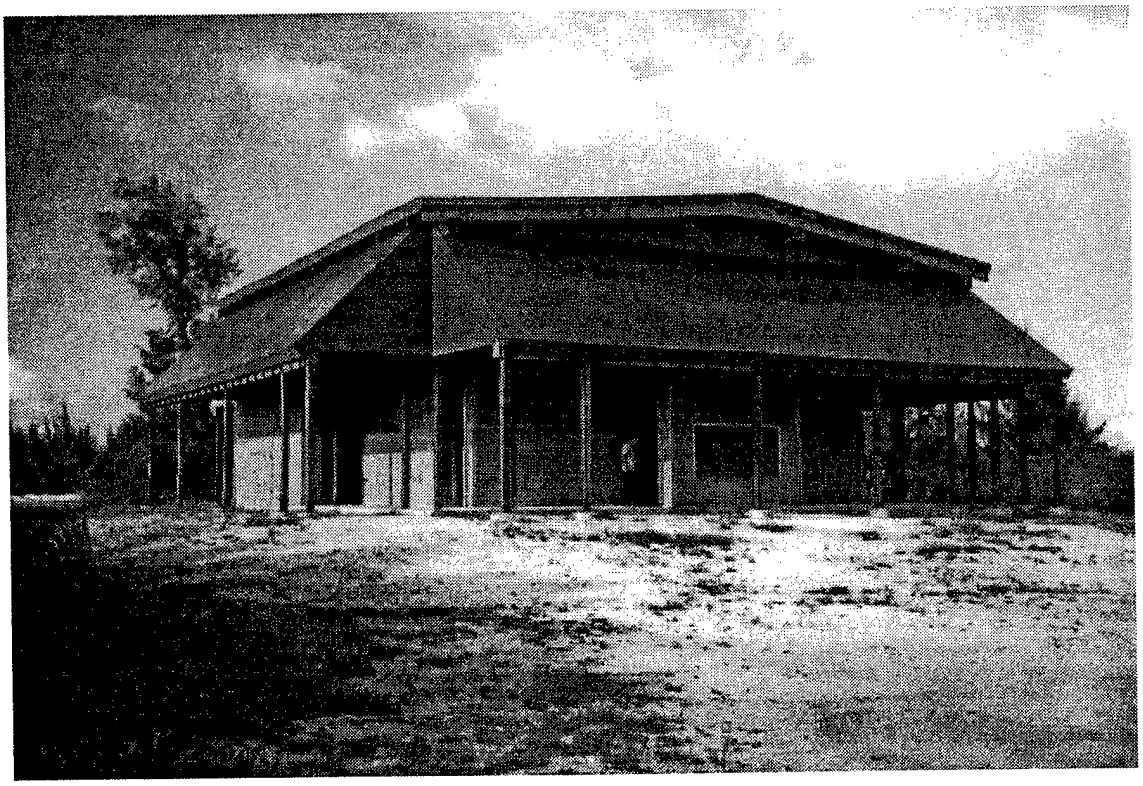
The AAV is 3.25 m wide, 7.9 m long, and 3.1 m high; its maximum draft is 1.7 m. Its tracks are 0.9 m wide and bottom clearance is 0.4 m. Although the AAV can climb walls one meter high once its tracks are in contact with land, it requires a slanting surface for initial touchdown during a water approach.



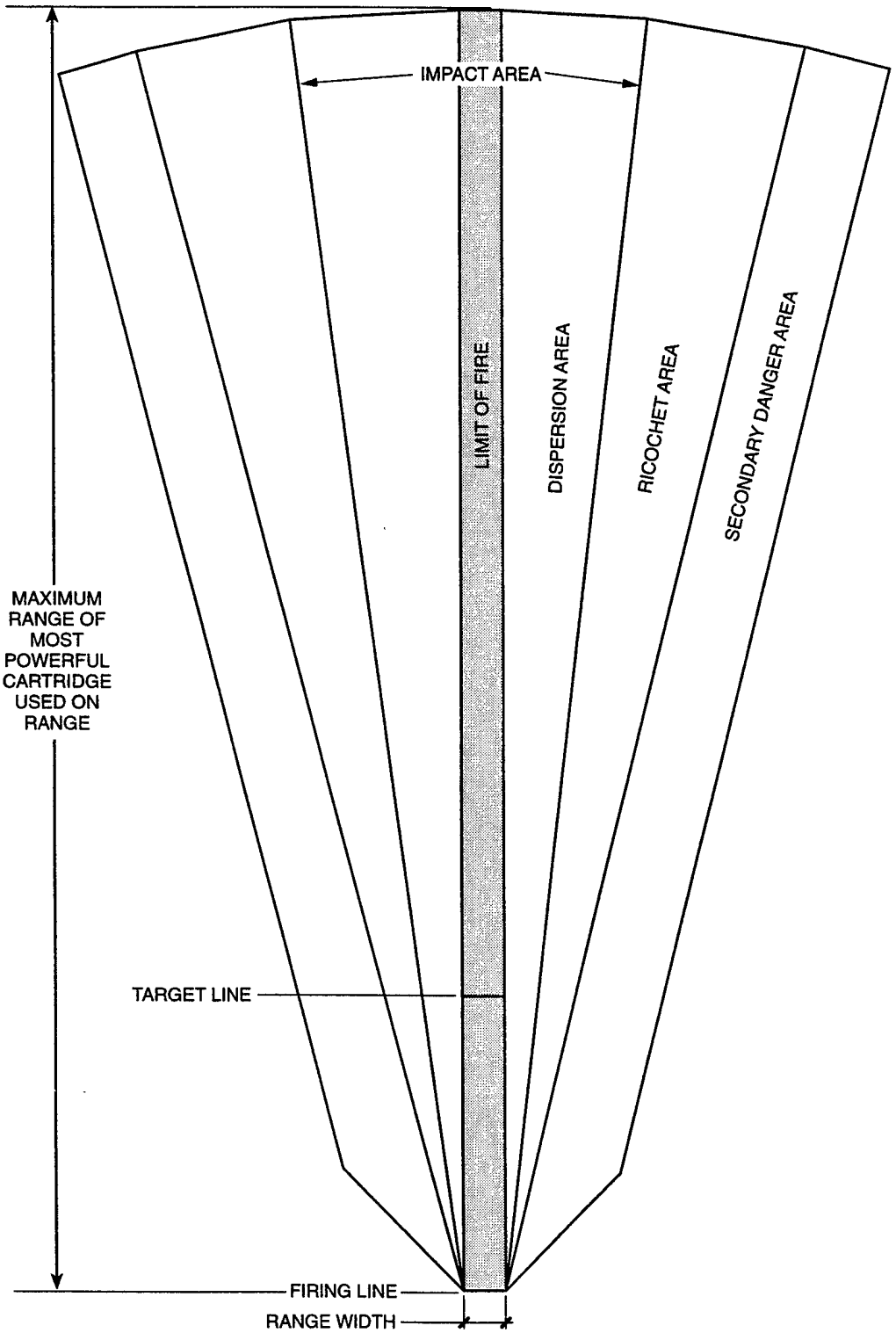


The LCAC is powered by gas turbine engines and propelled by two large propellers. It travels over both land and water on a cushion of air created by internal fans and contained by a flexible skirt. It is used to carry large vehicles, cargo, and weapons systems during ship-to-shore tactical exercises. The LCAC travels at approximately 93 kph on water and 46 kph over land.

Appendix B
LANDING CRAFT AIR CUSHION (LCAC)



A shooting house is a house equipped with bullet traps and a roof to prevent projectiles from leaving the premises. There is a space between the top of the walls and the roof to allow for through ventilation.



A Surface Danger Zone (SDZ) is the area endangered by a particular type of weapons firing. It consists of an impact area, a dispersion area, a ricochet area, and a secondary danger area. All projectiles and fragments will be contained within the SDZ. The fan shape and size is specific to the weapons used on the range.

Source: *Range Facilities and Miscellaneous Training Facilities, other than Buildings*, NAVFACENGCOM, MIL-HDBK-1027/3, 1988

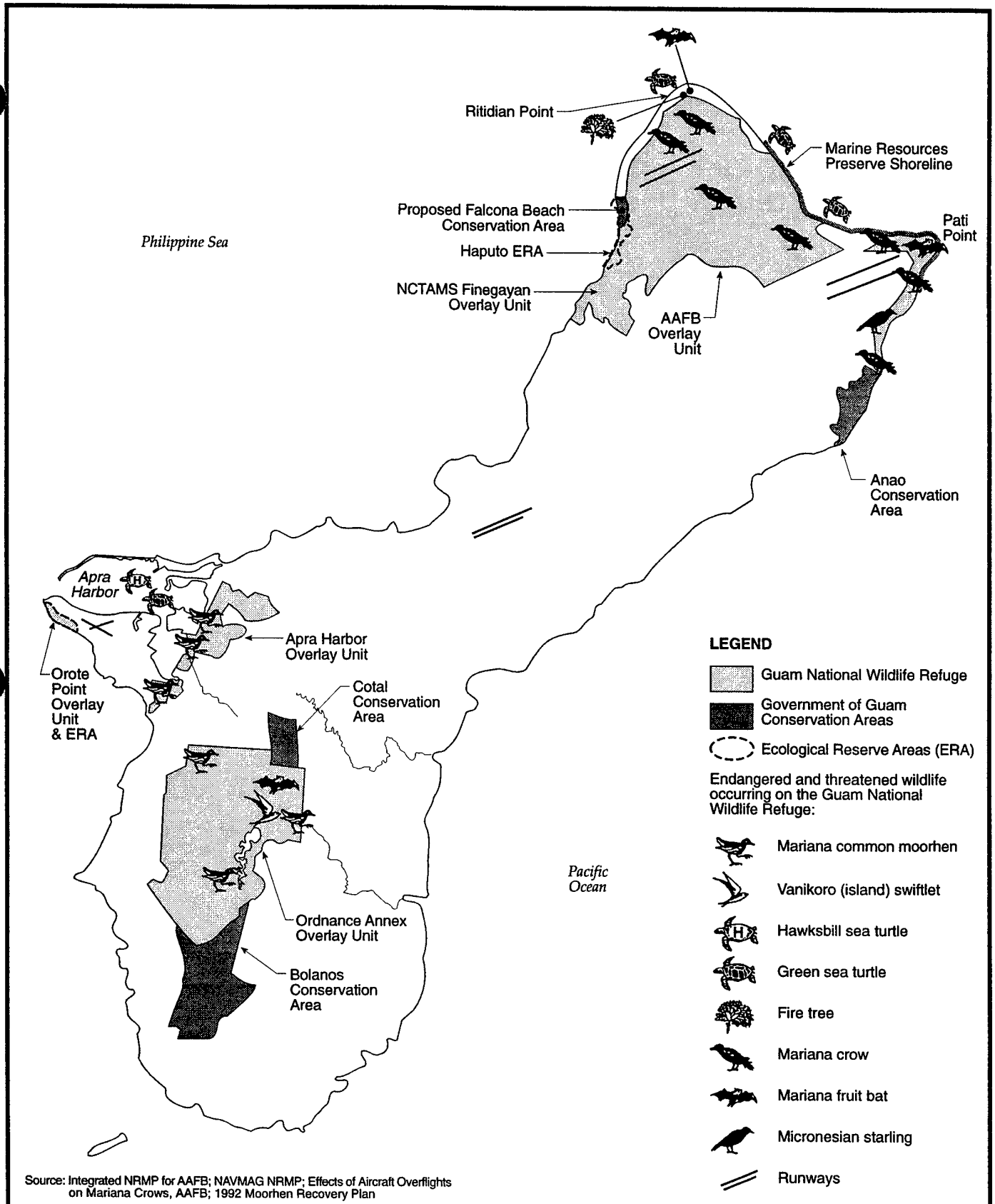
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Appendix B
SURFACE DANGER ZONE

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Appendix C

Supplementary Biological Information



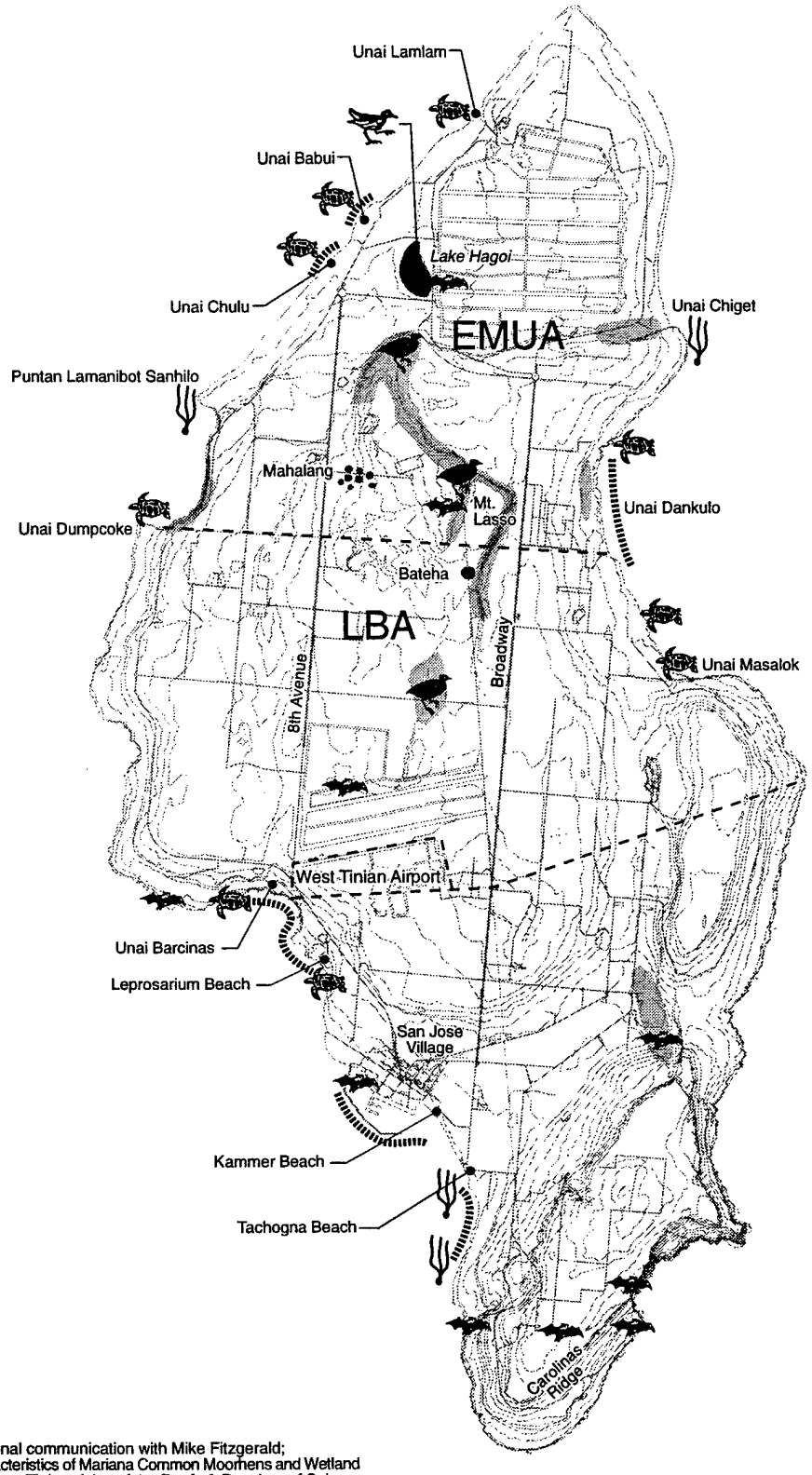
Source: Integrated NRMP for AAFB; NAVMAG NRMP; Effects of Aircraft Overflights on Mariana Crows, AAFB; 1992 Moorhen Recovery Plan

NORTH

0 3 6 (Km.)

0 1 2 3 4 (Miles)

Figure C-1
NATIONAL WILDLIFE REFUGE, OVERLAY UNITS, AND CONSERVATION AREAS OF GUAM
EIS: Military Training in the Marianas
Prepared by: Belt Collins Hawaii, 1997



LEGEND

- Coral reef
- Potential green sea turtle nesting sites
- Recent fruit bat sitings
- Seagrass beds (turtle feeding areas)
- Mariana common moorhen
- Micronesian megapode
- Tinian monarch (distributed throughout the island)
- Wetland
- Limestone forest

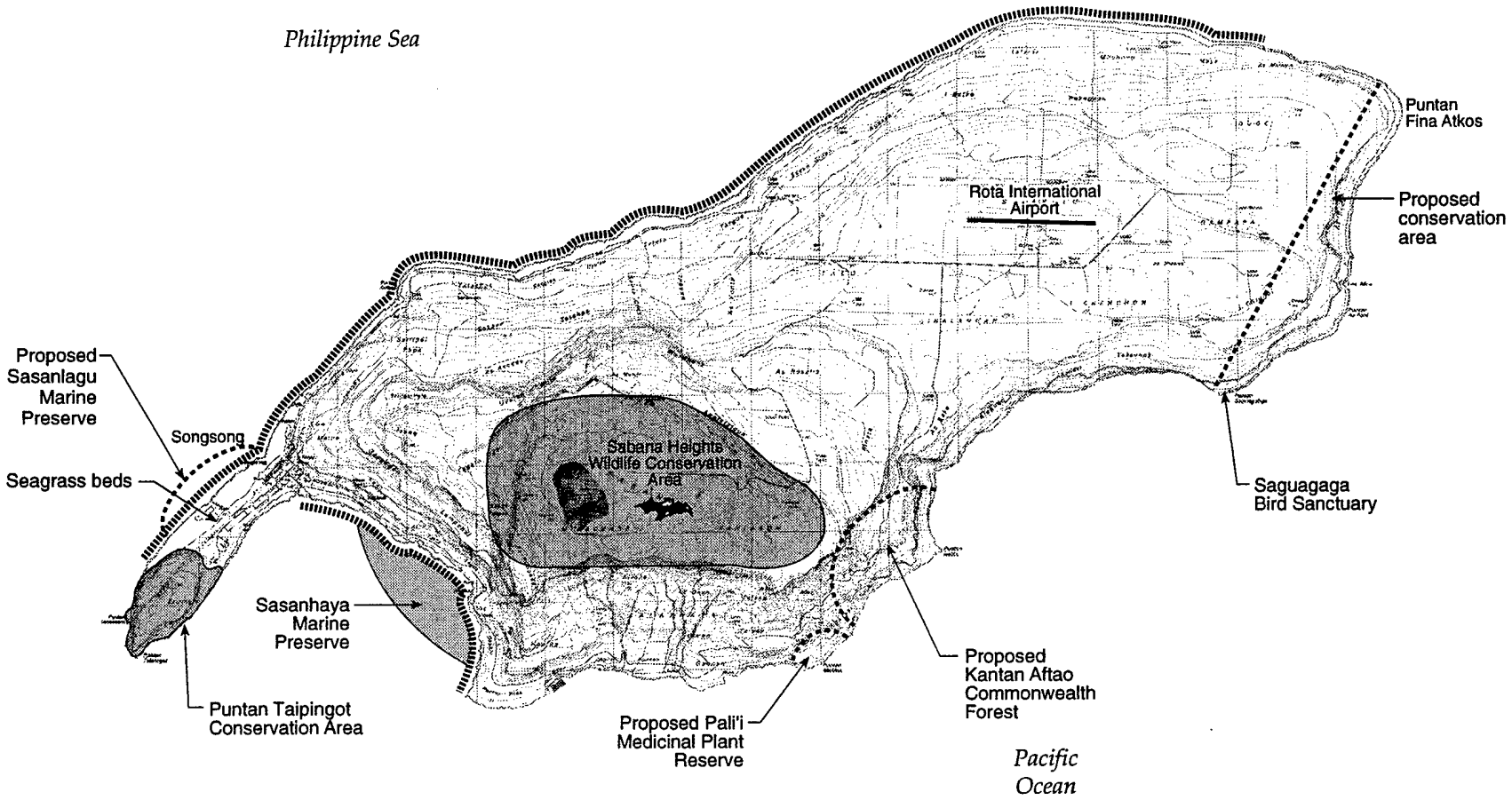
Sources: Personal communication with Mike Fitzgerald; Characteristics of Mariana Common Moorhens and Wetland Habitats, Tinian; Atlas of the Reefs & Beaches of Saipan, Tinian & Rota; Environmental Assessment, Tinian, Tandem Thrust 1995; Wildlife Research Report, Tinian.

NORTH

0 1000 2000 (Meters)

0 4000 8000 (Feet)

Figure C-2
SENSITIVE HABITATS AND THREATENED AND ENDANGERED SPECIES, TINIAN
EIS: Military Training in the Marianas
Prepared by: Belt Collins Hawaii, 1997



Note: The exact boundaries of the conservation areas and proposed conservation areas have not yet been established.

Source: Atlas of the Reefs and Beaches of Saipan, Tinian, and Rota; Physical and Economic Master Plan for Rota; Letter from Arnold Palacios

NORTH

0 1000 2000 (Meters)

0 4000 8000 (Feet)

LEGEND

- Coral reef
- Proposed Conservation Area
- Conservation Area
- Mariana crow (distributed throughout the island)
- Mariana fruit bat
- Runway

Figure C-3
SENSITIVE HABITATS AND THREATENED AND ENDANGERED SPECIES, ROTA
EIS: Military Training in the Marianas
Prepared by: Belt Collins Hawaii, 1997

Table C-1
Vegetation Types on Guam

SITE ON GUAM	VEGETATION TYPE											
	Limestone forest	Introduced mixed limestone forest	Ravine (riparian) forest	Tangan-tangan scrub forest	Halophytic-xerophytic scrub	Savanna	Coastal strand	Aquatic, wetland, and riparian vegetation	Freshwater wetland(s)	Estuarine wetland	Weed communities	Highly disturbed open woods
NAVACTS Ordnance Annex	X		X			X		X				
NAVACTS Waterfront Annex	X	X	X	X	X	X	X		X	X		X
NCTAMS, Barrigada	X			X					X		X	
Harmon Annex	X				X		X					
NCTAMS, Finegayan	X				X		X					
AAFB	X				X		X					

Source: BioSystems Analysis, Inc. (September 1990) *NRMP: Naval Station, Guam.*
BioSystems Analysis, Inc. (January 1990) *NRMP: U.S. NAVMAG, Guam.*
BioSystems Analysis, Inc. (September 1990) *NRMP: PWC, Guam.*
USFWS and USAF with Guam DAWR (November 1995) *Integrated NRMP for AAFB.*

Table C-2
Rare and Protected Native Species in the Marianas

Latin Name	Common Name	Status	Endemic	Location			
				Guam	Tinian	Rota	FDM
Birds:							
Acrocephalus luscinia	nightingale reed-warbler	E	√	*			
Actitis hypoleucos	common sandpiper	M,R(G)		X			
Aerodramus vanikorensis bartschi	island swiftlet	E		X	*	*	
Anas acuta	northern pintail	M,R(G)		X	X		
Anas crecca	green-winged teal	M,R(G,T)		X	X		
Anas oustaleti	Mariana mallard	E	√	*	*		
Anas penelope	Eurasian widgeon	M,R(G,T)		X	X		
Anas querquedula	garganey	M,R(G,T)		X	X		
Anas strepera	gadwall	M,R(G,T)		X	X		
Aplonis opacas guami	Micronesian starling	GE		X	X	X	X
Ardeola speciosa	Chinese pond heron	M,R(G)		X			
Arenaria interpres	ruddy turnstone	M		X	X	X	X
Aythya ferina	common pochard	M,R(G)		X			
Aythya fuligula	tufted duck	M,R(T)		X	X		
Bubulcus ibis	cattle egret	M		X	X	X	X
Buteo sp.	buteo	M,R(G)		X			
Calidris ferruginea	curlew sandpiper	M,R(G)		X			
Charadrius mongolus	Mongolian plover	M,R(T)		X	X		
Chlidonias leucopterus	white-winged tern	M,R(G,T)		X	X		
Corvus kubaryi	Mariana crow	E	√	X		X	
Egretta garzetta	little egret	M,R(G)		X			
Egretta intermedia	intermediate egret	M,R(G,T)		X	X		
Gallicolumba x. xanthonura	white-throated ground dove	GE		*	X	X	X

GE	Listed as endangered by Guam goverment	(G)	on Guam	X	present
E	Federally listed as endangered	(R)	on Rota	*	presumed extinct on this island
T	Federally listed as threatened	(T)	on Tinian		
S	Species of concern (may be deserving of federal endangered status, but listed yet)	(F)	on FDM	▲	in captive breeding program (no longer found in the wild)
C	Candidate for federal listing				
R	Rare or uncommon			√	if endemic
P	Protected locally (though hunting laws)				
M	Migratory				

Table C-2 *(continued)*:

Latin Name	Common Name	Status	Endemic	Location			
				Guam	Tinian	Rota	FDM
Birds *(continued)*:							
Gallinago sp.	snipe	M,R(G,T)		X	X		
Gallinula chloropus guami	Mariana common moorhen	E	√	X	X	X	
Halcyon c. cinnamomina	Micronesian kingfisher	E		▲			
Heteroscelus bervipes	gray-tailed tattler	M		X			
Heteroscelus incanus	wandering tattler	M		X	X		
Himantopus himantopus	black-winged stilt	M,R(G)		X			
Megapodius laperous	Micronesian megapode	E	√	*	X	*	X
Milvus migrans	black kite	M,R(G)		X			
Monarcha takatsukasae	Tinian monarch	T	√		X		
Motacilla cinerea	gray wagtail	M,R(G)		X			
Myiagra freycineti	Guam flycatcher	E	√	*			
Myzomela rubrata saffordi	cardinal honeyeater	GE		*	X	X	
Numenius phaeopus	whimbrel	M,R(T)		X	X	X	X
Numenius tahitiensis	bristle-thighed curlew	M,S		X			X
Pluvialis fulva	Pacific golden-plover	M		X	X	X	X
Pluvialis squatarola	black-bellied plover	M,R(G)		X			
Porzana cinerea	white-browed crake	GE		*			
Ptilinopus roseicapilla	Mariana fruit-dove	GE	√	*	X	X	
Puffinus pacificus	wedge-tailed shearwater	GE		*	X		
Rallus owstoni	Guam rail	E		▲			
Rhipidura rufifrons	rufous fantail	GE		*	X	X	
Sula dactylatra	masked booby	R(T)			X		X
Sula leucogaster	brown booby			X	X	X	X
Sula sula	red-footed booby					X	X
Tringa glareola	wood sandpiper	M,R(T)		X	X		
Tringa nebularia	common greenshank	M,R(G)		X			
Tringa stagnatilis	marsh sandpiper	M,R(G,T)		X	X		
Zosterops c. conspicillatus	Guam bridled white-eye	E		*			
Zosterops conspicillatus rotensis	Rota bridled white-eye	C(R)	√			X	

Table C-2 *(continued):*

Latin Name	Common Name	Status	Endemic	Location			
				Guam	Tinian	Rota	FDM
Mammals							
Emballonura semicaudata	sheath-tailed bat	GE		*		*	
Pteropus mariannus mariannus	Mariana fruit bat	E(G), S(T,R)		X	X	X	X
Pteropus tokudae	little Mariana fruit bat	E	√	*			
Reptiles							
Chelonia mydas	green sea turtle	T		X	X	X	X
Cryptoblepharus poecilopleurus	snake-eyed skink	GE		X			
Emoia astrocasteta	tide-pool skink	GE		X			
Emoia cyanura	azure-tailed skink	GE		X			
Emoia slevini	Slevin's skink	GE	√	X			
Eretmochelys imbricata	hawksbill sea turtle	E		X	X		
Gehyra oceanica	oceanic gecko	GE		X			
Lipinia noctua	moth skink	GE		X			
Nactus pelagicus	Pacific slender-toed skink	GE		X		X	
Perocinis ateles	Micronesian gecko	GE		*			
Invertebrates							
Birgus latro	coconut crab	P(T)		X	X		X
Catacanthus sp.	bronze boonie bug	R(G)		X			
Euploea eleutho	Marianas euploea butterfly	C(G,R)		*		*	
Hypolimnas octocula marianensis	Marianas eight-spot butterfly	R(G)		X			
Isabelloscia sp.	Almagosa cave isopod	R(G)		X			
Melita sp.	Almagosa cave amphipod	R(G)		X			
Partula gibba	Mariana Islands tree snail	GE, C(G,R)		X		X	
Partula radiolata	Pacific tree snail	GE,C(G)		X			
Partula salifana	Guam tree snail	GE,S		*			
Salomona guamensis	Guam karst cricket	R(G)		X			
Samoana fragilis	Mariana Islands fragile tree snail	GE, C(G,R)		X		X	
Succinea guamensis	Guam tree snail	S		*			

Table C-2 *(continued):*

Latin Name	Common Name	Status	Endemic	Location			
				Guam	Tinian	Rota	FDM
Invertebrates *(continued):*							
Succinea piratarum	Guam tree snail	S		X			
Succinea quadrasi	Guam tree snail	S		X			
Plants							
Callicarpa lamii	no common name	R(T)		X	X	X	
Canthium odoratum	no common name	R(T)		X	X	X	
Coelogyne guamensis	orchid	S(G,R)		X		X	
Cyanthea lunulata	tree fern	GE		X			
Digitaria gaudichaudii	bunch grass	R(F)	√		X		X
Enhalus acoroides	no common name	R(T)			X		
Euphorbia sparrmannii	seagrass	R(T)		X	X		
Gossypium hirsutum	seaside cotton	R(F)			X		X
Heritiera longipetiolata	ufa tree	GE		X	X		
Lycopodium phlegmaria	club moss	S(G,R)		X		X	
Nervilia jacksoniae	no common name	S(G,R)		X		X	
Nesogenes rotensis	no common name	C(R)				X	
Osmoxylon mariannense	no common name	C(R)				X	
Serianthes nelsonii	fire tree	E(G,R)		X		X	
Tabernaemontana rotensis	no common name	C(G,R)		*		X	

Note: Information obtained from the Status and Distribution of Marine Turtles on Tinian Report; the Micronesian Forest Bird Survey; the USFWS table of listed, proposed, and candidate species; the Guam Natural Resource Management Plans; the Ornithological and Mammalian Surveys for Tinian; the Final EIS for FDM; the Final Report for Flora and Fauna Survey of Tinian; the Botanical Survey of FDM, the Avifaunal Survey Report of FDM, and a personal communication with USFWS (December 10, 1996).

Appendix D

Fish Kills from the Navy Underwater Mine Detonation

FISH KILL from the Navy Underwater Mine Detonation (Training) on MARCH 6, 1996 at Apra Harbor (LAT 13°27'42"/LONG 144°38'30")		
SPECIES	**QUANTITY**	**SIZE (cm)**
Upeneus taeniopterus (Band-tailed goatfish)	1	24
Lutjanus fulvus	1	8.5
Lethrinus olivaceus (Longnose emperor)	1	16
Gerres argyreus	1	28
TOTAL NUMBER OF SPECIES: 4	**TOTAL: 4**	

GEPA FILE

**Down-time restricts the complete collection of fishes killed.

FISH KILL from the Navy Underwater Mine Detonation on September 20, 1995; Apra Harbor (LAT 13°27'42"/LONG 144°38'30")	
SPECIES	**QUANTITY**
Chaetodon auriga (Threadfin butterflyfish)	1
Cheilodipterus quinquelineata (Five-lined cardinalfish)	1
Dascyllus aruanus (Humbug dascyllus)	2
Stegastes fasciolatus (Pacific gregory)	5
Cheilinus fasciatus (Red-breasted wrasse)	1
Chromis viridis (Blue-green chromis)	2
Amblygobius nocturnus (Nocturn goby)	5
Oplopomus oplopomus (Blue-spotted hole goby)	19
Fusigobus longispinsus (Longspine goby)	2
Stolephorus sp.?	36
Dussumieria sp. B (Sharp-nosed sprat)	3
Leiognathus stercorarius (Oblong slipmouth)	8
Vanderhorstia ornatissima (Ornate prawn goby)	4
Myripristis juv. ?	13
Myripristis juv. ?	1
TOTAL NUMBER OF SPECIES: 15	**TOTAL: 103**

*Photos taken

GEPA FILE

FISH KILL from the Navy Underwater Mine Detonation (TAV) on 12/13/95; Apra Harbor (LAT 13°27'42"/LONG 144°38'30')		
SPECIES	**QUANTITY**	**SIZE (cm)**
Pseudobalistes flavimarginatus (Yellomargin triggerfish)	1	18
Lutjanus fulvus	1	23.5
Lutjanus gibbus	1	22
TOTAL NUMBER OF SPECIES: 3	**TOTAL: 3**	

NOTE: We were unable to collect a number of gobies seen during the dive; species and number of gobies are unknown.

**Down-time restricts the complete collection of fishes killed.

GEPA FILE

FISH KILL from the Navy Underwater Mine Detonation (Training) on MARCH 27, 1996 at Apra Harbor (LAT 13°27'42"/LONG 144°38'30")		
SPECIES	**QUANTITY**	**SIZE (cm)**
Lutjanus bohar	1	51.5
L. gibbus	13	18, 15, 20, 17, 19, 19, 18, 11, 20, 18, 20, 15, 15
Chaetodon auriga	2	14, 15
C. ulietensis	1	9
C. ephippium	1	11
Psuedobalistes flavimarginatus	1	23
Suflamen chrysoptera	2	15, 13
Gerres argyreus	4	19, 20, 21, 22
Parupeneus heptacanthus	1	31
Cheilinus fasciatus	4	22, 13, 13, 12, 28
Epibulus insidiator	1	28
Pomacentrus amboinensis	8	9.5, 9.5, 7, 10, 8.5, 8.5, 9.5, 8
Lethrinus olivaceus	5	17.5, 22, 21, 24.5, 23.5
L. harak	3	21, 22, 24.5
L. obsoletus	1	29.5
Neoniphon sammara	11	11, 13, 12, 13.5, 9.5, 13.5, 10.5, 14, 13, 12, 13
Family: *Holocentridae* (sp.?)	2	13, 14
Family: *Holocentridae* (sp.?)	1	11
Caesio caerulaurea	13	19, 14, 14, 17, 17.5, 15, 15.5, 16.5, 15.5, 17.5, 18, 18, 14
Ptereleotris (sp?)	1	19.5
Total species: 20	**Total: 76**	

GEPA FILE

**Photos taken of collected fishes **Down-time restricts the complete collection of fishes

Appendix E

COMNAVMARIANAS Instruction 5090.7 - Underwater Detonation of Explosives In and Around Apra Harbor

RETURN TO PACIFIC CENTRAL FILES

DEPARTMENT OF THE NAVY
U.S. PACIFIC FLEET
COMMANDER U.S. NAVAL FORCES MARIANAS
FPO AP 96536-0051

IN REPLY REFER TO:
COMNAVMARIANAS
INST 5090.7
N45
05 APR 1994

COMNAVMARIANAS INSTRUCTION 5090.7

Subj: UNDERWATER DETONATION OF EXPLOSIVES IN AND AROUND GUAM

Ref: (a) OPNAVINST 5090.1A
(b) USCINCPAC REP GUAM/CNMI/FSM/ROP//COMNAVMARIANAS INST 5400.1B
(c) COMSEVENTHFLT OPORD 201 (Tab J to APP 16 to Annex C)
(d) NOAA MD ltr of 27 Aug 93, Subj: Biological Opinion
(e) Guam EPA ltr of 24 Nov 93, Clearance for explosive for ship repairs

Encl: (1) Underwater Detonation Request Format
(2) Underwater Detonation Process Flowchart
(3) Statement Regarding Incidental Taking under Endangered Species Act

1. Purpose. To outline specific responsibilities and establish policy for coordination of underwater detonation of explosives in and around Guam.

2. Background. As established in references (a) and (b), COMNAVMARIANAS is responsible for coordinating activities among various naval commands on Guam, including activities conducted by the Navy in Apra Harbor. In addition, COMNAVMARIANAS serves as the regional environmental coordinator and assists commands in obtaining permits for various activities that might adversely affect the environment including endangered plants and animals. In accordance with reference (c), COMNAVMARIANAS provides local concurrence prior to COMSEVENTHFLT approval of underwater detonations within the regional Area of Responsibility (AOR).

3. Policy. The underwater detonation of explosives in Apra Harbor or in waters surrounding Guam will only be undertaken per the guidance provided in this instruction and then, only if consistent with the Navy's environmental policy and the Endangered Species Act provisions contained in reference (d). It is essential for continued operations and training that the various conservation recommendations, as well as reasonable and prudent measures, be taken to reduce adverse effects, which explosive charges may have on endangered or threatened species and water quality.

4. Exceptions. The sole exceptions to this policy will be diver recall charges [NALC I.378 (M-80)] and EOD underwater Shock Wave Action Generator (SWAG) countercharges. Use of either of these charges containing less than ten grams of net explosive weight

RETURN TO PACIFIC CENTRAL FILES

4. Exceptions. The sole exceptions to this policy will be diver recall charges [NALC L378 (M-80)] and Explosive Ordnance Disposal (EOD) underwater shock wave action generator (SWAG) countercharges. Use of either of these charges containing less than ten grams of net explosive weight will not require prior permission as they are used to recall divers to the surface, and in countering limpet mines attached to ship hulls and/or piers, and do not pose a significant threat to endangered or threatened species or detrimental effect on water quality.

5. Pre-Existing Certification. Reference (e) provides water quality certification to Naval Ship Repair Facility for use of explosives when necessary for propeller removal. Reference (e) delineates conditions and required Environmental Protection Agency (EPA) notifications required for this specific utilization of explosives.

6. Responsibilities

a. Naval Station (NAVSTA), Guam. The Commanding Officer, as host for various tenant commands, will be responsible for applying for environmental permits and providing necessary notifications, as required, to federal and Government of Guam agencies, e.g., National Marine Fisheries Service (NMFS), Guam Environmental Protection Agency (GEPA), Guam Department of Agriculture, Division of Aquatic and Wildlife Resources (DAWR), etc., for proposed detonation of explosives in the waters surrounding Guam including Apra Harbor. COMNAVMARIANAS will be responsible for permits and coordination of underwater explosives in other areas in the AOR.

b. Requesting Activity. The activity, which requires the underwater detonation of explosives, is responsible for requesting permission from local and federal agencies via NAVSTA Guam and from COMSEVENTHFLT directly. Additionally, the requesting activity is responsible for ensuring area safety and security during the evolution, and meeting the reporting and other requirements outlined in reference (d).

7. Action

a. Commanding Officer, NAVSTA Guam will coordinate with local officials for all underwater detonation requests and permits involving Apra Harbor, and the surrounding waters of Guam as stated in paragraph 6a above.

b. Requesting activities will:

(1) Initiate underwater detonation of explosives requests by completing enclosure (1), and submitting it to NAVSTA Guam no later than 30 days prior to the intended date of detonation.

(2) Provide military divers, and other personnel (e.g., security watches, guards, roving patrols, etc.) as necessary, to assess the presence of non-military divers and endangered marine life in the vicinity of intended detonation site prior to any detonation of explosives. Additionally, they will assist GEPA personnel in determining the number of fish kills, and whether sea turtles were killed/maimed as a result of the explosion, when requested.

(3) Coordinate with the U.S. Coast Guard to ensure adequate security support is provided.

(4) Submit underwater detonation of explosives request messages to COMSEVENTHFLT as required by reference (c).

(5) Conduct underwater detonation of explosives following the process outlined in enclosure (2).

(6) Assist NMFS, GEPA, Guam Department of Agriculture, and DAWR in assessing the impact of underwater detonations on indigenous marine life. In the event the endangered sea life are injured or killed, enclosure (3) will be used to assist with required notifications. Notify the Commanding Officer, Naval Station, Guam and COMNAVMARIANAS, Code N4, immediately.

(7) Retrieve, preserve, and forward via proper export/import permit any killed endangered sea life as required by enclosure (3).

(8) Provide public affairs information, including draft press releases, that might be necessary for notification of the public regarding detonations and related activities.

(9) Ensure appropriate Notice to Mariners, Broadcast Notice to Mariners, and Notice to Airmen are issued prior to detonation.

E. R. KRISTENSEN

Distribution:
USCINCPAC REP GUAM/CNMI/FSM/ROP//
COMNAVMARIANAS JOINT INST 5216.1L
List I (1 copy ea.)
List II

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COMNAVMARIANASINST 5090.7

05 APR 1994

UNDERWATER DETONATION REQUEST FORMAT

From: Requesting activity
To: Commanding Officer, U.S. Naval Station, Guam

Subj: UNDERWATER DETONATION REQUEST

Ref: (a) COMNAVMARIANASINST 5090.7

Encl: (1) Detailed Inner Apra Harbor Survey Plan (Written plan which outlines details of intended training evolution. A sample is provided.)

1. Per reference (a), representation is requested to the Guam Environmental Protection Agency (GEPA) for all necessary permits to authorize an underwater detonation of an (less than 2 pounds, 10 pounds or 20 pounds) explosive charge on (date) as part of our Mine Countermeasures (MCM) training at (area where detonation is planned to take place) in a depth of XXX feet of water. Purpose of detonation is for (training, blasting, EOD disposal, etc.).

2. A baseline survey of this area was conducted on (date) and the area was found to consist of (type of bottom-sand, coral, mud). Further, no protected species of hawksbill or green sea turtles have been observed by divers who conducted an area search.

3. Desire to commence using explosives on (date) using the detailed plan outlined in enclosure (1).

4. My point of contact is xxxxxxxxx, (671) 339-yyyy.

Signed

Copy to:
COMNAVMARIANAS (N45)

COMNAVMARIANASINST 5090.7

05 APR 1994

Detailed Inner Apra Harbor Survey Plan

1. All underwater explosive detonations scheduled to take place in Inner Apra Harbor area will be conducted as outlined in the attached flowchart and as follows:

a. Prior to commencing operations, a general boat sweep will be conducted around the intended detonation site. This sweep will consist of a spiraling circular pass from the intended site out to approximately 100 yds. In addition to the boat coxswain, two observers will look for turtles in the operating area.

b. Next a preliminary dive will be conducted at the intended detonation site to determine the existence of turtles/schools of fish. An EOD Diver will be available to assist GEPA to liaison with the Demolition Supervisor and assist in Communications.

c. Absent any turtles/schools of fish, civilian divers, or waterborne craft in the immediate vicinity and an explosive charge not to exceed two pounds will be placed in no more than 40 feet of water. If turtles are present, all operations will cease until the area is clear. Prior to initiating the main explosive charge, a hand thrown diver recall scare charge will be thrown in the general vicinity to scare away fish.

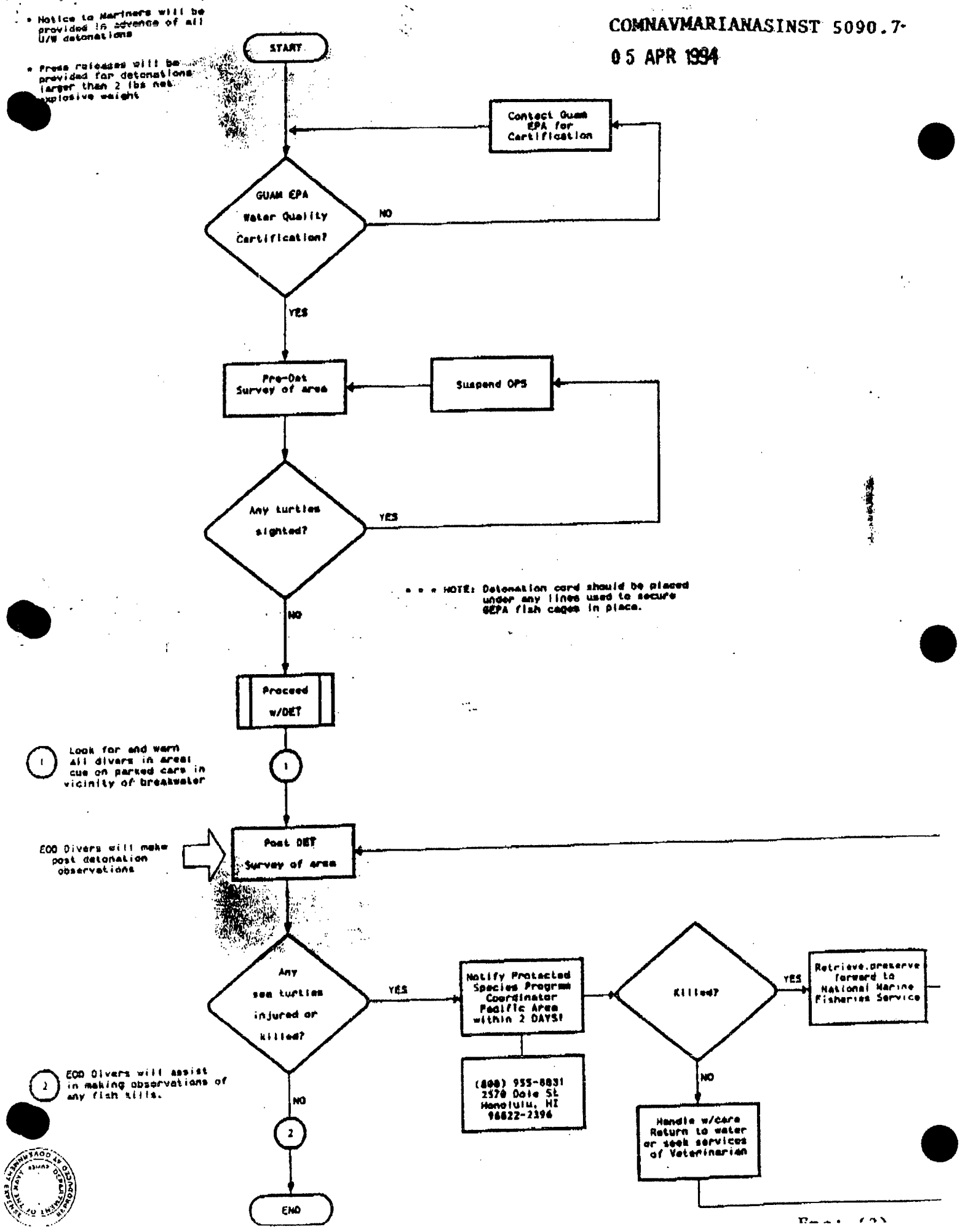
d. Another area sweep will be conducted via boat following placement of the charge to ensure no turtles are present. If no turtles are present, and all monitoring activities are in place, an all clear signal will be given, the boat will exit to a safe standoff distance and three loud "FIRE IN THE HOLE" exclamations will be made just prior to detonating the charge.

e. While preparing for the verification dive, and as part of the 30 minute waiting period, the boat will transit the area and look for signs of injured or dead turtles/marine life. If any are found, they will be turned over to DAWR for forwarding to the National Marine Fisheries Service.

f. During the verification dive, made to ascertain the effectiveness of the explosive charge, divers will scan the area for any signs of sea turtles or fish kills. A Navy Dive team will assist GEPA by making and collating observations of any fish kills (noting general numbers of fish killed).

2. A request will always be made to the United States Coast Guard to provide perimeter security services. When provided, these assets will also be used to conduct surface searches prior to, and following the detonation of the explosive charges.

3. The mine will be floated and towed to Polaris Point for beaching and recovery, avoiding shoals and coral formations.


• Notice to Mariners will be provided in advance of all U/W detonations
• Press releases will be provided for detonations larger than 2 lbs net explosive weight
START
Contact Guam EPA for Certification
GUAM EPA Water Quality Certification?
NO
YES
Pre-Det Survey of area
Suspend OPS
Any turtles sighted?
YES
NO
• • • NOTE: Detonation cord should be placed under any lines used to secure GEPA fish cages in place.
Proceed w/DET
1
Look for and warn all divers in area! cue on parked cars in vicinity of breakwater
Post DET Survey of area
EOD Divers will make post detonation observations
Any sea turtles injured or killed?
YES
NO
2
EOD Divers will assist in making observations of any fish kills.
Notify Protected Species Program Coordinator Pacific Area within 2 DAYS!
(808) 955-8831
2570 Dole St
Honolulu, HI
96822-2396
Killed?
YES
NO
Retrieve,preserve forward to National Marine Fisheries Service
Handle w/care Return to water or seek services of Veterinarian
END

COMNAVMARIANASINST 5090.7

05 APR 1994

Statement Regarding Incidental Taking
Pursuant to Section 7(b)(4) of
the Endangered Species Act of 1973, as amended

Section 7(b)(4) of the Endangered Species Act requires that when a proposed agency action is found to be consistent with Section 7(a)(2) of the Act and the proposed action may incidentally take individuals of listed species, NMFS will issue a statement that specifies the impact (amount or extent) of such incidental taking. It also states that reasonable and prudent measures be provided that are necessary to minimize such impacts. Incidental taking by the federal agency or applicant that complies with the reasonable and prudent measures of this statement is authorized and exempt from the taking prohibition of the ESA.

The available information indicates that incidental taking of listed sea turtles may occur as a result of mine warfare training conducted by the U.S. Navy in Apra Harbor. However, there are no data on the anticipated level of incidental take from these exercises.

On the basis of the best available information which includes reports of confirmed nesting activity by hawksbill turtles in Apra Harbor, sightings of green turtles within the proposed training area and information on the abundance and distribution of these two species around Guam and the northern Mariana Islands, an incidental take by harassment of listed sea turtles is authorized at 10 individuals per year. Of those 10 authorized takes by harassment, only one injury or mortality of listed sea turtle is authorized per year.

If the authorized level of take is met or exceeded, or if mortalities or serious injuries exceed the authorized levels, then consultation must be re-initiated and further conservation measures may be imposed.

Reasonable and Prudent Measures

The following reasonable and prudent measures must be implemented to allow training activities proposed by Explosive Ordnance Disposal Mobile Unit Five (EODMU FIVE) in Apra Harbor. These measures are necessary to monitor and minimize impacts on endangered and threatened sea turtles:

(1) All mine warfare training operations must be monitored to insure that the potential for injury or mortality of green or hawksbill turtles is reduced or eliminated. If turtles are sighted within the training area, activities involving detonation of explosive charges must be suspended until the animals have left the area. During placement, detection, detonation and disposal of the practice munitions, the site must be surveyed for the presence of sea turtles. A detailed survey plan, including pre-detonation and post-detonation surveys for turtles, must be submitted to the Protected Species Program Coordinator, Pacific Area Office, Southwest Region (Tel. (808) 955-8831, 2570 Dole St., Honolulu, HI 96822-2396) at least two weeks prior to the first exercise.

(2) If any listed sea turtles are injured or killed during these exercises, notification must be made to the Protected Species Program Coordinator, Pacific Area Office, Southwest Region (Tel. (808) 955-8831, 2570 Dole St., Honolulu, HI 96822-2396) within two working days. Consultation will be re-initiated at that time as appropriate.

(3) Any sea turtle killed during the conduct of training activities must be retrieved, preserved and forwarded with the proper export/import permits to the NMFS for necropsy and further evaluation. Any sea turtle injured during training must be handled with due care to prevent further injury, observed for activity, resuscitated if necessary, and returned to the water, or retained for treatment by an authorized veterinarian as appropriate.

(4) The U.S. Navy must provide annual reports on the results of the training exercises conducted for the previous calendar year by 31 January of the following year. Copies of the report should be forwarded to the Protected Species Program Coordinator, Pacific Area Office, Southwest Region (Tel. (808) 955-8831, 2570 Dole St., Honolulu, HI 96822-2396) and the Guam DAWR. The reports should include the number of exercises conducted, number, type and weight of charges detonated, and the number and species of sea turtles observed, disturbed, injured or killed.

Conclusion

Based on the available information, NMFS concludes that the proposed relocation of U.S. Navy and U.S. Air Force activities from the Philippines to Guam and facilities development associated with the transfer of activities will not jeopardize the continued existence of endangered hawksbill turtles (Eremochelys imbricata) or threatened green turtles (Chelonia mudas) that may be found associated with Guam or the Marianas Archipelago. However, NMFS concludes that the training proposed for EODMU FIVE may adversely affect hawksbill and green sea

turtles. Due to the uncertainty in the number of sea turtles during an exercise, the determination of an allowable incidental take must be conditioned to trigger re-initiation of consultation at low levels of mortality and/or injury.

Conservation Recommendation

The following conservation recommendation is provided pursuant Section 7(a)(1) of the ESA to assist the Navy in reducing adverse impacts to listed species within the Apra Harbor project site:

EODMU FIVE should notify the Guam DAWR sufficiently in advance of each exercise so that they may have the opportunity to monitor the proposed activities for potential adverse effects to listed sea turtles.

Appendix F

The Brown Tree Snake (BTS) Control/Interdiction Plan
for Military Training Exercises

Brown Tree Snake (BTS) Control/Interdiction Plan for Military Training Exercises

Prepared by:
Commander U.S. Naval Forces Marianas
Facilities & Environment, N45

1 October 1996

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BROWN TREE SNAKE (BTS) CONTROL PLAN

1 October 1996

This plan provides brown tree snake (BTS) control requirements to those responsible for cargo handling, and inspection and cleaning of vehicles, equipment and supplies as well as ships and aircraft involved in military training exercises that emanate or transhipthrough Guam

I. Introduction.

A. Purpose: The purpose of BTS inspection and control is to prevent the spread by inadvertent transportation of the BTS from Guam to other areas of the world. Emphasis is placed on those areas most at risk from Guam training activities, including the Commonwealth of the Northern Mariana Islands (CNMI), Hawaii and other snake-free Pacific Islands.

B. Background Information

1. The U.S. military trains routinely on Guam and the CNMI. Deployments for training on Guam and the CNMI can occur from virtually anywhere. Once on Guam, military units must take special precautions to prevent the inadvertent introduction of the BTS to other snake-free areas. This could result in an ecological disaster similar to that on Guam that has caused the loss of most of its native bird species. This could also hamper future training activities emanating or transiting through Guam.

2. Department of Defense (DoD) has supported BTS control efforts in a number of ways. In 1993, the DoD entered into a Memorandum of Agreement (MOA) with the U.S. Department of the Interior (DOI), U.S. Department of Agriculture (USDA), the Government of Guam (GovGuam) and the State of Hawaii, and developed cooperative efforts to participate and pursue BTS research, control, inspection and eradication efforts. A copy of the MOA is attached as enclosure (1).

II. Responsibilities.

The following categorized responsibilities provide a foundation for required action by certain agencies or individuals involved with the military training exercise and BTS control/interdiction program.

A. DoD: Enclosure (1) cites DoD's general responsibilities and commitment to BTS control.

B. Headquarters or Highest Operational Command: When lower echelon commands need upgraded manpower requirements for inspection and control requirements, this level of command should be consulted for support.

C. Shore Installation Commanders:

1. As land and facility managers and when deemed appropriate and necessary, establish snake sterile zones for staging of equipment and cargo. Assistance and support can be provided by the USDA, Animal Damage Control (ADC).

2. Coordinate all cargo handling procedures for cargo departing Guam with USDA/ADC personnel. Cargo handlers and/or managers will be required to work closely with USDA/ADC personnel to ensure an effective BTS control and inspection process is achieved.

D. Commander of On-Site Deployed Command:

1. Schedule BTS control briefings by USDA or Military Inspectors (MI) for members involved in the deployment. The MI may be those DoD members involved with cargo management, handling, and transportation at military shipping and aircraft ports on Guam.

2. Coordinate with on-site contacts to obtain wash down facilities and inspections. If no facilities available, exercise planners should plan for and provide for units wash down equipment.

3. Develop unit plans for wash down operations of equipment and vehicles.

4. Certify vehicles and equipment have been properly cleaned prior to transportation off Guam.

E. USDA/ADC:

1. Provide BTS qualified ADC specialists in appropriate numbers to cover military exercises.

2. Provide all pre- and post- training operations BTS trappings (includes required maintenance, placement, etc.).

3. Provide all pre- and post- training operations BTS fence line/jungle BTS spotlight searches.

4. Provide handling/scheduling of detector dog use at all identified shipping and aircraft ports on Guam.

5. Assist in establishment of cargo containment areas and sterile areas.

6. Make available detector dogs and handlers to assist military inspections of surface and air cargo.

7. Identify and purchase (if unavailable for loan through military) necessary tools, materials and equipment.

F. National Biological Survey (NBS): Provide technical support for issues regarding BTS control.

G. Military Inspectors (MI): Local MI responsible for cargo transportation or inspection will be expected to work closely with ADC personnel to execute BTS control and interdiction with cargo. The inspection of cargo by the MI must coincide with ADC control measures, i.e., detector dog use. Documentation of inspections shall be maintained by the military transporters or inspectors at the shipping and aircraft ports on Guam.

III. Control, Cleaning and Inspection Procedures.

A. Risk: The possibility of the inadvertent importation of the BTS to other areas of the world is always present whenever military units emanate or transit through Guam. BTS is a heat sensitive nocturnal snake that will seek shelter during the heat of the day in any area that offers shade, including CONEX boxes, shipping crates, pallets, vehicles, personal gear, as well as aboard aircraft and naval vessels. The snakes's ability to go without food for extended periods of time allows them to survive long voyages or flights undetected. Cargo and material may be categorized into the following levels of risk in terms of containing or housing a BTS:

1. Low Risk. Material originating off island and on Guam only during daylight hours or within sterile areas during nighttime hours.

2. Moderate Risk. Material on island for several days or more and exposed to entry by snakes due to use or storage outside snake sterile areas.

3. High Risk. Material originating from Guam, stored for extended periods, or in regular use.

B. BTS Control Measures on Guam:

1. During a scheduled DoD training exercise involving the shipment of military personnel and associated cargo off island via ship (Apra Harbor) and/or aircraft (Andersen AFB), USDA/ADC will provide BTS control support to military. This support will include those arrangements associated with the identification and purchase of BTS control tools, materials, and equipment needs. ADC will provide available personnel and trained detector dogs throughout the exercise on Guam. To ensure BTS control continues, ADC will rely on a close working relationship with military cargo managers and appropriate Installation Commanders.

2. Prior to exercise, ADC will intensify BTS trapping in sterile areas and aircraft staging areas on Guam. These areas shall include up to 500 meters from the established sterile areas and transport crafts. Night spotlight searches will be conducted in the same areas to further reduce BTS when they are most

active.

C. BTS Control Procedures at Tent City:

1. USDA/ADC should be consulted in establishing the most favorable locations for tent facilities based on low risk areas.

2. Surrounding the immediate vicinity of temporary lodging quarters on Guam, ADC will activate and monitor BTS traps. Traps will be placed at strategic locations suspected of attracting snakes.

3. Particular caution shall be exercised during breakdown and re-packing of tent facilities.

D. BTS Control Procedures in Tinian or Other Off-Island Locations for Major Training Exercises:

1. Prior to the arrival of the first military cargo from Guam, ADC will have an established working relationship with the local wildlife and quarantine officers. As part of a BTS prevention operation, ADC will identify, purchase, and arrange for transport or BTS control tools and materials prior to the training exercise. ADC will coordinate and train assisting local wildlife and quarantine personnel to provide coverage during the exercise.

2. Additional traps will be made available by USDA/ADC and activated throughout the training exercise if deemed necessary. Traps will be deployed prior to arrival of inbound traffic from Guam and shall be maintained for an appropriate amount of time after the exercise. Some of the traps will be at drop zones and port of entry. Established take-off zone(s) will also have traps activated. Additional BTS traps shall be made available for contingency and in case a BTS is sighted.

E. Cleaning Procedures:

1. It is the responsibility of the training unit to clean vehicles and heavy equipment prior to staging in a designated sterile/containment area and prior to transportation off Guam. High pressure cleaning may facilitate the removal of BTS from vehicles and equipment.

2. The following commands may be contacted to provide cleaning facilities and staging support:

(a) Andersen AFB Vehicle Operations: 366-2239, 24 hours, 7 days per week.

(b) Naval Activities, Guam (NAVACTS GU), Staff Civil Engineer Office (SCE), Code N50, 339-7053; NAVACTS GU Ordnance Annex Transportation, 339-7210; and Camp Covington, Battalion Washrack, Operations Chief, 339-7171.

(c) Ship Repair Facility, Guam (SRF GU) SCE, Code 400: 339-2167/2066.

(d) USDA/ADC for information on snake sterile areas: Andersen AFB Office: 366-3261; Barrigada Heights District Office: 635-4400; and NAVACTS Office: 564-3900.

F. Inspection Procedures on Guam:

1. ADC will assist DoD personnel in the establishment of a loading zone where all outgoing cargo (including cargo off-loaded and then reloaded) can be staged and inspected. Working closely with the military, and when deemed appropriate, ADC will search all cargo using trained detector dogs. High-risk equipment/materials may be subject to detector dog inspections, breakdown, fumigation, or staging in sterile containment areas. Any containerized cargo suspected of housing a BTS will be opened by the military. Interior contents will be further inspected to verify and remove any discovered BTS. Personal gear and other hand-carried equipment and supplies will be staged in established sterile containment areas and inspected when appropriate. High-risk materials subject to thorough inspection may be adjusted to a lower risk category once inspected and staged in a sterile area.

2. For the purpose of maintaining open lines of communication, DoD will provide ADC names of military contacts at shipping/airport facilities. ADC will keep these DoD designated contacts abreast of BTS related activities. To assist with the scheduling of inspections, ADC would request within reason, that some form of notification be provided when unscheduled changes/delays occur.

G. Inspection Procedures at Tent City:

1. Detector dogs will be walked through the area periodically while troops are being stage before departure.

2. Prior to departure off-island, military personnel shall check all of their personnel belongings thoroughly for snakes. DoD will brief military personnel associated with the training exercise on the concerns of BTS as they arrive. As time allows, ADC will assist designated DoD personnel with BTS orientation.

H. Inspection Procedures on Tinian, CNMI or Other Off-Island Locations:

1. Temporary structures shall be erected in drop zone(s) and port of entry cargo off-load area(s) to enhance snake detection when deemed necessary. Floodlights will be provided by the military to assist ADC and wildlife and/or customs officer with night inspections while personnel/cargo off-loading is taking place.

2. Nights when inbound traffic is arriving, ADC and military will coordinate spotlight search of areas in close proximity to established off-load and breakdown locations. Visual checks of these areas should be conducted periodically. The military shall place emphasis on visual inspections during all cargo off-load and breakdowns.

IV. <u>Guidelines for BTS Sighting During Military Operations</u>.

A. BTS Sighting on Guam: During military operations on Guam, USDA/ADC will be the primary point of contact in the event of a BTS sighting. Do not attempt to capture and/or disturb the snake. If the presence of a BTS is suspected and/or visually sighted, immediately contact your local ADC office as follows:

- Andersen AFB K9 Office: 366-3261
- USDA/ADC Guam District Office Barrigada Heights: 635-4400
- USDA/ADC, NAVACTS Office: 564-3900

1. Any sighting of snakes by the military shall be reported immediately to the chain of command. Unit or Group Commanders will immediately notify ADC personnel and local wildlife and quarantine personnel.

2. DoD shall assist ADC and local officials in the interdiction of snakes when requested by USDA/ADC and local officials.

3. If a BTS is suspected of being housed in cargo or equipment, a military official shall open the container to allow thorough inspection by USDA/ADC personnel or detector dog(s).

4. Once notified, USDA/ADC will dispatch either personnel or BTS detector dogs to the vicinity of a sighting.

B. BTS Sighting on Tinian, CNMI or other Off-Island Location: During a military training exercise on Tinian, CNMI or other off-island location, the local natural resource agency shall be the primary point of contact:

- Tinian, CNMI: Division of Fish and Wildlife
  CNMI Government
  Saipan, MP 96950
  Telephone: (670) 322-9627/8
  FAX: (670) 322-9629

To obtain points of contact for other locations in the Pacific, call:

USDA/ADC
Guam District Office
Telephone: (671) 635-4400
FAX: (671) 635-4401

1. If a BTS is seen or suspected, the unit's chain of command shall be immediately notified. The Unit Commander or Officer in Charge shall immediately notify the local wildlife official, USDA/ADC Guam District Office and USCINCPAC REP Guam Command Center at (671) 349-5235/6.

2. If a snake is sighted, care should be taken not to be bitten. A BTS is only mildly toxic; however, a snake spotted on other Pacific Islands may be of the more dangerous, venomous species. If a person is bitten by a snake, the snake should be killed and, if possible, kept refrigerated, or frozen, or placed in alcohol, until it can be turned over to the proper natural resource agency or health official.

3. Notification procedures of a snake sighting should be considered an integral part of any training deployment plan.

4. If deemed necessary, USDA/ADC will make special arrangements to airlift a detector dog and handler to off-island location where the suspected BTS is sighed during a military training exercise.

5. USDA/ADC or local wildlife officials, when notified by military, of a BTS sighting, shall respond immediately by visual inspection and BTS traps, if deemed appropriate.

OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, DC 20301-3000

ACQUISITION

Honorable Allen Stayman
Deputy Assistant Secretary
Territorial and International Affairs
10th and C Streets, NW
Washington, DC 20240

12 AUG 1993

Dear Mr. Stayman:

Enclosed are four signed copies of the "Memorandum of Agreement (MOA) Among the U.S. Department of Interior, U.S. Department of Defense, U.S. Department of Agriculture, Government of Guam, and the State of Hawaii" regarding the Brown Tree Snake. We have retained one copy for our files.

The Director of the Armed Forces Pest Management Board is designated as the DoD Project officer to coordinate military obligations in the MOA. Captain Herbert Bolton, MAC, USN, currently holds that position.

We look forward to the continued progress that can be obtained through this MOA in containing and preventing the spread of the Brown Tree Snake. We also look forward to results that we can obtain with you through our Department's participation on the Brown treé Snake Control Committee under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 Task Force.

If you have questions, please call Captain Bolton at (301) 427-5191.

Very truly yours,

Sherri Wasserman Goodman
Deputy Under Secretary of Defense
(Environmental Security)

Enclosures: (4)

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

TAKE PRIDE IN AMERICA

JUL 19 1993

The Honorable Sherri Wasserman Goodman
Deputy Under Secretary of Defense
(For Environmental Security)
The Pentagon - 3D833
U.S. Department of Defense
Washington, D.C. 20301-4000

Dear Ms. Goodman:

Enclosed please find the modified "Memorandum of Agreement Among the U.S. Department of the Interior, U.S. Department of Defense, U.S. Department of Agriculture, Government of Guam, and the State of Hawaii" regarding the Brown Tree Snake.

As you are aware, this modification has been jointly development by the parties involved in the original agreement, with additional inputs from the U.S. Department of Agriculture and State of Hawaii. We sincerely appreciate the comments and suggestions provided by your office at the start of the process.

If you concur, please sign all five copies. Retain one copy for your files, and please return the remaining four signed copies to my office.

Please call me if you have any questions.

Sincerely,

Allen Stayman
Deputy Assistant Secretary
Territorial and International Affairs

Enclosures (5)

APHIS AGMT. NO:
12-34-73-2241-MU

MEMORANDUM OF AGREEMENT
Among
U.S. Department of the Interior
U.S. Department of Defense
U.S. Department of Agriculture
Government of Guam
State of Hawaii

I. BACKGROUND:

The brown tree snake (Boiga irregularis), presumably introduced to Guam by post-World War II cargo movements, has produced a variety of ecological, technical, and socioeconomic problems on Guam. In the near future snakes colonizing other Pacific Islands as a result of military and civilian traffic from Guam may greatly magnify the problems caused by this snake.

To continue to address this problem an intensive and coordinated effort aimed at dealing with snakes in a broad spectrum of situations would:

- control and eradicate snakes in agricultural, port, and urban situations;
- prevent the spread of the snakes to any other area through strong airport and seaport inspection programs;
- protect endangered species on military and civilian lands.

II. PARTICIPANTS:

This AGREEMENT is hereby made and entered among: Department of the Interior, (hereinafter referred to as "Interior"); Department of Defense, (hereinafter referred to a "Defense"); Department of Agriculture, (hereinafter referred to as "Agriculture"); the Government of Guam, (hereinafter referred to as "Guam"); and the State of Hawaii (hereinafter referred to as "Hawaii").

III. FEDERAL AUTHORITY:

This AGREEMENT is written under the authority of Public Law 86-797, the Sikes Act (16 U.S.C. 670a-o); Public Law 97-304, the Endangered Species Act and amendments of 1982 (16 U.S.C. 1531, et seq); Public Law 85-624, the Fish and Wildlife Coordination Act as amended (16 U.S.C. 661); the Animal Damage Control Act of 1931 as amended (7 U.S.C. 426); the Law on Territorial and Insular Possessions (48 U.S.C.); the Nonindigenous Aquatic Nuisance Prevention and Control Act (16 U.S.C. 4701-4741); and the FY 1992 Farm Bill, as amended.

IV. PURPOSE AND OBJECTIVES OF AGREEMENT:

This AGREEMENT is made for the purpose of establishing a working relationship among Interior, Defense, Agriculture, Guam, and Hawaii to facilitate pilot inspection, control, and research programs and other activities allowing control or elimination of

brown tree snakes on Guam, and prevention of the transport of brown tree snakes to any other areas. All signatory parties have a vested interest in reducing the damages caused on Guam, minimizing the threat to endangered species, and protecting other U.S. insular areas from the harmful pest species.

V. TERMS OF AGREEMENT:

This AGREEMENT shall become effective upon signature by all parties. It shall remain in force for five (5) years at which time the cooperative program will be reviewed, and may be extended upon mutual consent.

VI. REIMBURSEMENTS AND COST CEILINGS:

By joining in this AGREEMENT all parties are acknowledging the importance of brown tree snake control in the Pacific Region and the need for cooperative efforts to solve the resultant problems. Signatory parties may provide and transfer funding to cover the costs of such research, control, inspection or eradication efforts between themselves without being subject to overhead or other indirect costs. Nothing in this Agreement commits any signatory to present or future funding amounts. To date all parties to the agreement have contributed research funds.

VII. ANNUAL MEETING:

The Project Officers of the cooperating parties will meet annually during the first quarter of each fiscal year to determine objectives for the coming year, the amount of funding needed for those and future efforts, and the appropriate sources of funding for conducting necessary work.

VIII. TRANSFER OF FUNDS:

Efficient and effective implementation of research and control efforts pursuant to this Agreement requires that funding for each Fiscal Year be identified and made available at the beginning of each year or as soon as possible to avoid any interruption of work.

IX. MUTUAL CONSENT:

Each party agrees to cooperate with the other parties and fulfill their obligations as herein provided. All parties agree to full cooperation in development, coordination and implementation of present and future plans regarding research and eradication of the brown tree snake in Guam. Any of the parties may fund or directly initiate necessary research and control efforts if funds and qualified personnel are available. Research results shall be disseminated when they become available and each party reserves the right to publish or distribute results in any manner deemed appropriate.

X. SPECIFIC OBLIGATIONS OF THE PARTIES:

A. INTERIOR OBLIGATIONS:

Interior, in cooperation with the other signatory parties, shall assume the lead responsibility for disseminating information and training of personnel within U.S. affiliated insular governments, and in encouraging the development of control and elimination techniques, including those necessary to prevent dispersal of snakes to other islands as a result of civilian and military traffic and commercial and non-commercial carriers. Specific obligations include, but are not limited to:

1. Designating a Project Officer from the Office of Territorial and International Affairs with responsibilities for coordinating activities associated with the snake program and representing Interior in coordination meetings.

2. Seeking future funds, as appropriate, to reduce the impact of snakes on Guam and control dispersal to the other areas, in keeping with past performance of providing funds for the pilot control and research program for Fiscal Years 1990, 1991 and 1992.

3. Distributing appropriated funds as needed to various agencies and governments. Guam will

receive no less than 15% of amounts appropriated for brown tree snake control and inspection during the period of this AGREEMENT.

4. Coordinating the annual meeting, described in paragraph VII above, and coordinating current program year reviews and meetings, as required.

5. Assisting in developing informational brochures, educational programs, and other instructional materials for use by Federal, state, insular and local governments.

6. Taking the lead in conducting the research needed to allow control or elimination of the brown tree snake on Guam by:

   a. Designating a Principal Investigator from Region 8 (Research), Fish and Wildlife Service, to lead research pursuant to this AGREEMENT and provide technical guidance, including technical meetings as required, for the cooperating entities.

   b. Designating a Project Officer from Region 1 (Pacific Islands Office), Fish and Wildlife Service (FWS), for coordinating activities on Guam and the Pacific Islands among FWS, Interior, Defense, Hawaii and Agriculture.

7. Making arrangements for FWS researchers and cooperating scientists to conduct field and laboratory studies pursuant to this AGREEMENT.

8. Providing annual progress and final reports on all research conducted in fulfillment of this AGREEMENT.

B. DEFENSE OBLIGATIONS:

Defense, in cooperation with the signatory parties, shall assume the lead in promoting and supporting studies to develop control techniques for the brown tree snake in military situations on Guam and to prevent dispersal in military traffic to other Pacific islands. Specific obligations include, but are not limited to:

1. Designating a Project Officer with responsibilities for coordinating with the designated project and research personnel of cooperating entities.

2. Providing financial or logistical support, subject to availability, for control and research or perform pilot control and research programs as necessary.

3. Continuing use of military customs inspection program to insure inspection of military cargo areas, military aircraft, cargo, and vessels to prevent import and export of the brown tree snake.

4. Facilitating access for responsible personnel of the cooperating parties to enter military lands on Guam to conduct control and research projects on the brown tree snake pursuant to this AGREEMENT.

5. Exchanging information with cooperating parties on the incidents of snake movements in military traffic and information appropriate to defining the risk of future movement within limits imposed by security and military information protocols.

6. Assist in producing informational brochures and other educational material for military and civilian personnel within Defense and providing training for controlling the brown tree snake in military situations on Guam and preventing its dispersal in military traffic to other areas.

C. AGRICULTURE OBLIGATIONS:

Agriculture shall assume lead responsibility for the development and implementation of appropriate brown tree snake control and develop an inspection program in cooperation with the other parties to this AGREEMENT. Specific obligations include, but are not limited to:

1. Designating a Project Officer with responsibilities for coordinating activities associated with the brown tree snake program.
2. Providing funds, subject to availability, for control research, inspection and other associated projects, as determined by Agriculture as necessary, for snake control.
3. Cooperating in planning and implementation of a brown tree snake control program on Guam in concert with Interior, Defense, Guam and Hawaii.
4. Making arrangements for Agriculture biologists, support technicians and collaborators, and cooperating scientists to conduct field work trials pursuant to this AGREEMENT.
5. Assisting in developing informational brochures, educational program, and other instruction materials for use by Federal, state, insular and local governments.

D. GUAM OBLIGATIONS:

Guam shall assume lead responsibility for specific on-island control and inspection research, and other efforts required to establish pilot control and localized elimination programs of the brown tree snake. Specific obligations include, but are not limited to:

1. Designating a Project Officer with responsibilities for coordinating on-site activities with the designed project and research personnel of the cooperating entities.
2. Developing specific plans for the use of funds provided for on-island control research, and pilot control and elimination programs, with concentration on the civilian airport and seaport areas.
3. Providing locally appropriated funds for research, control and inspection, and perform research, control and inspection efforts determined necessary by the entities.
4. Facilitating access for responsible personnel of the cooperating entities to enter lands on the islands under the jurisdiction of Guam, and when appropriate, assist in obtaining permission for entry to private lands.
5. Exchanging information with cooperating entities on the incidents of snake movements in civilian

aircraft, vessels and containers.

6. Exchanging information with cooperating entities on incidents of snake bites to humans, incidents and statistics regarding predation to domestic and non-domestic fowl, mammals and other species, and development of educational programs for local citizens, businesses and other interested parties.

E. HAWAII OBLIGATIONS:

Hawaii shall assume lead responsibility for specific on-island research, inspection and control program to reduce the potential for the import of the brown tree snake to the State of Hawaii. Specific obligations include but are not limited to:

1. Designating a Project Officer with responsibilities for coordinating on-site activities with the designated project and research personnel of the cooperating entities.
2. Developing specific plans for use of funds provided for development and implementation of an on-island inspection program using detector dogs and pilot control and detection programs.
3. Facilitating access for responsible personnel of the cooperating entities to meet and work with

Hawaiian researchers, control, and inspections personnel.

4. Exchanging information with cooperating entities on incidents of snake movements in civilian and military aircraft, vessel and containers.

XI. SPECIAL TERMS AND CONDITIONS:

The obligation of the cooperating parties for performance of this AGREEMENT is contingent upon the availability of staff and funds.

XII. AMENDMENTS:

Amendments to the INTERAGENCY AGREEMENT may be proposed by any signatory party and shall become effective upon execution by all parties of a written instrument.

XIII. TERMINATION:

This INTERAGENCY AGREEMENT may be terminated by any party upon a 60-day written notice to the other cooperating parties.

IN WITNESS WHEREOF, each party hereto has caused this INTERAGENCY AGREEMENT to be executed by an authorized official on the day and year set forth opposite their signature.

For the Secretary of the Interior

Title: Assistant Secretary

Date: 31 Dec. 1992

For the Governor of Guam

Title: Governor

Date: 2-5-93

For the Secretary of Defense

Title: Deputy Under Secretary

Date: 8/12/93

For the Secretary of Agriculture

Title: Ast. Sec. NRE

Date: June 21, 1993

For the State of Hawaii

Title: Governor

Date: MAR 25 1993

Appendix G

Rota NVG Noise

Appendix G
Rota NVG Noise

To identify the scale of potential noise impacts from NVG training on Rota, noise contours for helicopter training were developed by Darby & Associates (Appendix K). Noise presently generated by commercial aircraft at Rota International Airport is sporadic and generally limited to daytime hours,[1] while the NVG noise will be continuous for a period of up to three hours. The study identified day-night equivalent sound level contours (Ldn) for a typical training day (see Figure 4-4).[2] Results show that sound levels generated by helicopters in the nearby crow habitat will not exceed 55 dBA, roughly the equivalent of average suburban sound levels. This sound level is generally considered compatible with natural wildlife areas (Figure 4-5).

However, the Ldn is an average value and it is often the peak noise level that wildlife find most disturbing. Therefore, a peak noise level was calculated. The peak noise level for the helicopter used for NVG training is estimated to be 118 dBA at a horizontal distance of 30.5 meters from the source.[3]

Because sound levels vary with distance from the source, the peak noise level at the nearest edge of the high density Mariana crow population area (see Figure 4-4) needed to be calculated. A logarithmic equation and several assumptions were used to determine the peak noise levels. The equation used is as follows:

$$L_{m2} = L_{m1} - 20 * \log \frac{r_2}{r_1} - A_{12}$$

where L_{mx} = peak noise level at a specific location x
r_x = distance between the source (runway) and location x
A_{12} = attenuation due to vegetation and terrain

The assumptions made were:

- sound level data from CH-46 helicopter operations provide a reasonable basis for estimating sound levels of H-46D helicopter;
- acoustical environment at Bellows Air Force Station where measurements were taken is similar to that at Rota Airport
- a Mariana crow would be located no closer than the edge of the high population density area (see Figure 4-4);
- NVG training activities take place above the centerline of the runway;

[1]Personal communication with Michael Muña, Saipan FAA, August 8, 1996.

[2]The Ldn is measured in units of A-weighted decibels, which emulate the response of the human ear. It is the level of sound measure over a 24-hour period, with a penalty added to noises between 2200 and 0700 (to account for people's higher sensitivity to noise at night, when the background noise level is typically lowered).

[3]Personal communication with Thao N. Ngyuen, Darby & Associates, August 22, 1996, based on previous measurements.

- attenuation of noise due to vegetation and/or terrain is not estimated, therefore the peak sound level may actually be lower than calculated.

The distance was first assumed to be the shortest horizontal distance between the runway and the high density area. A distance of about 154.2 m (between the middle of the runway and the edge of the high density area) was used for the calculations. Based on this assumption, the peak noise level at the nearest edge of the high density Mariana crow population area would be 104 dBA.

The distance was then assumed to be the greatest distance between the runway and the high density area. A distance of 219 m (between the eastern end of the runway and the edge of the high density area) was used. The peak noise level for this scenario is estimated to be about 101 dBA.

The nearest known crow nest within this high density population area is located approximately 2 km from the runway. The peak sound level at this location was calculated to be slightly less, at 82 dBA. For nests deeper in the forest, farther from the edge of the high density area, noise attenuation due vegetation would be significant, greatly reducing the peak sound levels experienced.

D.L. ADAMS ASSOCIATES, LTD.
dba
DARBY
& ASSOCIATES
ACOUSTICAL CONSULTANTS

Project No. 96-05

HC-5 HELICOPTER NOISE STUDY FOR NIGHT VISION GOGGLE TRAINING AT ROTA AIRPORT ROTA, MARIANA ISLANDS

May 9, 1996

Prepared for
BELT COLLINS HAWAII
Honolulu, Hawaii

PALI PALMS PLAZA • 970 NO. KALAHEO AVENUE • SUITE A-311
KAILUA, HAWAII 96734 • (808) 254-3318 • FAX (808) 254-5295

SUMMARY

Helicopter noise contours for the proposed HC-5 night vision goggle training exercises at Rota Airport were generated. Day-night equivalent sound level (L_{dn}) contours for a typical training exercise day and for a daily average are presented. The latter are based on 120 training exercises per year as proposed.

COMPUTER NOISE MODEL AND INPUT DATA

The helicopter noise model used in this study was NOISEMAP Version 6.4 [Reference 1]. Input data required was flight tracks, approach and takeoff profiles, number of daytime (0700 - 2200 hours) and nighttime (2200 - 0700 hours) operations and other information pertaining to the runway location, such as longitude and latitude, field elevation, average yearly temperature, average yearly humidity, etc.

Data and information pertaining to the HC-5 night vision goggle training exercises at Rota Airport were obtained from Lt. H. S. Parrish, HC-5 NVD Officer, [References 2 and 3]. A typical training exercise was described as follows:

- Helicopter will maintain altitude of 500 feet above ground level (AGL) at all times except during approach to and departure from landing.

- Rates of climb and descent will not exceed 1,000 feet per minute.

- Helicopter makes normal approach and descent to landing from the northwest side of Rota Island. Landing types will consist of the following:

    1. Approach to a 10-foot hover for approximately 15 seconds followed by a vertical landing,

    2. No hover landing, and

    3. Running landings at maximum forward speed of 50 knots.

- Helicopter spends a maximum of five minutes on deck before vertical ascent to a ten-foot hover and takeoff. After takeoff, helicopter will not commence turn to downwind leg until reaching an altitude of 200 feet AGL. Helicopter commences a climbing 180° left turn to an altitude of 500 feet AGL for the downwind leg. When abeam the approach end of the runway, helicopter will make a 180° descending left turn before landing. It is estimated that the helicopter will repeat this closed pattern maneuver 19 times before departing from the Rota Airport.

- Approximately 120 flights per year to Rota Airport for the HC-5 trainingt exercises are proposed.

- The planned flight tracks are as shown in Figure 1.

- These HC-5 training exercises will commence one hour after sunset and departure will occur before 2200 hours.

DAY-NIGHT EQUIVALENT SOUND LEVEL CONTOURS

Day-night equivalent sound level (L_{dn}) contours for the modeled HC-5 night vision goggle training exercises at Rota Airport were computer generated using NOISEMAP. Figure 2 represents the L_{dn} contours for a typical training exercise day based on the estimated 19 closed pattern maneuvers, one approach to and one departure from Rota Airport per day. The L_{dn} contours for a daily average, based on the proposed 120 training exercises per year, are presented in Figure 3. Appendix A provides a brief description of the acoustic terminology used in this report. Enlargements of the contours in the vicinity of the airstrip are shown in Figures 4 and 5.

Land areas encompassed by each contour are as follows:

1. L_{dn} Contours for a Typical Training Exercise Day (Figure 2)

L_{dn} (dB)	Millions of Square Feet
40	72.25
45	45.10
50	29.11
55	7.90
60	0.04

2. Daily Average L_{dn} Contours Based on One Year (Figure 3)

L_{dn} (dB)	Millions of Square Feet
40	45.74
45	29.31
50	8.37
55	0.04

REFERENCES:

1. NOISEMAP Version 6.4, Department of the Air Force, July, 1995.

2. Facsimile Transmittal from Lt. H. S. Parrish, HC-5 NVD Officer, Helicopter Combat Support Squadron Five, to Darby & Associates, Received April 3, 1996.

3. Telephone Conversation with Lt. H. S. Parrish, April 4, 1996 and April 15, 1996.

APPENDIX A

ACOUSTICAL TERMINOLOGY

Sound Pressure Level

Sound or noise consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. It is measured in terms of decibels (dB) using precision instruments known as sound level meters. Noise is defined as "unwanted" sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/Pref) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and Pref is the reference pressure, 20 micropascals, which is approximately the lowest sound pressure that can be detected by the human ear. For example, if P is 20 micropascals, then SPL = 0 dB, or if P is 200 micropascals, then SPL = 20 dB. The relation between sound pressure in micropascals and sound pressure level in decibels (dB) is shown in Figure A-1.

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound levels, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined level of 53 dB, not 100 dB; two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of a sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 5 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

The human ear is more sensitive to sound in the frequency range of 250 Hertz (Hz) and higher, than in frequencies below 250 Hz. Due to this type of frequency response, a frequency weighting system, was developed to emulate the frequency response of the human ear. This system expresses sound levels in units of A-weighted decibels (dBA). A-weighted sound levels de-emphasizes the low frequency portion of the spectrum of a signal. The A-weighted level of a sound is a good measure of the loudness of that sound. Different sounds having the same A-weighted sound level are perceived as being about equally loud. Typical values of the A-weighted sound level of various noise sources are shown in Figure A-1.

Statistical Sound Levels

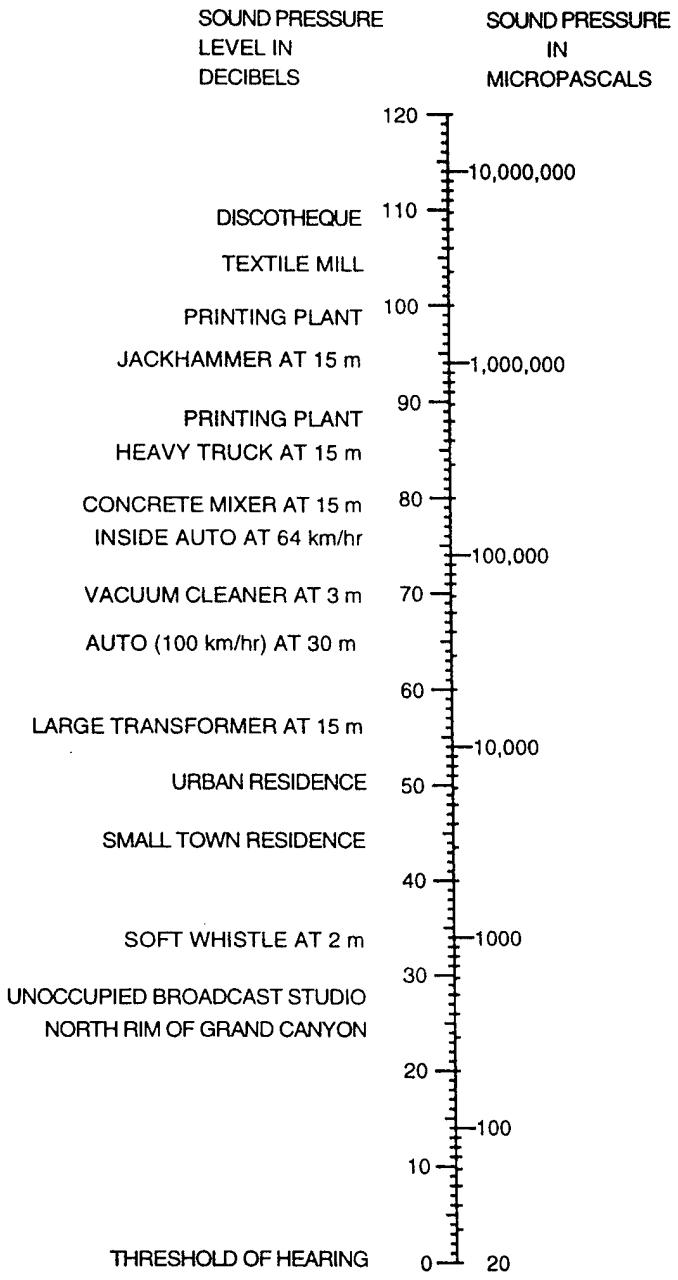
The sound levels of long-term noise producing activities, such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, a statistically-based method of expressing sound or noise levels developed. It is known as the Exceedence Level, L_n. The Exceedence Level, L_n, represents the sound level which is exceeded for n% of the measurement time period. For example, L_{10} = 60 dBA indicates that for the duration at the measurement period, the sound level exceeded 60 dBA 10% of the time. Commonly used Exceedence Levels include L_1, L_{10}, L_{50}, and L_{90}, which are widely used to assess community and environmental noise. Figure A-2 illustrates the relationship between selected statistical noise levels.

Equivalent Sound Level

The Equivalent Sound Level, L_{eq}, represents a constant level of sound having the same total acoustic energy as that contained in the actual time-varying sound being measured over a specific time period. L_{eq} is commonly used to describe community noise, traffic noise, and hearing damage potential. It has units of dBA and is illustrated in Figure A-2.

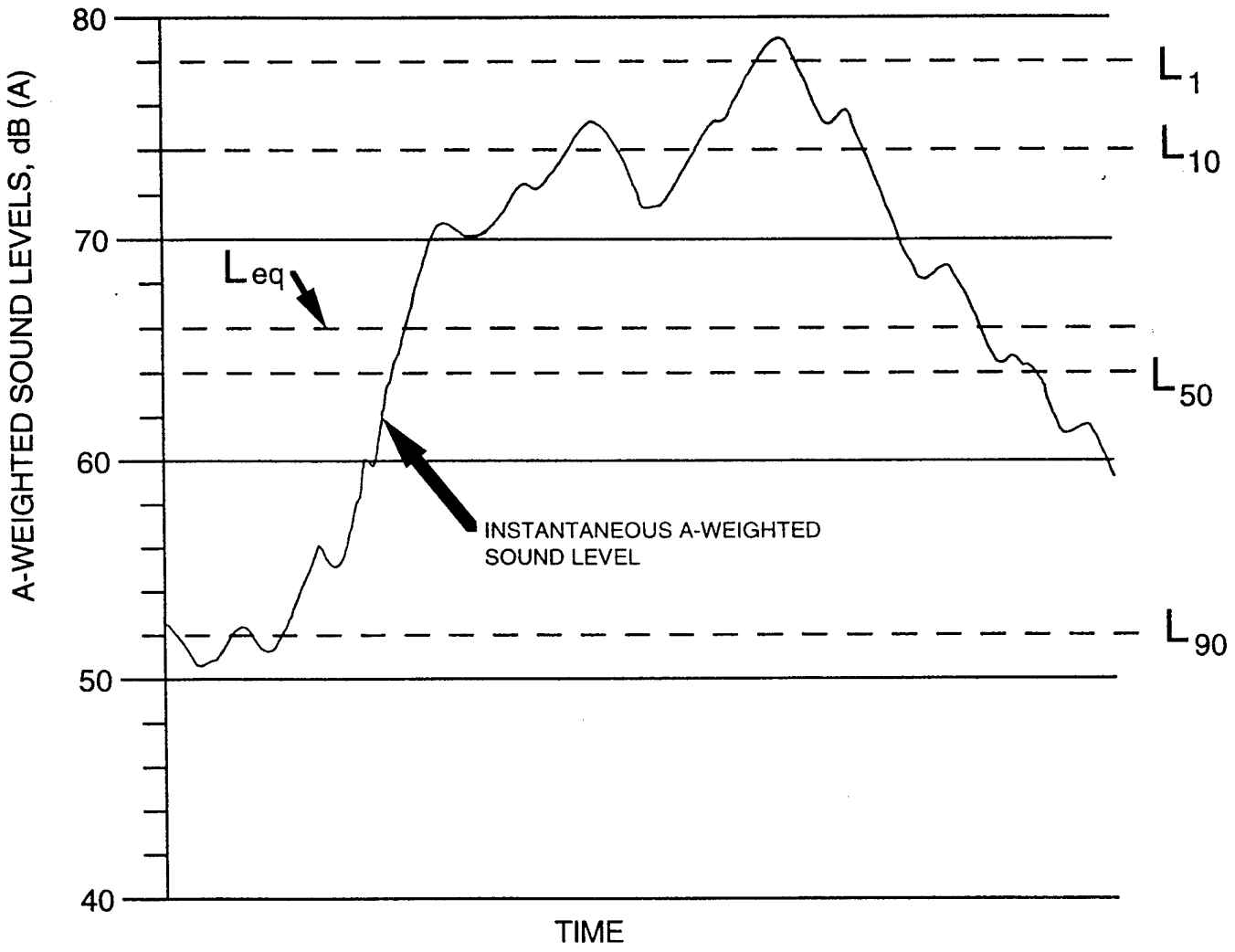
Day-Night Equivalent Sound Level

The Day-Night Equivalent Sound Level, L_{dn}, is the Equivalent Sound Level, L_{eq}, measured over a 24-hour period. However, a 10 dB penalty is added to the noise levels recorded between 10 pm and 7 am to account for people's higher sensitivity to noise at night when the background noise level is typically lower. The L_{dn} is a commonly used noise descriptor in assessing land use compatibility, and is widely used by federal and local agencies and standards organizations. Qualitative descriptions, as well as local examples of L_{dn}, are shown in Figure A-3.



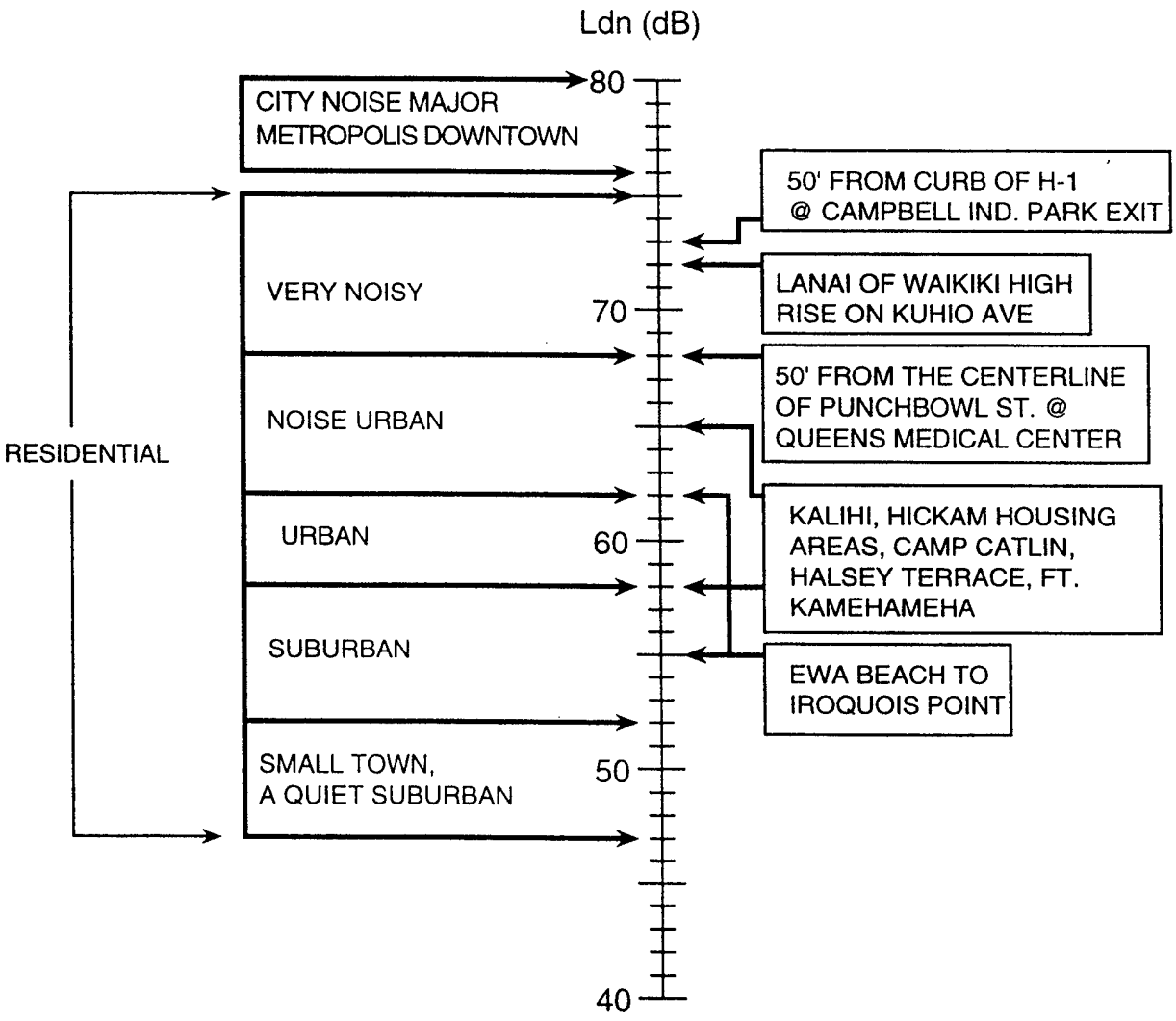
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DARBY & ASSOCIATES
ACOUSTICAL CONSULTANTS

FIGURE A-1 THE RELATION BETWEEN SOUND PRESSURE, P, AND SOUND PRESSURE LEVEL, SPL. ALSO SHOWN ARE TYPICAL VALUES OF A-WEIGHTED SOUND LEVELS OF VARIOUS NOISE SOURCES.



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FIGURE A-2 COMPARISON OF AN INSTANTANEOUS SOUND LEVEL AND THE CORRESPONDING STATISTICAL SOUND LEVELS



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FIGURE A-3 QUALITATIVE DESCRIPTION OF THE DAY-NIGHT SOUND LEVELS (Ldn) AND AND EXAMPLE Ldn's AT SELECTED LOCATIONS ON OAHU



Flight Tracks

HC-5 Training Exercises at Rota Airport

Scale: 1" = 6,000'

Figure No. 1

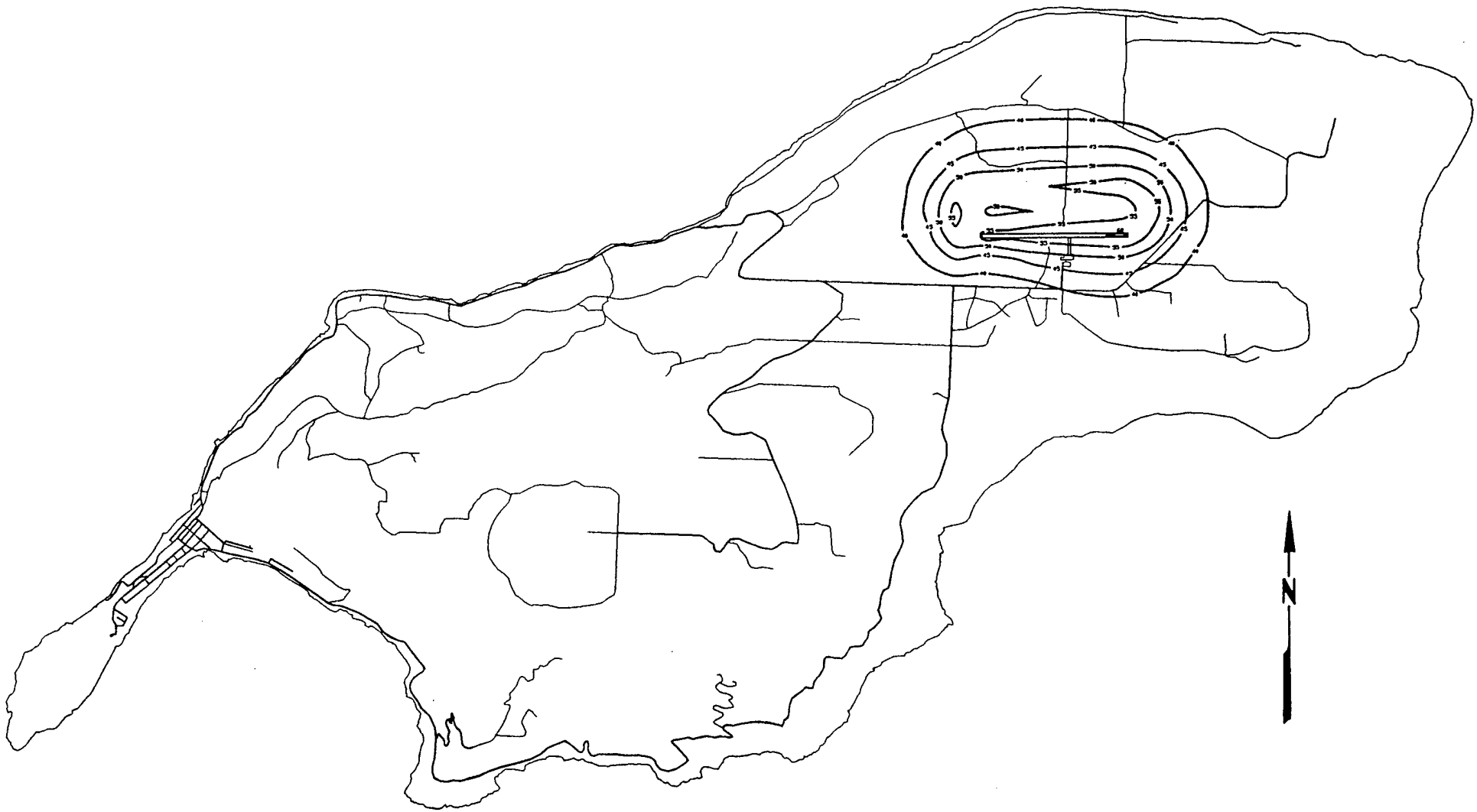
Date: May 9, 1996

Project No.: -05

Drawn By: PTN

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Ldn Contours for A Typical Training Exercise Day

HC-5 Training Exercises at Rota Airport

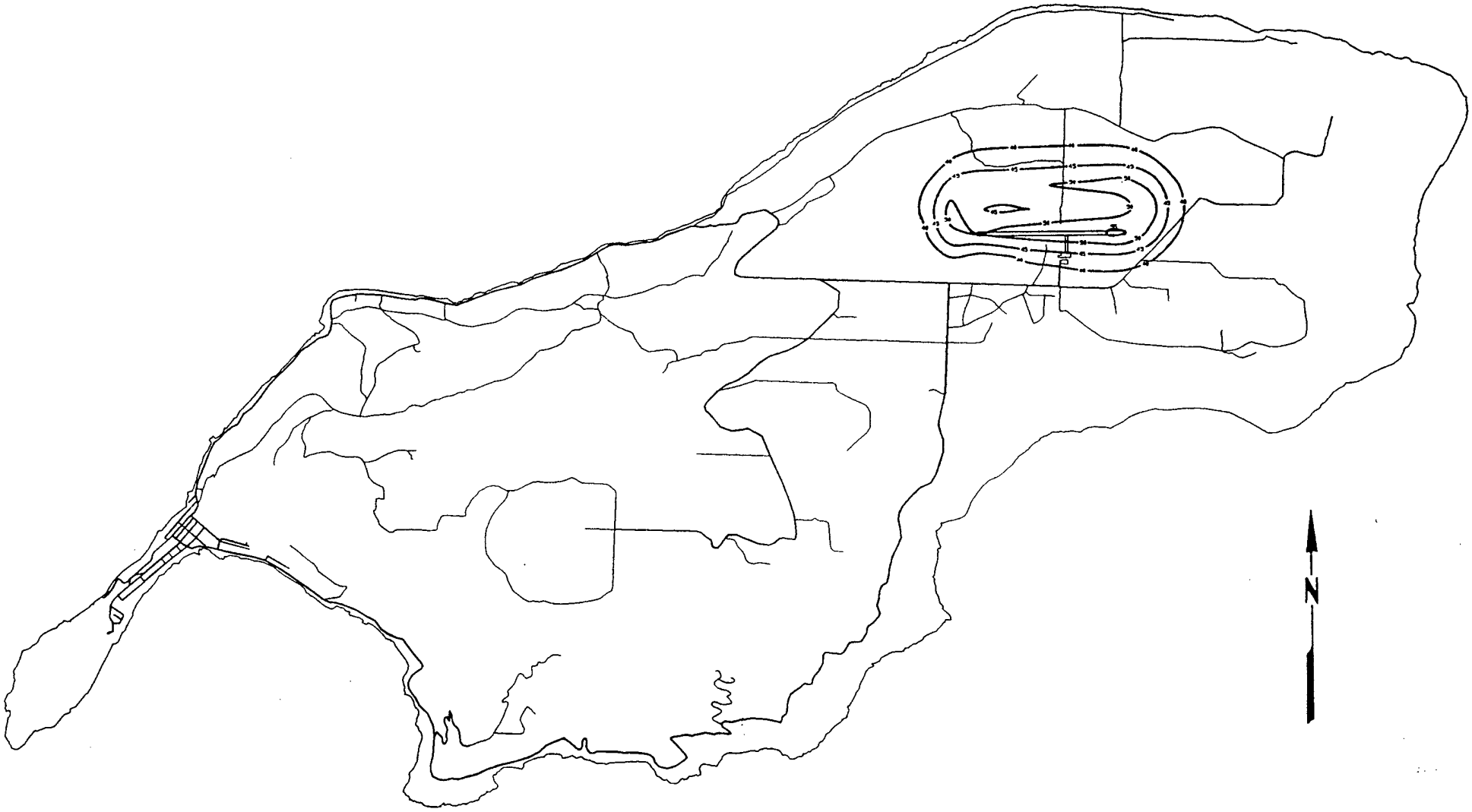
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Figure No. 2

Date	Project No.	Drawn By
May 9, 1996	96-05	PTN

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Daily Average Ldn Contours Based on One Year

HC-5 Training Exercises at Rota Airport

Scale: 1" = 6,000'

Figure No. 3

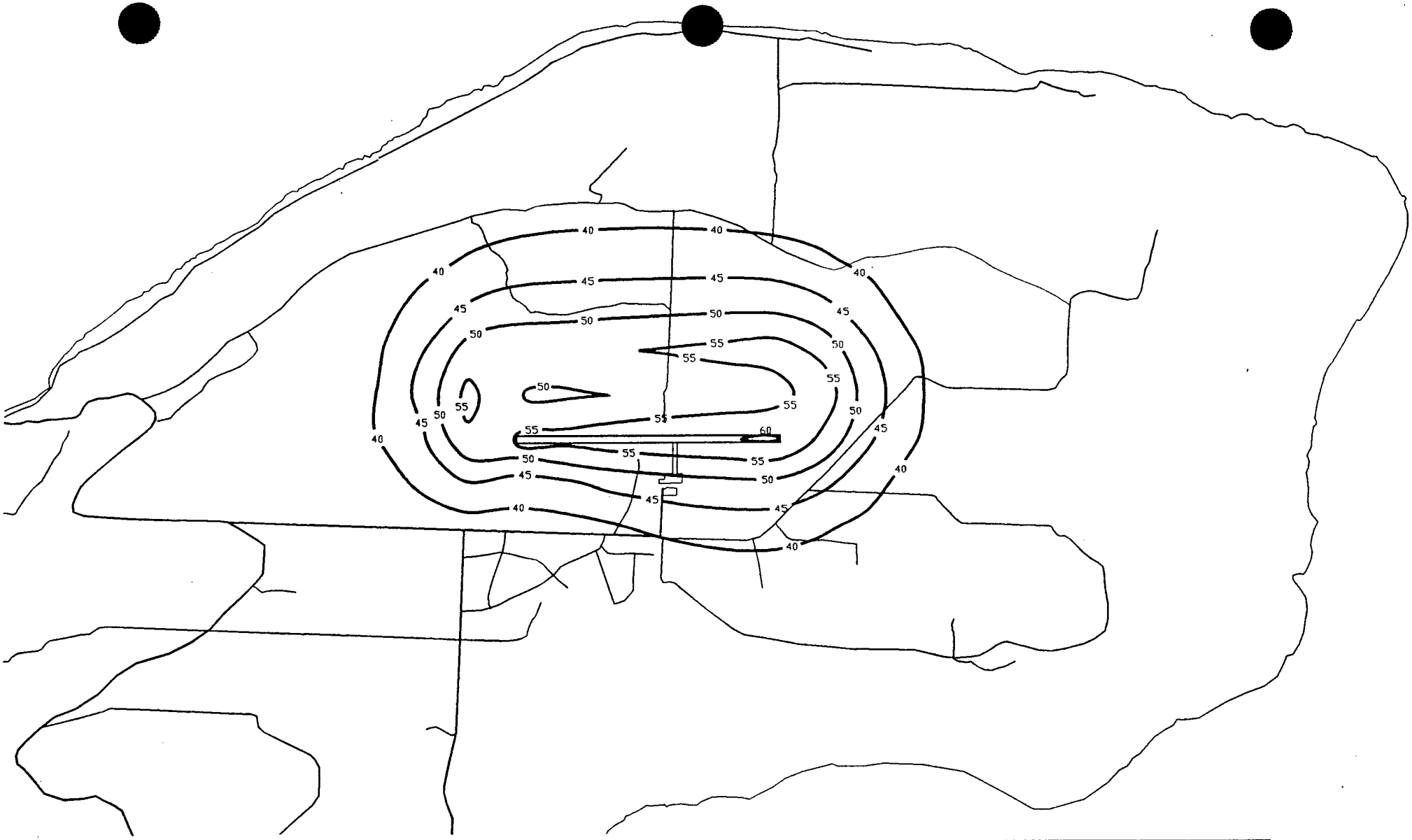
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Date: May 9, 1996

Project No.: [illegible]-05

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Enlargement of Figure No. 2

HC-5 Training Exercises at Rota Airport

Scale: 1" = 3,000'

Date	Project No.	Drawn By
May 9, 1996	96-05	PTN

Figure No. 4



Enlargement of Figure No. 3

HC-5 Training Exercises at Rota Airport

Scale: 1" = 3,000'

Figure No. 5

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808/2[illegible]3318 FAX 808/254-5295

Date	Project No.	Drawn By
May 9, 1996	[illegible]-05	PTN

Appendix H

Farallon de Medinlla Reports:

H-1— Avifaunal Survey Report of Farallon de Medinilla by Phil Bruner
H-2— Preliminary Report-Marianas EIS-Farallon de Medinilla Marine Assessment by Steven Dollar, Ph.D.
H-3— Trip to Farallon de Medinilla (FDM), Commonwealth of the Northern Marianas Islands by Michael Lusk (in association with Curt Kessler)
H-4— Endangered Species Survey of Farallon de Medinilla (FDM) 16-17 Dec 96 by Tim Sutterfield
H-5— Botanical Survey of Farallon de Medinilla, Commonwealth of the Northern Mariana Islands by Dr. Art Whistler

AVIFAUNAL SURVEY REPORT OF FARALLON DE MEDINILLA

Prep. for

Belt Collins & Associates

Honolulu, Hi

by

Phillip L. Bruner
Environmental Consultant
Faunal Surveys

19 November 1996

INTRODUCTION

This report provides the findings of a brief one day (15 November 1996) avifaunal survey of Farallon De Medinilla. The purposes of the investigation were:

1- Determine what birds presently occur on the island.

2- Where possible, and within the constraints of available time, obtain data on the relative abundance of each species.

3- Record breeding phenology.

4- Identify the general types of habitats available to birds.

METHODS

The field survey was limited to a walking tour of the northern 2/3 of the island. Fig. One indicates the route walked. Brief stops were made at locations where birds were nesting. Notes were kept on the numbers of each species and their breeding activity. At a few locations the near shore waters were scanned with binoculars. Night observations were not conducted.

Weather during the survey was warm with light clouds and strong easterly winds. The sea was rough and onshore waves were high. Occasionally sea foam was blown up on the top of the island. The vegetation was low in stature but lush. Apparently the island had

received sufficient rain during the past few months. No signs of fire or high wind damage were noted.

The common and scientific names of birds used in this report follow those given in Pratt et al. 1987. The taxonomic sequence of species presentation also follow the order given in this resource.

RESULTS AND DISCUSSION

Table I summarizes the field survey findings. Below are expanded notes obtained for each species.

Family: Phaethontidae: Tropicbirds

Red-tailed Tropicbird (Phaethon rubricauda)

Four Red-tailed Tropicbirds were seen flying over and around the island. This species nests on the ground under vegetation and on coastal cliffs. Pratt et al. 1987 report this species from Maug and Pagan. They probably nest on Farallon De Medinilla but our brief visit did not permit sufficient time to search for nests.

Family: Sulidae: Boobies and Gannets

Masked Booby (Sula dactylatra)

This species is the largest of the boobies (Genus Sula). They nest on the ground. Males can be distinguished from females by their

brighter yellow bills and thin high whistle-like calls. A rough estimate of 750 birds was obtained by a combination of over flight of the island and a walking survey. We found most were incubating eggs but a small percentage had downy chicks. Many pairs had two eggs but this species typically raises only one chick. At the time of our visit Masked Boobies were clearly the most abundant bird on the island. At other times of the year other species likely dominate. Boobies typically nest in areas where they are not frequently disturbed. They show little fear of man and only leave their nest if approached too closely.

Brown Booby (Sula leucogaster)

Brown Boobies were the least common booby recorded on the survey. We estimated around 200 were either nesting or just resting on the island. Those that were nesting had large, almost fledged chicks. Apparently they were at the end of their breeding season. We found several dead chicks that were nearly fledged when they died. We also saw some chicks that appeared thin and may have been abandoned. Perhaps recent storms reported to have passed through this region affected the adults ability to forage and feed their chicks. Brown Boobies nest on the ground like Masked Boobies. They were most concentrated along the eastern side of the island (Fig. 1).

Red-footed Booby (Sula sula)

An estimated 500 Red-footed Boobies were scattered on nests or seen flying over the island and offshore. This species builds its nest of sticks and places it up in trees or on the tops of bushes. The absence of trees on the island meant that low bushes were the preferred nesting sites. A few had eggs but most were just beginning to build their nests. One dark phase bird was seen attending a nest. In the north Pacific the white color phase predominates with typically better than 90% of the adults colored white with black wing tips. In the south-eastern Pacific the dark color phase of brown to gray bodies with golden heads and white tails comprises the vast majority of these populations. This apparent anomaly is usually explained by the suggestion that north and south Pacific gene pools are not mixing due to the isolating effects of the equatorial doldrums. The continued predominance of one color phase over the other may be due to initial founding events and genetic drift rather than particular selection pressures.

Family: Fregatidae: Frigatebirds

Great Frigatebird (Fregata minor)

This species occurs in the tropical waters of Pacific, Indian and Atlantic Oceans. They nest in trees and bushes and construct loosely arranged flat platforms of small sticks similar to Red-footed Booby nests. A small colony of frigates were nesting on the west of the island (Fig. 1). No chicks were seen but some adults were on eggs.

Perhaps 25 frigates were on or near the island during our visit. We saw juveniles with white heads roosting near the colony and flying near shore. This species chases other seabirds and steals their catch. Boobies are often a favorite target of these aerial pirates.

The Lesser Frigatebird (Fregata ariel) also occurs pantropical but nests more often on the ground. They are less common than the Great Frigatebird and none were seen on this survey.

Family: Ardeidae: Herons, Egrets and Bitterns

Cattle Egret (Bubulcus ibis)

Pratt et al. (1987) report this species as a common migrant to western Micronesia. One Cattle Egret was seen flying across the island near the Brown Booby colony. This land bird forages on a wide variety of prey including small rodents, insects, prawns, eggs and chicks. We saw only the one bird but our brief visit might have missed others on the island.

Family: Megapodiidae: Megapodes

Micronesian Megapode (Megapodius laperouse)

Four Micronesian Megapodes were seen on the walking portion of the survey. All were flushed from the cover of dense vegetation. They called and flew a short distance before dropping into the vegetation. Time did not permit a search for nest mounds. This dark brownish chicken-like bird is often called an Incubator Bird because of their unusual habit of burying their eggs in mounds of

dirt and leaf liter where the heat of the sun and the decomposing plants provide the warmth necessary to promote development of the embryo. The young are independent and very precocial at hatching. The nest mounds are used communally by several females and are often large and distinct. This species is endangered. They are restricted (endemic) to Micronesia. On uninhabited islands they are less shy. How many actually occur on Farallon De Medinilla was not determined. The four birds we observed probably do not represent the entire population. A more thorough systematic search would provide a more accurate picture of the species abundance.

Family: Charadriidae: Plovers and Dotterels

Pacific Golden-Plover (Pluvialis fulva)

Approximately ten plover were seen and heard during the survey. The southern end of the island was not visited but appeared from the air to be more barren and thus more useable by shorebirds like plover. This migrating species requires open habitat to forage. They are the most common and abundant shorebird wintering in the north Pacific. They nest on the tundra in western Alaska and the Russian far east. Long term studies in Hawaii and Alaska suggest that plover wintering in Hawaii and the central and southeastern Pacific nest in Alaska while those which migrate to the western Pacific, Coastal Asia and the Indian Ocean breed on the Russian tundra. All of the plover seen on the survey were in their non-breeding (winter) plumage. We did not have close enough looks at the birds to see if any were juveniles (birds of the year). Pacific Golden-

Plover are usually territorial on the wintering grounds and return each year to the same foraging territory. This behavior makes it possible to obtain quite accurate population counts if there is sufficient time to observe a site over a few days. Our studies in Hawaii have found that better than 70% of the plover marked in one season will survive to return the subsequent winter (Johnson et al. 1989). We have birds marked in the early 1980's still returning to our study sites on Oahu. These birds may be 16+ years old!

Family: Scolopacidae: Sandpipers, Phalaropes, and Related Birds

Whimbrel (Numenius phaeopus)

Two Whimbrel were seen during the walking survey. This migratory shorebird is a common winter visitor in Micronesia (Pratt et al. 1987). Whimbrel's breed in the arctic tundra of north America and Russia. They are similar in size to Bristle-thighed Curlew (Numenius tahitiensis) but have a different call, are lighter in color and lack the cinnamon rump of the Bristle-thighed Curlew. Although only two were tallied on the survey others may occur on the island, particularly in the more open southern sector.

Bristle-thighed Curlew (Numenius tahitiensis)

Pratt et al. (1987) report this species from eastern Micronesia. They typically winter in the central and southeastern Pacific. The three birds seen on Farallon De Medinilla indicate a more westerly distribution than previously believed. Bristle-thighed Curlew are

the only shorebirds whose entire winter range is confined to oceanic islands. They breed in a very restricted area of western Alaska. Presently the United States Fish and Wildlife Service (USFWS) list the Bristle-thighed Curlew as a "species of concern".

Ruddy Turnstone (Arenaria interpres)

Six Ruddy Turnstones were counted on the walking survey. This is a common migratory shorebird in the Pacific. They forage in open habitats covered in low vegetation as well as along shorelines and wetlands. Typically they winter in small flocks and are not territorial. A longer survey of the island might find more turnstones. The ones we recorded were in the central sector of the island.

Family: Laridae: Jaegers, Gulls and Terns

Sooty Tern (Sterna fuscata)

One Sooty Tern was seen flying offshore by T. Sutterfield (PACDIV) but none were recorded by those involved on the walking bird survey. This species is very common in the tropics and usually nests in large numbers on uninhabitated islands. They probably nest on Farallon De Medinilla but were not doing so during the period covered by this survey. Outside of the breeding season Sooty Terns are pelagic.

Brown Noody (Anous stolidus)

A rough estimate of 30 Brown Noddies were seen flying about the island and nesting on the eastward facing cliff faces. This species

occurs in all the tropical oceans. They are flexible in their nest sites. Some will construct nests in trees while others will nest on the ground. Brown Noddies are more pelagic and forage less in flocks than the similar Black Noddy (Anous minutus) (Pratt et al. 1987). Relatively few birds were present during the survey which might indicate that the breeding season was just beginning.

Black Noddy (Anous minutus)

This species is smaller and darker than the Brown Noddy with a more contrasting gray cap. They forage closer to land but also will nest on the ground or in trees. About 20 Black Noddy were seen on the survey, some on nests on narrow ledges in the sea caves. Pratt et al. (1987) report Black Noddies forage in flocks.

Common Fairy-Tern (Gygis alba)

This species was the most abundant tern seen on and around the island. About 200 were observed, many on nests in the same sea caves as the noddies. Fairy-terns are pan-tropical and nest on inhabited as well as uninhabited islands. They are not shy and will readily approach people.

Family: Columbidae: Pigeons and Doves

White-throated Ground-Dove (Gallicolumba xanthonura)

Around 30 White-throated Ground-Doves were seen on the walking survey. No nests were discovered. The birds were fairly tame and only flushed when approached closely. This species is endemic to the Mariana Islands and Yap. Despite their name they frequently forage

in trees on forested islands. The population appeared robust for such a small island.

Family: Passeridae: Old World Sparrows

Eurasian Tree Sparrow (Passer montanus)

This was the only introduced (non-native) species recorded on the survey. Four Eurasian Tree Sparrows were seen in the central region of the island. Pratt et al. (1987) reports this species is native to Eurasia and may have been introduced in the 1940's to the Mariana Islands. They occur on Saipan and many have gotten to Ferallon De Medinilla on their own or may have been introduced from Guam during military operations on the island.

HABITATS

The island supports a dense cover of low vegetation where birds can shelter, nest and for some species find food. The shoreline cliffs and sea caves provide nesting sites for terns. Masked Boobies and Brown Boobies were nesting along the eastern (windward) side where they could more easily become airborne when departing their ground nests. Red-footed Boobies and Great Fregatebirds breed on the western side of the island where there is less wind but higher brush to support their nests. Shorebirds like plover, curlew and turnstone require open habitat and were found in areas that were barren or had patchy vegetation. Megapodes and doves were in the dense vegetation where cover and food were more available. Rats (species unindentified) were also observed on the field survey.

OTHER STUDIES

The only previous data available for Farallon De Medinilla are contained in the 1975 Department of the Navy Final Environmental Impact Statement, Farallon De Medinilla Bombardment Range, Mariana Islands. Section 8 of this document concerns wildlife. Six species of seabirds are reported: Red-footed Booby; Masked Booby; Brown Booby; Great Frigatebird; Fairy Tern; and Common Brown Noddy Tern. These same species were also observed on the 1996 field survey. The 1975 report further indicates that Pacific Golden-Plover, Whimbrel, Micronesian Starling (Aplonis opacus guani), White-fronted Ground Dove and Philippine Turtle Dove (Streptopelia bitorquata dusumieri) are "found on the island". The 1975 EIS also notes "a large population of Polynesian Rats (Rattus exulans)".

Population estimates for each species are not given in the 1975 EIS. The report does, however, state that "boobies nest as a colony which is fairly evenly distributed over the vegetated top of the island at a rate of about 100 nests to the acre". They extrapolate this approximate nesting density to estimate a population of 50,000± adult boobies on the island. This estimate apparently refers collectively to all three booby species. No methods are presented in the wildlife section so one cannot know how these numbers were obtained, what time of year the survey was conducted and how many days were involved in the survey. Furthermore, the comment that the boobies were "evenly

distributed" over the island does not conform to the present nesting patterns.

CONCLUSIONS

A total of seventeen avian species were recorded on this brief survey. Estimates of their abundance are necessarily imprecise. Seabirds, migrants and resident landbirds share the island. Several species were nesting. No night observations were conducted. Birds like petrels and shearwaters which forage away from the island during the day and return after dark may have been missed by this diurnal survey. Other species might use the island for nesting at different times of the year.

The only endangered species recorded was the Micronesian Megapode. Only four birds were tallied. A more thorough search of the island, especially the areas covered in dense vegetation, would likely reveal more megapodes.

Despite potentially detrimental military activity, the island supports a diverse avifauna. Birds were nesting in target areas which must result in some mortality during training exercises, although no direct evidence of this mortality was observed.

RECOMMENDATIONS

1- More data are needed on the abundance, distribution and breeding status of the endangered Micronesian Megapode. Two or three additional field days would probably be sufficient to obtain this information.

2- Night observations need to be made in order to learn whether or not petrels and shearwaters may be using the island.

3- The White-throated Ground Dove appears to be common. Any future visit ought to attempt a more complete census of the dove population.

4- More data on seabird activity on the island should be collected from future site visits or flyovers. The accuracy of the booby population estimate in the 1975 report is questionable because there is no explanation of methodology.

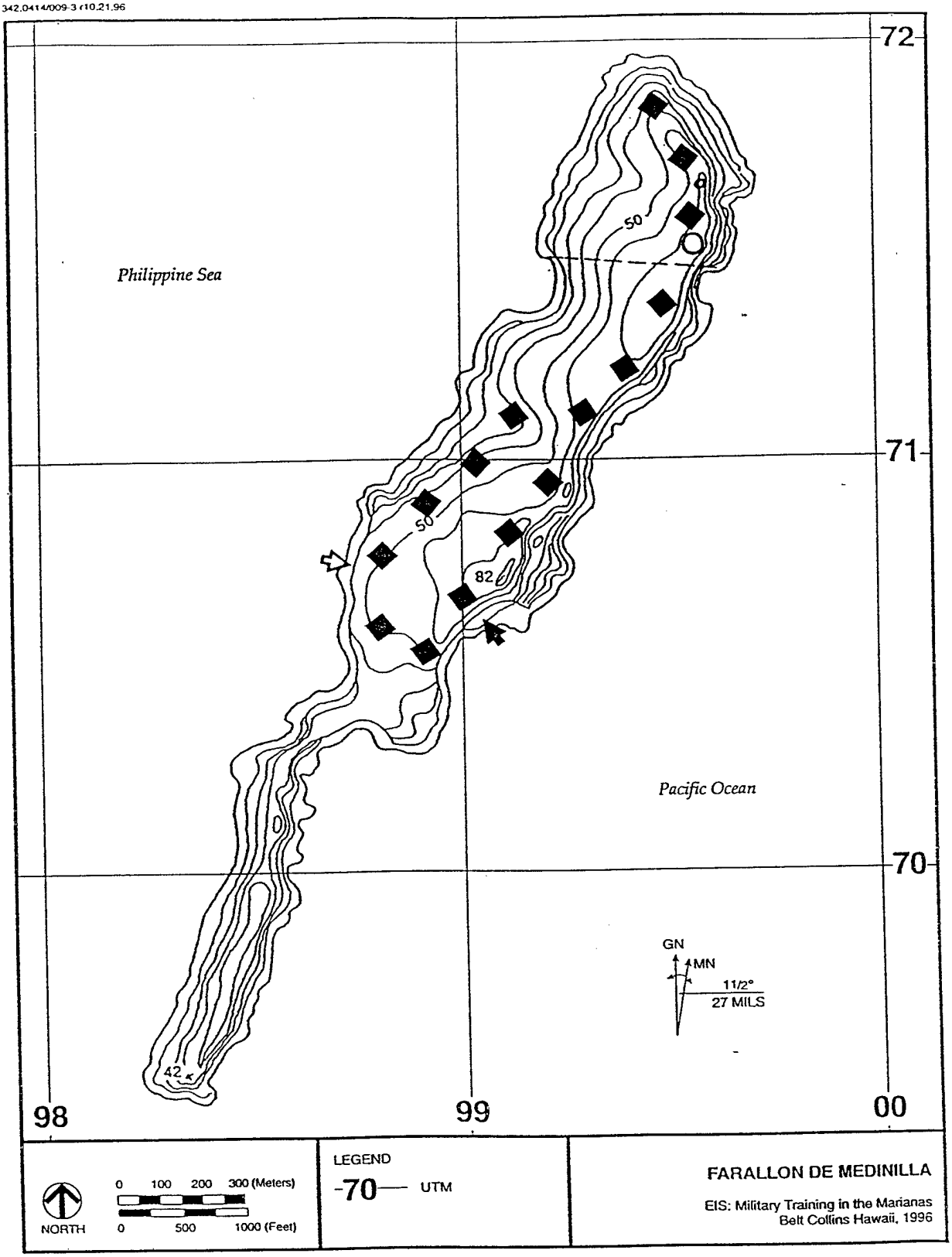


Fig. 1. Location of avifaunal survey. Solid diamonds indicate path of walking survey. Open arrow points to Great Frigatebird colony. Solid arrow indicates the area where Brown Boobies were nesting.

TABLE 1

Birds recorded on a one day field survey (5 November 1996) of Farallon De Medinilla. Abundance estimates are based on either the total number recorded or a broad estimate of birds seen on or near the island.

Family Name	Scientific Name	Common Name	Abundance
Seabirds:			
Phaethontidae	Phaethon rubricauda	Red-tailed Tropicbird	4
Sulidae	Sula dactylata	Masked Booby	750
	Sula leucogaster	Brown Booby	200
	Sula sula	Red-footed Booby	500
Fregatidae	Fregata minor	Great Frigatebird	25
Laridae	Sterna fuscata	Sooty Tern	1
	Anous stolidus	Brown Noddy	50
	Anous minutus	Black Noddy	20
	Gygis alba	Common Fairy-tern	200
Migrants:			
Ardeidae	Bubulcus ibis	Cattle Egret	1

TABLE 1 (cont.)

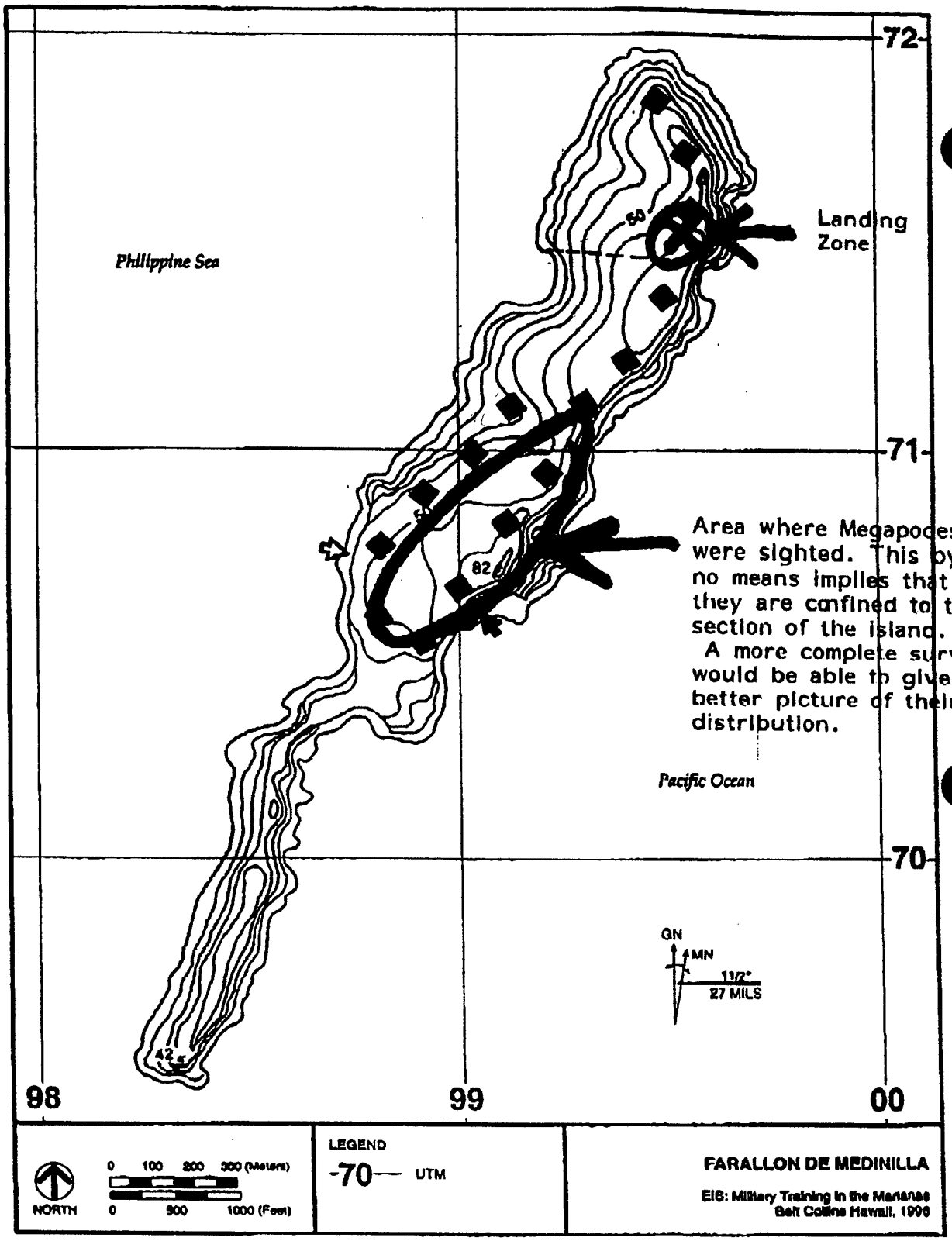
Family Name	Scientific Name	Common Name	Abundance
Migrants:			
Charadriidae	Pluvialis fulva	Pacific Golden-Plover	10
Scolopacidae	Numenius phaeopus	Whimbrel	2
	Numenius tahitiensis	Bristle-thighed Curlew	3
	Arenaria interpres	Ruddy Turnstone	6
Resident Land Birds:			
Megapodiidae	Megapodius laperouse	Micronesian Megapode	4
Columbidae	Gallicolumba zanthonura	White-throated Ground-Dove	30
Passeridae	Passer montanus	Eurasian Tree Sparrow	4

SOURCES CITED

Department of the Navy. 1975. Final Environmental Impact Statement Farallon De Medinilla Bombardment Range, Mariana Islands.

Johnson, O. W., M. L. Morton, P. L. Bruner, and P. M. Johnson. 1989. Fat cyclicity, predicted migratory flight ranges, and features of wintering behavior in Pacific Golden-Plovers. Condor 91: 156-177.

Pratt, H. D., P. L. Bruner, and D. G. Berrett. 1987. A field guide to the birds of Hawaii and the tropical Pacific. Princeton Univ. Press. 409 pp.


72
71
70
98
99
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Philippine Sea
Pacific Ocean
Landing Zone
Area where Megapodes were sighted. This by no means implies that th they are confined to this section of the island.
A more complete survey would be able to give a better picture of their distribution.
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FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Belt Collins Hawaii, 1998

4467 SIERRA DRIVE
HONOLULU, HI 96816
PHONE: 808-734-4009
FAX: 808-732-1813

December 3, 1996

Mr. John Goody
Belt Collins Hawaii
680 Ala Moana Blvd.
Honolulu, HI 96813

RE: Preliminary Report - Marinas EIS - Farallon de Medinilla Marine Assessment

Dear John:

Following the field expedition of November 1- 6, 1996 to the Island of Farallon de Medinilla CNMI, I would like to provide you with a preliminary summary of findings. The fieldwork on which the report is predicated consisted of a land survey of the Island conducted on November 5, 1996. No in-water work was conducted as a result of ship evacuation of the area in response to a developing Typhoon.

The island consists primarily of uplifted lithified limestone substrata with the margins consisting primarily of steep vertical walls with numerous wave-cut caves and notches. The shoreline consist primarily of large boulders and rock outcrops with little beach formation. While there is little detailed bathymetry of the waters surrounding the island, it was visually apparent that there is little shoal area around most of the island, and the submarine slope of the island appears to be very steep. Weather conditions during the field visit consisted of strong tradewinds (20-30 kts) that resulted in fully developed seas. Wind-generated seas caused large surf to break on the shorelines of the windward side of the island (northwest); there was considerable lee on the southeast side with relatively calm water and small surf. The combination of steep vertical profiles of the submarine shoreline, and the massive physical forces from breaking waves on the windward side of the island likely results in a limited assemblage of benthic biota, at least to the depth of wave base.

Because the shortened mission prevented reconnaissance dives, I have interviewed all parties that to my knowledge have dived at FDM. These include members of the EOD team based in Guam, and Patrick Bryan, a Fisheries Official for CNMI. The consensus of these interviews was that deep water surrounds much of the island, with the exception of shoal areas at the northern and southern ends. Bryan reports that at the northern end and central parts of the leeward side of the island substrate drops gradually seaward. In these areas coral growth was good with *Pocillopora, Acropora, Porites, Montipora* and *Millepora* providing coverage of about 50% of available substratum. Fish were reported to be abundant by all observers. Bryan reports that Kyphosids were abundant near the shoreline, and Acanthurids (surgeonfish) and Chaetodonts (butterflyfish) were abundant in deeper water. In the central part of the island, Bryan reports two large unexploded projectiles and other related materials at a depth of

approximately 20 m. Bryan also reported that while the emergent sides of the island showed signs of explosive blasts, there was no evidence of similar damage underwater.

Our land-based survey also revealed the presence of at least several coconut crabs (*Birgus latro*) inhabiting cracks in the rocks near the shoreline. One green sea turtle (*Chelonia mydas*) was observed from the shoreline on the surface off the leeward side of the island. No marine mammals were observed.

In sum, with the very limited information available, it appears that the marine resources are primarily concentrated on the leeward side of the island. Steep underwater topography probably limits the area where explosive materials would remain at shallow depths; in most areas ordnance would likely roll down the steep embankment to abyssal depths. Without doubt, future field surveys that include underwater reconnaissance will add significantly to the ability to assess the potential impacts of the proposed uses of Farallon de Medinilla.

Sincerely,

Steven Dollar, PhD.

TRIP REPORT

TO: Robert Smith, Ecoregion Manager
Brooks Harper, Field Supervisor
Karen Rosa, Recovery Program Leader
Margo Stahl, Interagency Program Leader
Mariana Island Team
Beth Flint, Refuges

DATE: 10 December 1996

FROM: Michael Lusk (in association with Curt Kessler, CNMI Wildlife Biologist)

RE: Trip to Farallon de Medinilla (FDM), Commonwealth of the Northern Mariana Islands

The purpose of this memo is to provide a "quick and dirty" overview of my trip to the island. It is not intended to fully evaluate the impacts of potential training on the species encountered, nor to fully chronicle all important island resources (e.g., vegetation). In addition to this report, there is a video on file in our office that chronicles our findings. I hope to make slides available to our library in the near future.

Brief Itinerary

3 Nov. -6:00 A.M.: Pick-up at hotel by Navy.

1:00 P.M.: Board USNS Kilauea, Guam.

4:00 P.M.: USNS Kilauea underway.

4 Nov.-7:30 A.M.: Transported by helicopter from USNS Kilauea to FDM.

1:00 P.M: Transported by helicopter from FDM to USNS Kilauea.

3:00 P.M.: Transported by helicopter from USNS Kilauea to Saipan.

8:15 P.M.: Depart Saipan (Airline).

9:00 P.M.: Arrive Guam

Overview

We were transported by the USNS Kilauea from Guam to offshore Farallon de Medinilla (FDM). On the morning of 4 November we were transported by helicopter from the Kilauea to FDM.

We surveyed FDM for approximately five hours from 7:30 AM to 1:00 PM. During this time we were able to walk the perimeter of the large northern portion of the island (Figure 1). The interior portion of the island was inaccessible due to heavy groundcover which hides unexploded ordnance. The small southern part of the island is not accessible by foot from the north. Estimations of seabirds for this area were done from the helicopter during fly-over. Original plans were to spend the rest of the day and all of the next day on the ground, but an approaching storm required our early withdrawal. Despite the small amount of time spent on the island, we were able to gain a great deal of valuable information. I took both slide and video film of the trip.

Several different "teams" were deployed to the island with Navy EOD escort. I accompanied Curt Kessler, CNMI wildlife biologist, and Phillip Bruner, Belt Collins ornithologist. Other teams included Art Whistler, Belt Collins botanist, Scott Vogt, CNMI herpetologist, and a Belt Collins archaeologist. Representatives from the National Marine Fisheries Service and CNMI fisheries were also present, but due to rough seas were not able to survey the marine resources of the island.

Wildlife Resources

During the trip we recorded sixteen bird species, estimated their population sizes, and noted any obvious breeding activities (Table 1). Typhoon Yates hit the island two to three weeks prior to our visit and may have had an effect on the breeding bird population. This may account for some of the dead immature birds mentioned later in the account.

Masked Boobies: Masked boobies were concentrated primarily on the eastern rim of the island, although some were found in the more interior portions of the southern tip of the main island (Figure 2). Several boobies were seen attending one or two eggs, one downy chick was seen, and several family groups contained immatures. Nests were located mostly on bare hardpan soil along the cliff edges on the windward (eastern) side of the island.

Red-footed Boobies: Small colonies of red-footed boobies were observed on the western edge and southeastern corner of the island (Figure 2). This species was roosting and nesting in the low shrub vegetation (< six feet). Their distribution and population on the island is probably limited by the lack of medium and tall trees. Nests were seen containing eggs, but no chicks or fledglings were observed.

Brown Boobies: Brown boobies were limited in their distribution, being restricted to the southeastern corner of the island (Figure 2). Although no nests were observed, several dead immatures were found in the southeastern portion of the island and some living immatures appeared emaciated. More brown boobies were probably utilizing the steep cliffs of the island for roosting and nesting, but were not visible from our vantage point.

Great Frigatebirds: A breeding colony of great frigatebirds was discovered on the west central edge of the island (Figure 2). The colony was distinct, but was surrounded by nesting red-footed

boobies. Several nests, one egg, and one immature were observed. The frigatebirds were nesting in low shrubs (four to six feet high), similar to those being used by the red-footed boobies, adjacent to the cliff line.

Black Noddies, Common Noddies, and White Terns: All three species were seen using the sea caves on the east central edge of the island (Figure 1). Nesting was noted for common noddies and white terns inside the caves. Eggs were seen for both of these species.

Micronesian Megapodes: Four megapodes were flushed on the southern end of the main island (Figure 3). Within approximately 100 feet of the northern most megapode sighting was an area of exposed soil containing scratching and burrows. It is unclear if this was the result of megapode activity however. Megapodes were encountered in low, shrubby vegetation from 2 to six feet in height. Megapodes were encountered in fairly open areas, but this may be a result of our search pattern. Heavy vegetation and the threat of concealed ordinance in the interior of the island prevented us from throughly searching this area. We should not assume that megapodes are restricted to areas of shrubby vegetation on the southern end of the island.

Other Species: At least two rats were seen, but none were captured. They were most probably Polynesian rats (*Rattus exulans*) but positive identification was not possible. Three small (<6 inches across carapace) coconut crabs (*Bigus latrus*) were observed (Figure 3). Two species of lizards were observed, the snake-eyed skink (*Cryptoblepharis poecilopleurus*) and the blue tailed skink (*Emoia caeruleocauda*).

Some Impact Concerns

There is no question that bombing of this island will result in the death of seabirds, migratory shorebirds, and possibly the endangered Micronesian megapode. On several occasions we observed boobies nesting very close to unexploded ordinance. While the unexploded ordinance may not provide an immediate threat to the birds, it does indicate that bombs do fall in active nesting areas. Although there may be peaks in the seabird breeding season, our observations indicate that breeding probably occurs year-round. Two megapode sightings, the northern and southern most (Figure 3), were near the edges of the island where ordinance impacts appear to be the greatest.

Another major concern is the transport of junk cars from Guam onto FDM as targets. Currently there are about twelve of these vehicles on the island. Even though these cars may be searched for brown tree snakes (*Boiga irregularis*) before transport, there is still a good chance snakes may stow away in the cars and later invade the island. Snake traps were brought to the island by the CNMI herpetologist, but the short time we had on the island prevented their distribution.

It is very difficult to gauge the impact that naval activity has had on the seabird and megapode population. As the helicopter approached and landed, several hundred seabirds were airborne, but some of the masked boobies began to resettle on nests within fifteen minutes. It was not possible to tell how long other species, such as red-footed boobies, were off their nests.

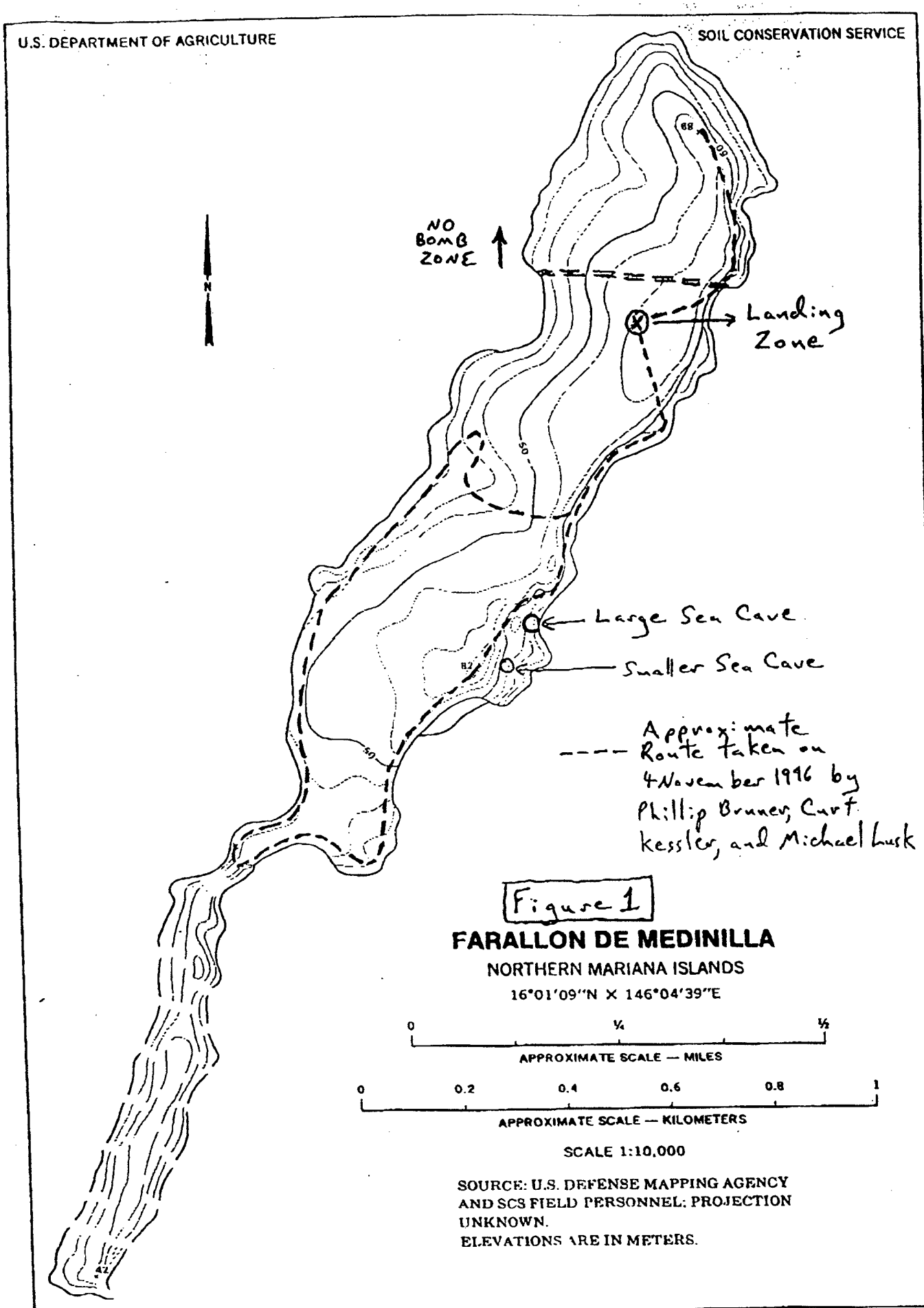
Historically, it is very difficult to determine how many birds were using the island. An Environmental Impact Statement prepared by the Navy in 1975 states that boobies are evenly distributed over the island and estimates a population of 50,000 boobies and 1,000 white terns. If this estimate is accurate, then bombing on the island since 1975 has had a tremendous effect on the birds. However, the report does not state how they arrived at their estimate. The only pictures included in the report are from offshore, which leads me to believe they may have never been on the island. A 1991 paper by Jim Reichel in an ICBP technical publication lists the population of masked boobies on FDM to be 50 pairs, red-footed boobies 200 pairs, and brown boobies as 500 pairs. These estimates in turn are based primarily on observations made in 1984 by biologists who approached the island by boat but never actually got onto the island (Thane Pratt, personal communication). These numbers are much lower than our estimates, but are close enough that seasonal variation may account for most of the difference. To gauge the impacts of bombing it will be important to determine the accuracy of the 1975 EIS estimates. It is possible that bombing changed the predominate vegetation cover of the island to such a degree that nesting habitat was significantly reduced. The University of Guam Marianas Archipelago Resource Center has aerial photos of FDM from 1944 that may give additional information on past seabird use and vegetation changes. In addition, there is a reference to FDM in a 1902 report by the German G. Fritz that may indicate past seabird use and that needs further examination.

Possible Mitigation Measures

Should the Navy be allowed to continue to use the island for bombing, there are several mitigation steps to consider. The most obvious recommendation is that bombing be restricted to nonpeak breeding seasons for seabirds and that the impact area be restricted to the interior portion of the island where there are very few, if any, seabirds. Edge impacts in particular should be avoided. It is unknown what effect this would have on the megapodes however. The Navy could also arrange for aerial photos of before and after bombing sorties to gauge nesting disturbance and coordinate annual visits by its own, and possibly Service and CNMI, biologists. Other more long term mitigation measures might be considered such as the aerial broadcast of rodenticide over FDM, or the Navy's assistance in eradicating feral ungulates and non-native predators from another island such as Sarigan.

Table 1. Bird species recorded on 4 November 1996 from Farallon de Medinilla, their approximate populations, and indication if breeding was observed.

Common Name	Scientific Name	Population Estimate	Breeding Status
Brown Booby	*Sula leucogaster*	200	Immatures
Masked Booby	*Sula dactylatra*	750	Nests w/eggs, chicks, immatures
Red-footed Booby	*Sula sula*	500	Nests w/eggs
Great Frigatebird	*Fregata minor*	25	Nests w/eggs, immatures
Red-tailed Tropicbird	*Phaethon rubricauda*	4	
Common Noddy	*Anous stolidus*	50	Nests w/ eggs
Black Noddy	*Anous minutus*	20	
Sooty Tern	*Sterna fuscata*	1	
Bristle-thighed Curlew	*Numenius tahitiensis*	2	
Whimbrel	*Numenius phaeopus*	2	
Ruddy Turnstone	*Arenaria interpres*	2	
Lesser Golden-plover	*Pluvialis dominica*	5	
White Tern	*Gygis alba*	200	Nests w/eggs
Eurasian Tree Sparrow	*Passer montanus*	4	
White-throated Ground-dove	*Gallicollumba xanthonura*	50	
Cattle Egret	*Bubulcus ibis*	1	
Micronesian Megapode	*Megapodius laperouse*	4+ (four observed)	



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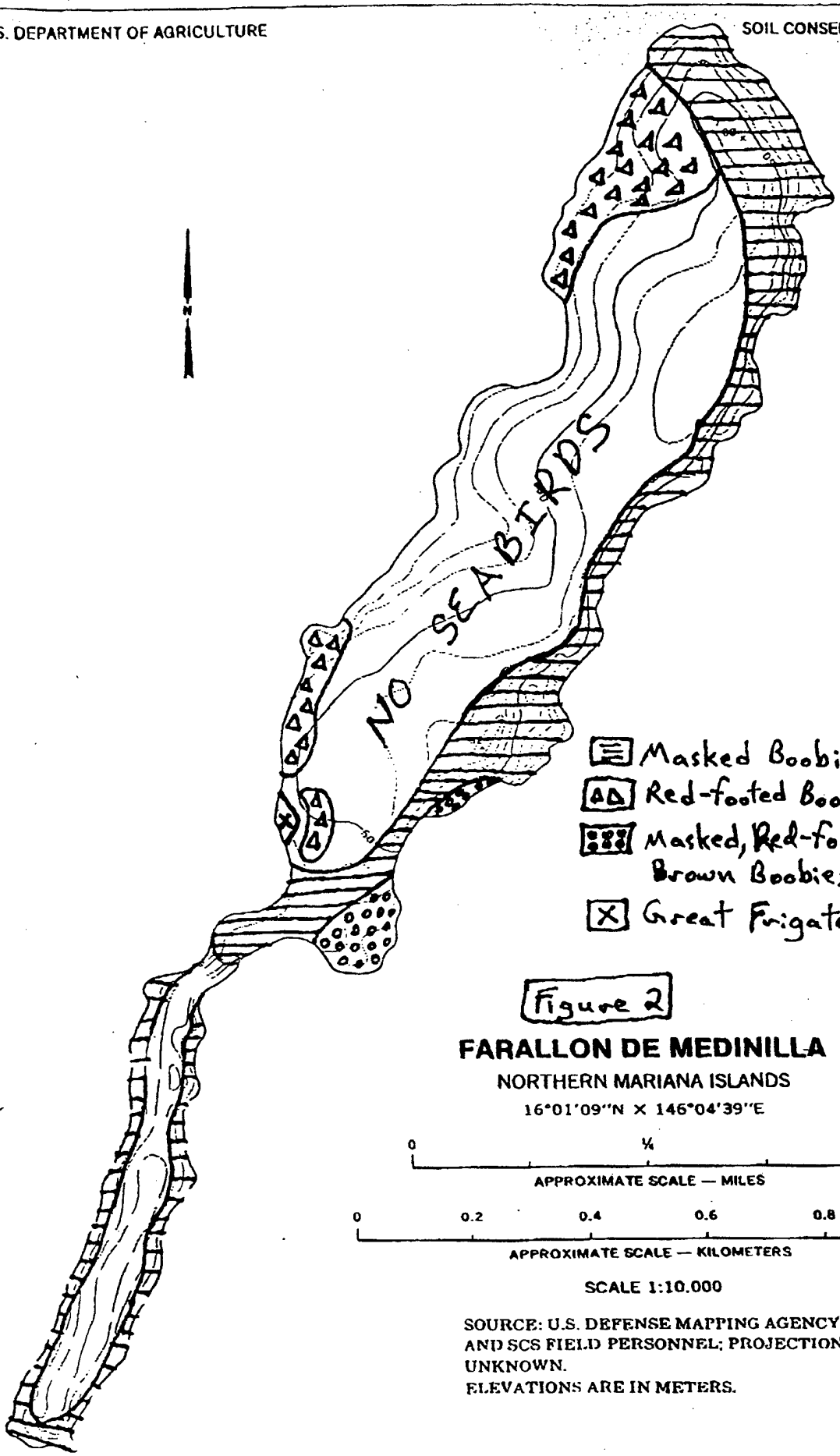


Figure 2

FARALLON DE MEDINILLA

NORTHERN MARIANA ISLANDS

16°01'09"N × 146°04'39"E

0 ¼ ½

APPROXIMATE SCALE — MILES

0 0.2 0.4 0.6 0.8 1

APPROXIMATE SCALE — KILOMETERS

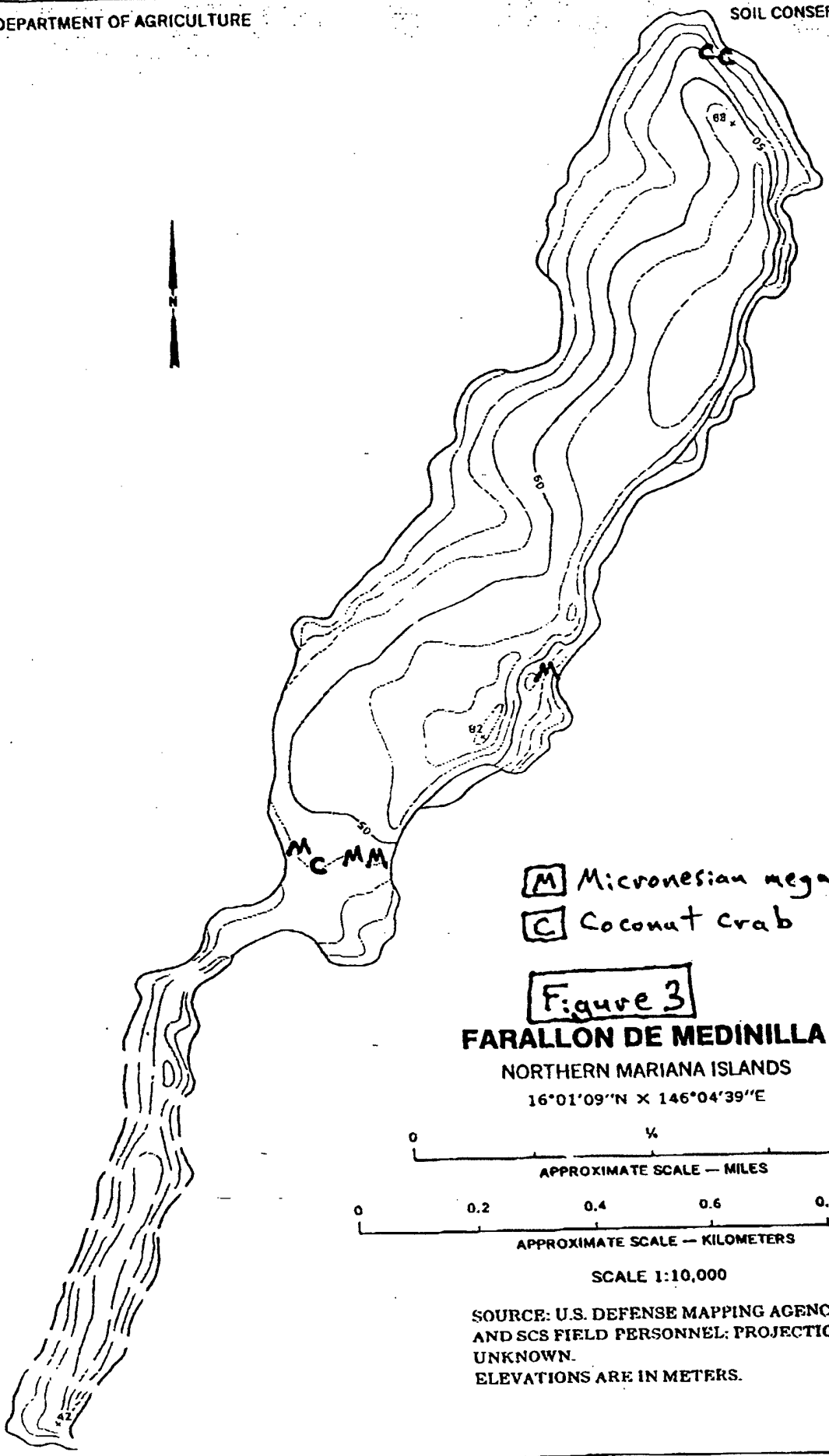
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SOURCE: U.S. DEFENSE MAPPING AGENCY AND SCS FIELD PERSONNEL; PROJECTION UNKNOWN.
ELEVATIONS ARE IN METERS.

JUNE 1986 BASE 4-R-19789

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SOIL CONSERVATION SERVICE



M Micronesian megapode

C Coconut crab

Figure 3

FARALLON DE MEDINILLA

NORTHERN MARIANA ISLANDS

16°01'09"N X 146°04'39"E

0 ¼ ½

APPROXIMATE SCALE — MILES

0 0.2 0.4 0.6 0.8 1

APPROXIMATE SCALE — KILOMETERS

SCALE 1:10,000

SOURCE: U.S. DEFENSE MAPPING AGENCY AND SCS FIELD PERSONNEL: PROJECTION UNKNOWN.
ELEVATIONS ARE IN METERS.

JUNE 1986 BASE 4-R-39789

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236/FDMES
8 Jan 96

MEMORANDUM

From: PACNAVFACENGCOM CODE 23 Tim Sutterfield
To: File
Via: 23

Subj: ENDANGERED SPECIES SURVEY OF FARALLON DE MEDINILLA (FDM) 16-17 Dec 96

Encl: (1) Map of 16 Dec survey route and findings.
(2) Map of established census stations.
(3) Map of 17 Dec survey route and findings.

1. The Subject survey was conducted by PACNAVFACENGCOM Fish and Wildlife Biologist Tim Sutterfield and COMNAVMARIANAS Lieutenant Commander Jaego while accompanied by an EOD technician. A total of ten hours was spent on the Island. six hours on 16 December and four hours on 17 December. Transportation to FDM was provided by HC-5 helicopter squadron.

2. On the morning of 16 December an overflight of the entire island was done and photos were taken. EOD technicians were lowered to the previously unsurveyed southern end of the island to determine the degree of unexploded ordnance hazard prior to allowing the biological team access to that portion of the island. EOD determined that numerous components of MK-80 cluster bombs discovered on that portion of the island made ground surveys unsafe. However additional overflights and photos were taken and it appears that there is very little vegetation that might support endangered species on that end of the island.

3. In the late morning and afternoon of 16 December we performed a foot survey of the entire perimeter of the northern portion of the island (see enclosure 1 map). No megapodes were seen but a Mariana fruit bat was detected in the ravine west of the hole that looks into the large sea cave and a second bat was seen on the northern end of the island near the red footed booby colony (see enclosure 1 map). Both bats were roosting on shrubs that were approximately three feet tall. The fruit bat is neither a federally or Commonwealth listed species on FDM. Six snake traps that were set during the 5 November trip were recovered. there were no sign of snakes having been in the traps but coconut crabs had eaten holes through two of the traps.

4. On 17 December six variable circular plot count stations were established along the eastern cliffline. the stations were 150 meters apart and marked with pink marker flags 12 inches tall (see enclosure 2 map). At each station Micronesian megapode recordings were played for two minutes followed by three minutes of monitoring. There were no responses to the recordings and no megapodes were heard calling. We then descended into the heavily vegetated ravine that bisects the northern end of the island searching the area where megapodes were seen during the November survey. We flushed two megapodes from this area one from the southeastern end of the ravine and one from the northeastern end of the ravine and a Mariana fruit bat was also seen in this ravine (see enclosure 3 map). Both megapodes were flushed from dense vegetation and flew short distances before diving into lily (Crinum asiaticum) patches.

5. Because of time constraints seabirds were not censused. It was noted that the masked boobies were on eggs or on very young hatchlings. red-footed boobies were on eggs. a few brown boobies were nesting. and frigatebirds were nesting but did not determine if they were on eggs.

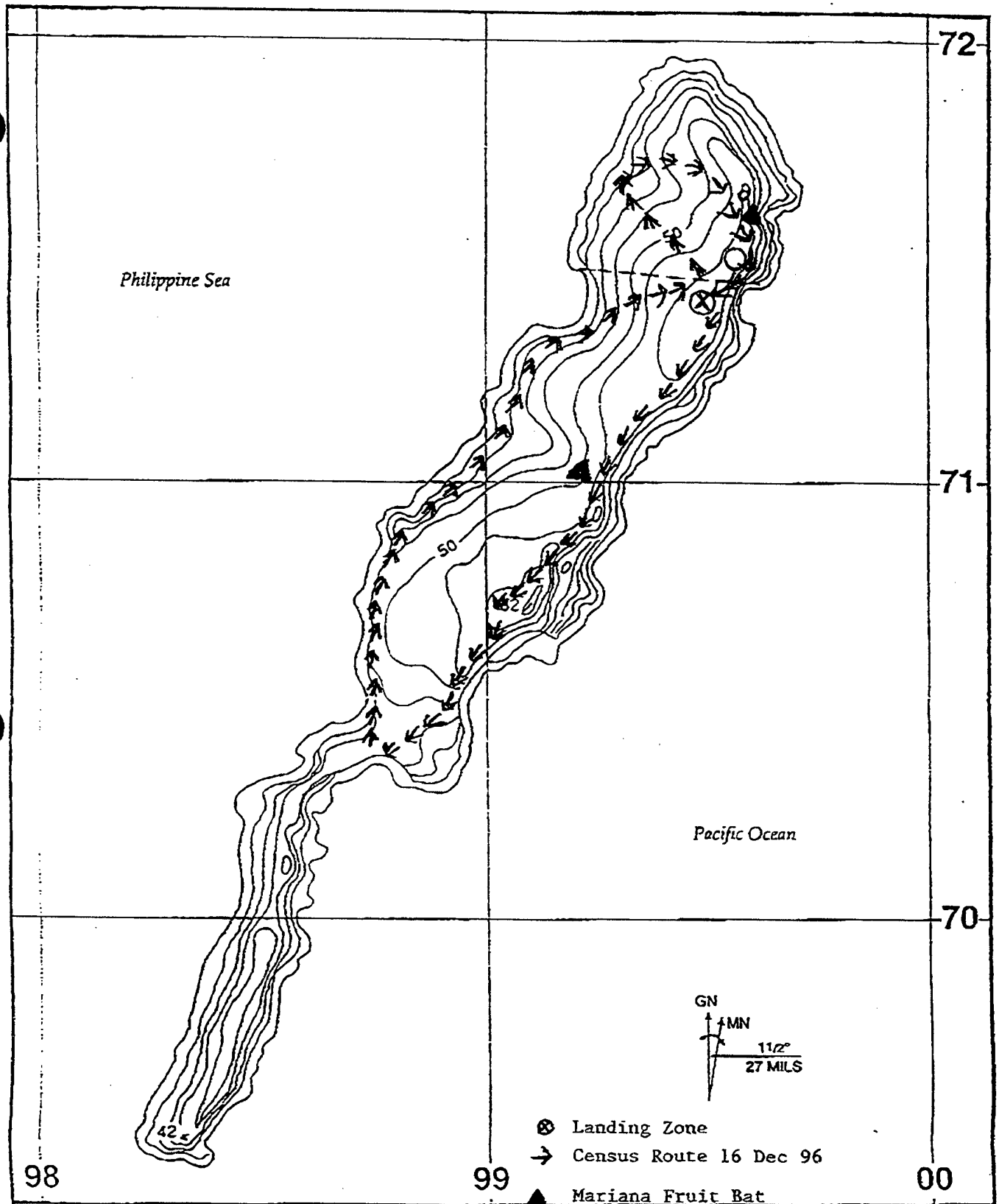
6. During the flyovers and while following the shoreline no sea turtles were observed in the near shore waters or on the two beaches where nesting might be possible.

7. For future surveys a minimum of two full eight hour days or three six hour days should be allotted to survey the northern portion of the island. The ten hours that were spent during this survey did not allow for sufficient coverage of the interior portions of the island.

Tim Sutterfield
Fish and wildlife Biologist

Copy to:
COMNAVMARIANAS N45
CINCPACFLT N465
09P

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NORTH

0 100 200 300 (Meters)

0 500 1000 (Feet)

LEGEND

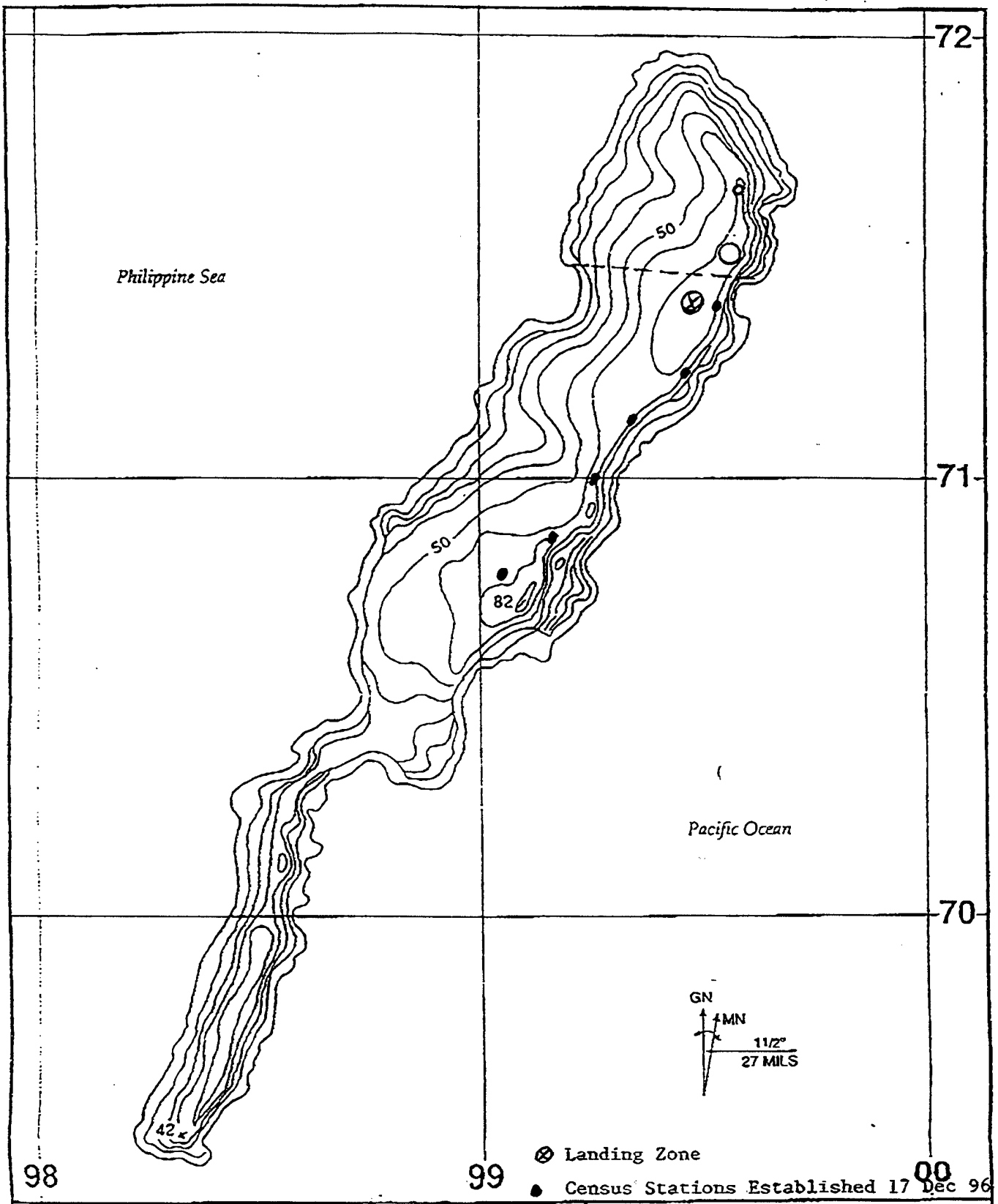
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FARALLON DE MEDINILLA

EIS: Military Training in the Marianas
Belt Collins Hawaii, 1996

Incl: (1)

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NORTH

0 100 200 300 (Meters)

0 500 1000 (Feet)

LEGEND

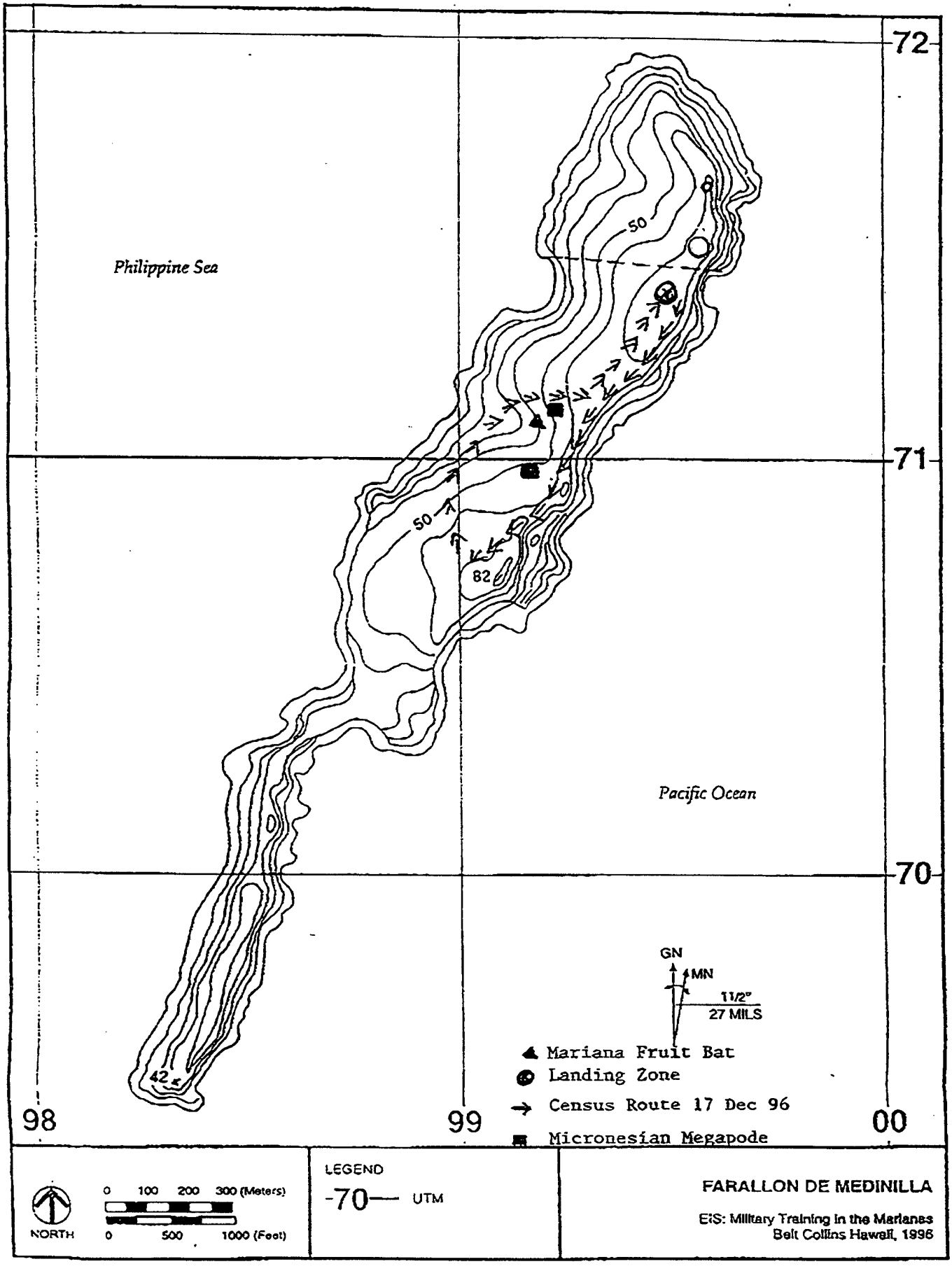
-70— UTM

FARALLON DE MEDINILLA

EIS: Military Training in the Marianas
Belt Collins Hawaii, 1996

Encl: (2)

342.0414/009-3 r10.21.96



Enclosure (2)

BOTANICAL SURVEY OF FARALLON DE MEDINILLA,

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

Prepared by
Dr. W. Arthur Whistler
Isle Botanica

for
Belt Collins and Associates
Honolulu, Hawai'i

December 1996

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INTRODUCTION

Farallon de Medinilla is situated in the Commonwealth of the Northern Mariana Islands (CNMI) at 16° N and 146° E, about 45 miles north-northwest of Saipan. The CNMI can be divided into a northern portion comprising eight volcanic islands (some of them recently active) and six relatively low, limestone-covered islands. Farallon de Medinilla is the northern-most of the latter type, and is covered mostly with eroded limestone soil, with scattered limestone outcroppings.

The straight, narrow island is little more than a limestone ridge arising out of the sea. It is aligned in a northeast to southwest direction and surrounded on all sides by cliffs, which are highest on the eastern edge. It is approximately 2 miles long and 1600 ft across at its widest point, and has an area of approximately 224 acres. Its highest elevation, approximately 82 ft, occurs in the central portion. The topography inland from the cliffs is for the most part flat to gently sloping. The island has apparently never been inhabited, nor have feral animals been established there (although the Polynesian rat, Rattus exulans, is present).

PREVIOUS BOTANICAL STUDIES

Apparently no botanist has ever visited Farallon de Medinilla, although one made reconnaissance overflights by helicopter in 1984. Apparently the only specimens, 13 in number, known from the island were collected by two wildlife biologists in the same year. These are Capparis spinosa, Abutilon indicum,

Portulaca lutea, Pisonia grandis, Morinda citrifolia, Excoecaria agallocha, Callicarpa candicans, Ipomoea pes-caprae, Boerhavia sp., Operculina ventricosa, Wollastonia biflora, Crinum asiaticum, and an unidentified sterile grass (D. Herbst. pers. comm.).

Three main publications have been published on, or which include, the flora of the CMNI. One is a checklist of the flora of Micronesia (Fosberg et al. 1979, 1982, 1987), the second is a checklist (with two additions) of the flora of the CNMI (Fosberg et al. 1975, 1977, 1980), and the third a checklist of the CMNI prepared during a Japanese expedition to the northern volcanic islands in 1992 (Ohba 1994). At least seven species, Mariscus javanicus, Heteropogon contortus, Sesuvium portulacastrum, Wollastonia biflora, Ipomoea pes-caprae, Morinda citrifolia, and Premna serratifolia, are recorded by Fosberg et al. (1979, 1987) from Farallon de Medinilla, but it is not certain if these records are based on specimens or observations.

The Japanese expedition did not visit, nor did Ohba's publication mention, other than in passing, Farallon de Medinilla. The publication includes a checklist of species recorded during their visit (but excludes species recorded only by previous botanists). Only 29 of the 40 species recorded on Farallon de Medinilla during the present survey were noted (see Table 1) by Ohba for the volcanic CMNI islands.

The only other botanical record turned up in the literature search from the island is found in an environmental impact statement produced by the Navy (anon. 1975). It lists the following species: Morinda citrifolia, Calophyllum inophyllum,

Hibiscus tiliaceus, Bikkia tetrandra, Crinum asiaticum (misidentified as Pancratium littorale), Carica papaya, Cyperus spp. (Mariscus javanicus), Ipomoea pes-caprae, Cynodon dactylon, Heteropogon contortus, Euphorbia spp. (it is not clear what this is), Boerhavia spp., Sesuvium portulacastrum (misidentified as Batis spp.), and Portulaca spp. There is no indication of how these were identified, and no mention of voucher specimens.

METHODOLOGY

Two aspects of the botany of Farallon de Medinilla were studied during the site visit--the flora and the vegetation. The island was visited by the Principal Investigator on the 5th of November 1996, accompanied by other members of the survey team and several EOD (Explosive Ordnance Disposal) team members. The trip was to include four days of daily visits via helicopter from the U.S.S. Kilauea. However, because of an approaching hurricane, the visit was cut short just after noon of the first day, and the survey team was evacuated to Saipan.

While on the island, the Principal Investigator made a reconnaissance along with other members of the survey team and recorded notes on the vegetation and flora. This reconnaissance covered only the northern half of the island in the half day available.

Most plant identifications were done in the field, since nearly all species present were well known and were familiar to the Principal Investigator. To insure accuracy, voucher specimens of most species encountered (37 of the 40) were

collected. Insufficient time prevented the collection of the remaining three. The voucher specimens were divided into sets, one sent to the University of Guam, another to the Bishop Museum Herbarium, a third to the Smithsonian Institution, and a fourth retained at the University of Hawai'i Botany Department. Also because of the insufficient time, only a preliminary checklist of the flora, augmented by the Navy E.I.S. (anon. 1975), and an abbreviated description of the vegetation, is possible from the notes made during the visit.

THE FLORA

The flora of Farallon de Medinilla comprises all the plants found on the island. These plants are either native (species arriving by natural means, usually before human occupation) or alien (species arriving by accidental or intentional transport). Native species can be further divided into "endemic" species that are restricted to that area (i.e., are found only in the Mariana or Northern Mariana Islands) and "indigenous" species that are widespread and found in other areas. Alien species can be further divided into cultivated plants, which are usually intentionally introduced, and weeds, which in most cases are accidentally introduced. Since the island shows no signs of previous occupation, cultivated plants, other than two species that escape from cultivation (papaya and crinum lily), are not found on the island. Consequently, the vascular plants on the island are put into the two categories below: native species and weedy species.

The number of native and naturalized species recorded on the island 43 (Table 1), although additional time on the island would have no doubt increased this number.

Native Species

There are about 32 native vascular plant species recorded from Farallon de Medinilla (Table 1). The low number of native species is not unusual, since small islands with inhospitable conditions often have a small flora. This is due mainly to the small size, low elevation (which precludes multiple habitats), and harsh environmental conditions that are detrimental to most species. Only one species, Digitaria gaudichaudii, is endemic to the Mariana Islands (and Wake Island). This low rate of endemism is also to be expected on an island such as Farallon de Medinilla, where the majority of species are widespread littoral plants.

Strangely, the most common littoral shrub in the Pacific, Scaevola taccada (beach naupaka) was not seen on the island. Another plant that would be expected there, the coconut (Cocos nucifera), was likewise missing from the flora.

Weedy Species

About 11 of the 43 recorded species could be classified as weedy or naturalized alien species. This includes one grass that could not be identified beyond genus (Brachiaria), but which is probably an alien species not previously recorded from the CNMI. Some of the weedy species are uncommon, such as Blechum brownei, Amaranthus viridis, Leucaena leucocephala, Physalis angulata, and

Stachytarpheta jamaicensis. Only one alien species, Operculina ventricosa, was common, but this plant, which is native to tropical America, probably arrived naturally by seawater flotation of its seeds from neighboring islands.

THE VEGETATION

The climate at Farallon de Medinilla is wet tropical, and the vegetation in this area would be expected to be a limestone forest. However, because of the effects of the salt-laden sea breezes and occasional hurricanes, the island was probably originally covered with littoral scrubland. This vegetation probably prevailed up to 1971, when the island was first utilized as a bombardment range for the Navy and Air Force.

The current vegetation of the island has been heavily impacted by the activities of man, almost entirely due to the bombardment of the island. The earlier E.I.S. (anon. 1975) noted that "the overstory is composed primarily of Morinda citrifolia ... which at this location grows as a small shrub-like tree up to about 12 feet high." At the time of the visit, no woody plants found on the island even approached this height, and Morinda was rather uncommon. It is likely that this was a misidentification for Pisonia grandis, which at the time of the present survey was common, but not large.

Currently the island is covered with herbaceous or shrubby vegetation dominated by littoral species, but to distinguish plant communities would be nearly impossible because of the short duration of the visit and the mosaic nature of the vegetation.

Most of the plants on the island are to some degree tolerant of salty conditions, and each is distributed on the basis of its own tolerances. Since there is an environmental (probably salinity) gradient from the shore of the island up to the highest elevation (82 ft), there is also a gradient in vegetation, with each species growing where it can. Consequently, there is few clear boundaries between any vegetation units that could be created.

However, several aspects of the vegetation can be discussed, bearing in mind that these aspects generally lack definable boundaries. These aspects are divided here into a littoral zone, limestone outcroppings, central area, and wetland.

The Littoral Zone

The littoral zone (Fig. 1) occurs just above the high tide mark. It is present on the west side of the island where the cliffs are low, but on the east side the cliffs are so high that the right environmental conditions are lacking. The vegetation here is usually dominated by littoral species, such as Ipomoea pes-caprae (beach morning-glory) (Fig. 2), Portulaca lutea (sea purslane) (Fig. 3), and Sesuvium portulacastrum (seaside purslane, a misnomer since it does not actually belong to the purslane family) (Fig. 4), and Fimbristylis cymosa (Fig. 5), along with lesser amounts of other littoral plants, such as Portulaca oleracea (purslane), Wollastonia biflora (beach sunflower) (Fig. 6), and Boerhavia repens (Fig. 7). These species are able to survive occasional sea spray, which does not extend very far away from the shore.

Limestone Outcroppings

The eastern side of the island is bounded by limestone cliffs (Fig. 8), and at the the north end, at least (the southern end was not visited), there are some outcroppings inland. The vegetation on the cliffs and outcroppings is dominated by plants that can live rooted in rock cracks rather than soil, but which may not be able to withstand any direct sea spray. The dominant species in this habitat is Excoecaria agallocha (Fig. 9), with lesser amounts of Digitaria gaudichaudii, Bikkia tetandra, Hedyotis strigulosa, and Portulaca oleracea.

Some of these species, such as the beautiful Bikkia tetrandra (Fig. 10), are more or less restricted to this habitat because in soil they would soon be overgrown and shaded out by more vigorous species.

The Central Area

This comprises the central area of the island away from the low, exposed edges of the west coast (Fig. 11). It is covered with soil that appears to be a combination of highly eroded, red volcanic material and eroded limestone. The dominant plant here is probably Wollastonia biflora (beach sunflower). Also common are Mariscus javanicus, Capparis spinosa (spiny caper) (Fig. 12), and Ipomoea pes-caprae (beach morning-glory), with lesser amounts of Boerhavia spp., Portulaca lutea (sea purslane), Operculina ventricosa (Fig. 13), and Pisonia grandis (Fig. 14). In some places, the grass Digitaria gaudichaudii dominates (Fig. 15).

Because of the years of bombardment, and possibly other

factors, the vegetation here is not homogeneous, but rather a mosaic of several types, but which generally lack boundaries. Two additional subtypes can be distinguished, crinum thickets and disturbed vegetation.

Crinum Thickets

Crinum thickets, dominated by Crinum asiaticum (crinum lily), cover much of the central region (Figs. 16 & 17). The large crinum lily, which is widely cultivated in the tropics, appears to be native to Farallon de Medinilla. Probably 90% of the biomass in these thickets is composed of crinum lily, since it can crowd out or shade out most of the other species.

Disturbed Vegetation

Patches of disturbed vegetation are scattered throughout the central area, and probably represent places most recently impacted by explosives. In some places above the cliffs on the eastern side of the island, baren areas, inhabited by Masked Boobies, are present (Fig. 18). Since the "natural" vegetation in disturbed areas has been removed, the regrowth is usually dominated by herbaceous, light-loving species, many of which are called "weeds." These species, such as Portulaca oleracea (purslane), Phyllanthus amarus, Chamaesyce hirta, and Boerhavia repens are often present throughout the central area, but are either obscure under the other larger species, or are shaded out there but remain in the soil as seeds awaiting disturbed conditions when they can again propagate. After a few years, other taller or viney species, such as Wollastonia biflora and Capparis spinosa overgrow these places, concealing the past disturbance.

Wetland

There are no true wetlands on the island, since it lacks the right soil conditions and the indicator species. However, there are areas where the soil appears to be relatively impermeable and where water collects after rains, or perhaps drains down from up the slope. Only one of these areas (Fig. 19) was seen during the short reconnaissance (on the west-central slope), and it was entirely dominated by Mariscus javanicus, a littoral species classified as a "fac-wet" plant (Reed 1988). Since the soil did not appear to be wetland soil, the area was so small, and no obligate wetland species were present, this would probably not qualify as a significant wetland. However, other wetland areas not located because of insufficient time may be present on the island.

DISCUSSION

There are major two aspects of the botany of Farallon de Medinilla that must be addressed, sensitive types of vegetation and threatened or endangered plant species. Also to be discussed is the impact of introduced plant species on the island.

Sensitive Vegetation

There are apparently no sensitive types of vegetation on the island. The one wetland seen was too small and lacked the prerequisites of a wetland. However, these areas may be vital to the presence of land birds on the island, such as the megapode. Sea birds do not need fresh water, but land birds generally do.

Threatened and Endangered Plant Species

There are no threatened or endangered plant species on the island. This is mostly because there is only one listed threatened or endangered species in the CNMI (Serianthes nelsonii) and only three that are being considered for candidacy (M. Lusk, pers. comm.). Such species are usually inland plants, which tend to have a higher rate of endemism than littoral species. Nearly all the species encountered on the island are widespread plants, most of them littoral.

Only two species recorded from the island can be considered rare or uncommon. One is the seaside cotton Gossypium hirsutum var. taitense (Fig. 20), which has a spotty distribution across the Pacific, and has been previously recorded only a couple of times in the CNMI. The other is the bunch grass Digitaria gaudichaudii, which is endemic to the Marianas and Wake Island, and was the only endemic species recorded from the island.

The Introduction of Alien Species

The introduction of alien plant species to island ecosystems can be a major problem. This problem is somewhat mitigated on Farallon de Medinilla because most introduced plants are unable to germinate and/or survive in the harsh maritime conditions, and native plants, which are adapted island conditions, can usually compete successfully against introduced plants.

Despite the relative resistance of small islands to invasive species, the problem of alien species on is obvious. As noted earlier, during the present survey and in the literature, only 11

species appear to be non-native. With the exception of two, these appear to be plants restricted mostly to disturbed habitats, and which do not pose a threat to the environment.

The two possible exceptions are Leucaena leucocephala (tangantangan) and Operculina ventricosa. Tangantangan dominates most of the disturbed areas of Guam and the other Mariana Islands. Only one small patch was observed on Farallon de Medinilla, in the east-central area. Its seeds do not disperse very well, but once the plant becomes established in an area, it competes with native vegetation and is hard to eradicate. The other species is a morning-glory vine from the Caribbean and was introduced sometime ago to the Marianas, but which is probably a natural introduction to Farallon de Medinilla, to which it spread by seawater-dispersed seeds.

RECOMMENDATIONS

The flora on the island is in good shape, and no species seem to be adversely affected by the bombardment, at least those species recorded during the abbreviated visit. However, the vegetation is damaged by the bombardment, which could lead to problems for native birds who use it. Some sea birds, such as the Red-footed Booby, nest in trees, which are the most likely plants to be damaged by bombardment. To address the possible problems for the flora and vegetation, the following recommendations are made:

1. Finish the botanical survey to see if there are any other significant plant species on the island, and to see if any critical vegetation types can be recognized.

2. Map and study the marginal wetlands, and correlate this with information from ornithologists to see if these areas are critical to the land birds.

3. Control the introduction of new weedy species, and eradicate the patch or patches of tangantangan before they become a problem.

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TABLE 1. CHECKLIST OF THE FLORA OF FARALLON DE MEDINILLA

The species are arranged in two groups, monocots and dicots. Within these two groups they are arranged in alphabetical order by family, and in alphabetical order within the families.

FAMILY Scientific name	Status[2]	Common Name	Voucher Number
MONOCOTS			
AMARYLLIDACEAE (Amaryllis Family)			
Crinum asiaticum L.	I	crinum, piga-palayi	10288
CYPERACEAE (Sedge Family)			
Fimbristylis cymosa R. Br.	I	-----	10289
Mariscus javanicus (Houtt.) Merr. & Metcalfe	I	-----	10290
POACEAE (Grass Family)			
Brachiaria aff. reptans (L.) Gardner & Hubb. ex Hook.	X?	-----	10291
Cynodon dactylon (L.) Pers.	X	Bermuda grass	10296
Digitaria gaudichaudii (Kunth) Henrard	E	-----	10292
Digitaria radicosa (Presl) Miq.	I	-----	10293
Heteropogon contortus (L.) Beauv.	I	tangle-head	10295
Lepturus repens (L.) R. Br.	I	lesaga	10294
DICOTS			
ACANTHACEAE (Acanthus Family)			
Blechum brownei Juss.	X	yerbas babui	10297
AIZOACEAE (Fig-marigold Family)			
Sesuvium portulacastrum (L.) L.	I	chara, seaside purslane	10298
AMARANTHACEAE (Amaranth Family)			
Achyranthes canescens R. Br.	I	-----	10299
Amaranthus viridis L.	X	kuletes apaka	10300
ASTERACEAE (Sunflower Family)			
Wollastonia biflora (L.) DC.	I	masigsig, beach sunflower	10301

FAMILY Scientific name	Status[2]	Common Name	Voucher Number
CAPPARIDACEAE (Caper Family)			
Capparis cordifolia Lam.	I	spiny caper, atkaparas	10302
CARICACEAE (Papaya Family)			
Carica papaya L.	X	papaya	n.s.
CLUSIACEAE (Mangosteen Family)			
Calophyllum inophyllum L.	I	Alexandrian laurel, da'og	n.s.
CONVOLVULACEAE (Morning-glory Family)			
Ipomoea pes-caprae (L.) R. Br.	I	beach morning-glory alalag-tasi	10303
Operculina ventricosa (Bert.) Peter	X	-----	10304
EUPHORBIACEAE (Spurge Family)			
Chamaesyce hirta (L.) Millsp.	X	garden spurge, golandrina	10305
Excoecaria agallocha L.	I	blinding tree	-----
Phyllanthus amarus Sch. & Th.	X	maigo-lalo	10306
FABACEAE (Pea Family)			
Pongamia pinnata L.	I	gulos	10307
Leucaena leucocephala (Lam.) de Wit	X	wild tamarind, tangantangan	10308
MALVACEAE (Mallow Family)			
Abutilon indicum (L.) Sweet	I	mallow, matbas	10309
Gossypium hirsutum L. var. taitense (Parl.) Roberty	I	cotton, algodon	10310
Hibiscus tiliaceus L.	I	beach hibiscus, pago	n.s.
MORACEAE (Mulberry Family)			
Ficus prolixa Forst. f. var. carolinensis (Warb.) Fosb.	I	banyan, nunu	10311
MYRTACEAE (Myrtle Family)			
Eugenia reinwardtiana (Bl.) DC.	I	a'abang	10312

FAMILY Scientific name	Status[2]	Common Name	Voucher Number
NYCTAGINACEAE (Four-o'clock Family)			
Boerhavia albiflora Fosb.	I	dafao	-----
Boerhavia repens R. Br.	I	dafao	10313
Pisonia grandis R. Br.	I	pisonia, umumu	-----
PORTULACACEAE (Purslane Family)			
Portulaca australis Endl.	I	-----	10314
Portulaca lutea Sol. ex Forst. f.	I	sea purslane	10315
Portulaca oleracea L. var. granulato-stellulata V. Poel.	I	purslane, botdolagas	10316
RUBIACEAE (Coffee Family)			
Bikkia tetrandra (L. f.) A. Rich.	I	gausali	10317
Hedyotis strigulosa (Bartl. ex DC.) Fosb.	I	-----	10318
Morinda citrifolia L.	I	lada, Indian mulberry	10319
SOLANACEAE (Nightshade Family)			
Physalis angulata L.	X	wild cape-gooseberry, tomate chaca	10320
STERCULIACEAE (Cacao Family)			
Melochia villosissima (Presl) Merr.	I	sayafe	10321
VERBENACEAE (Verbena Family)			
Callicarpa candicans (Burm. f.) Hochr.	I	qualitay	10322
Premna serratifolia L.	I	ahgao	10323
Stachytarpheta jamaicensis (L.) Vahl	X	false verbena	10324

[2] STATUS: E = Endemic (to the Marianas); I = indigenous (native); X = Alien (non-native).

N.s. indicates species recorded in the 1975 E.I.S. but not seen during the present survey.

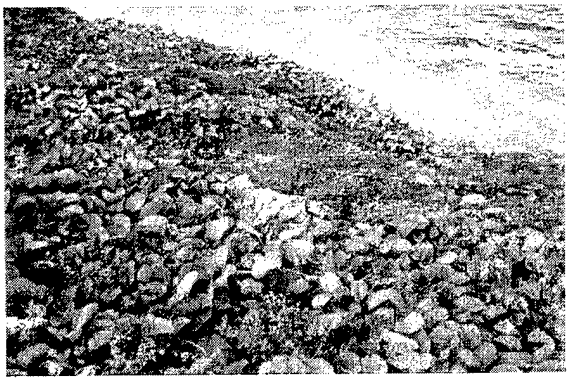


Figure 1: Littoral strand



Figure 2: Ipomoea pes-caprae

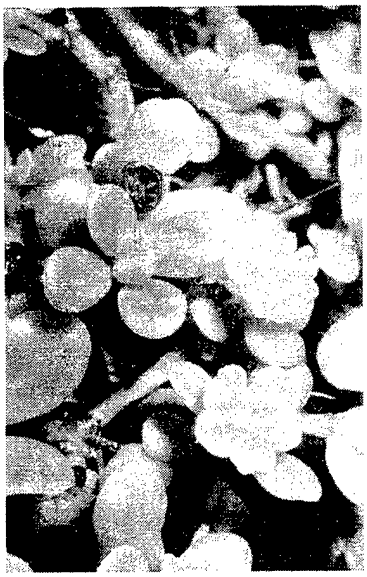


Figure 3: Portulaca lutea



Figure 4: Sesuvium portulacastrum

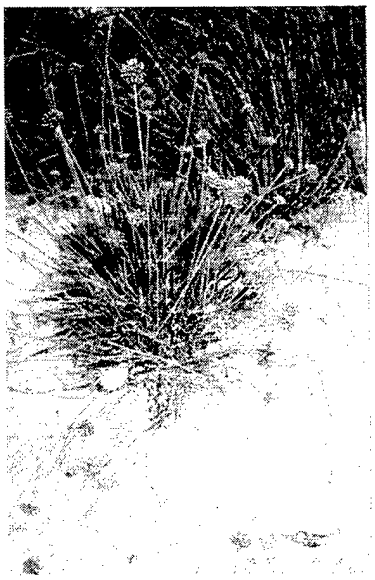


Figure 5: Fimbristylis cymosa



Figure 6: Wollastonia biflora



Figure 7: Boerhavia repens

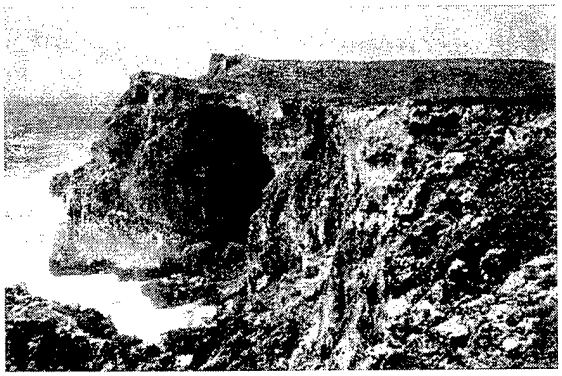


Figure 8: East cliff of F.D.M.



Figure 9: Excoecaria agallocha



Figure 10: Bikkia tentrandra

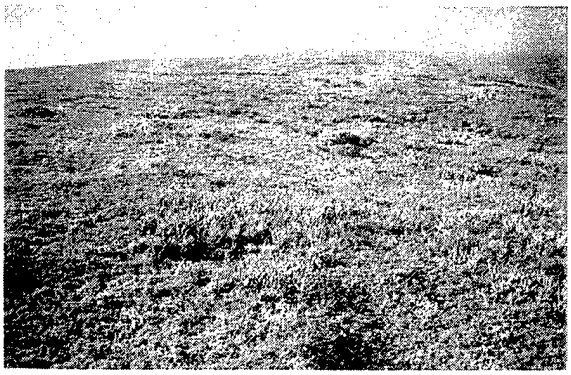


Figure 11: Looking south from north end, F.D.M.

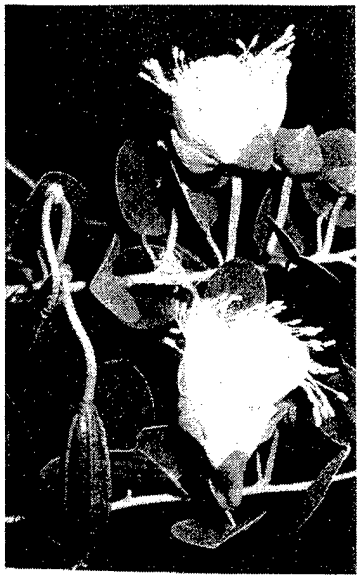


Figure 12: Capparis spinosa



Figure 13: Operculina ventricosa

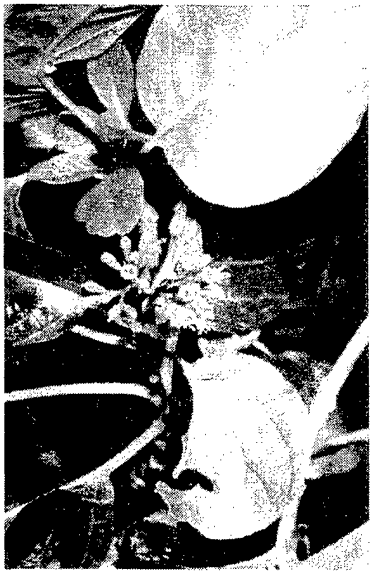


Figure 14: Pisonia grandis

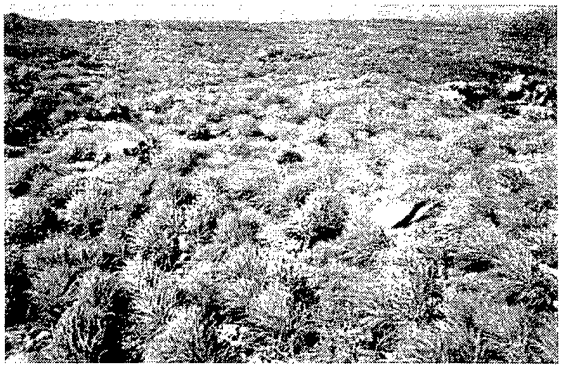


Figure 15: F.D.M. central, east coast



Figure 16: Crinum patch, F.D.M.



Figure 17: Crinum asiaticum



Figure 18: East cliffs of F.D.M.

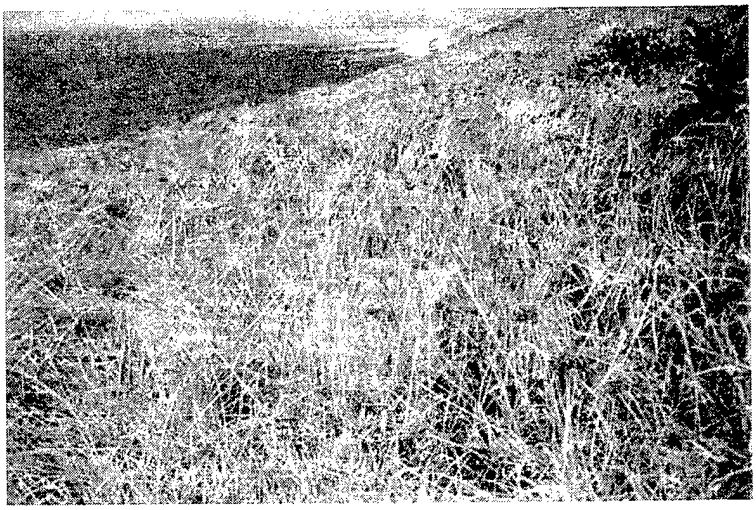


Figure 19: Central F.D.M. – looking north



Figure 20: Gossypium hirsutum var. taitense

Appendix I

Marianas Environmental Impact Statement Marine Environmental Assessment
Guam and Tinian

MARIANAS ENVIRONMENTAL IMPACT STATEMENT

MARINE ENVIRONMENTAL ASSESSMENT

GUAM AND TINIAN

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A. GUAM

1. SEAL Shallow Water Mine Training Locations

Seven sites in and around Apra Harbor were surveyed for suitability for shallow water mine countermeasure training exercises by Navy SEALS. SEAL personnel (Petty Officer Glen Davis) assisted in the field investigations and provided input as to the description of the training exercises and the desirable characteristics of mine countermeasure training sites. Exercises consist of locating, deploying, and disarming mine charges with consisting of approximately one pound of explosive. Exercises are generally carried out at night in shallow water (less than 20 feet). No information appears to exist describing the radius of impact of such charges that might affect corals or other biota. However, because there is obviously potential to impact biota, a major criteria of evaluation was the extent of active reef growth in the surveyed areas. Locations of survey sites are shown in Figure 2.2 of *Environmental Impact Statement for Military Training in the Marianas.*

a. Spanish Steps

Located at the southern inner point of the Apra Harbor entrance channel, this area consists of a shallow inner reef shelf that terminates in a sharp shelf break that slopes down to the Harbor floor. The composition of the inner reef shelf consists of limestone spurs and grooves that deepen moving seaward, and are of maximum depth at the shelf break. During the survey, the area was impacted with breaking waves emanating from the north. Owing to the proximity of the Spanish Steps area to the mouth of the Harbor, it is one of the only locales within Apra Harbor that is exposed to long-period swell. Coral cover is absent in the area close to shore (water depth ~3 ft), probably as a result of impact from breaking waves. Moving seaward from the shoreline across the reef shelf, coral cover gradually increases. On the outer region of the reef shelf coral cover consists of relatively isolated colonies, with an estimated total cover of 10-20% in water that ranges from about 4-10 feet in depth. Coral cover increases moving to the east, presumably because wave stress decreases with distance into the Harbor. Because there are relatively large intra-colony areas on the reef shelf between coral colonies, it is possible that mine charges could be deployed with no major impact to corals, as long as the placement of charges was conducted with care. Beyond the shelf break, the sloping reef face is composed of high living coral cover, predominantly consisting of large lobate and branching colonies of *Porites rus.* In sum, the Spanish Steps area could

be used for shallow mine training with minimal environmental impacts to reef biota, but is not an optimal area for these exercises.

b. Breakwater Beach

"Breakwater Beach" is a very small area of sand on the inner corner at the end of the Glass Breakwater on the northern side of the Apra Harbor entrance. The shoreline area is composed of large boulders that make up the breakwater. The boulders drop off rapidly to a sandy bottom at a depth of 30-40 ft. Scattered small encrusting coral colonies occur on some of the boulders. No corals or other macrobiota occurred on the sandy bottom at the base of the boulder walls. Because of the lack of biotic community structure, this area is environmentally suitable for mine countermeasure training. However, there is no region of shallow water; the sand floor of the Harbor appears to be deeper than the preferred depth of the SEAL exercises. In addition, the area delineated by the cove formed by the end of the breakwater is very small.

c. Drydock Island

This site is located in a small inlet on the landward side of a man-made peninsula at the back of Apra Harbor called Drydock Island. The entire bottom of the inlet is composed of fine calcium carbonate (limestone) sand/silt. The surface layer of fine material is white in color; several inches below the surface the sediment column is composed of black fine mud indicative of anoxic conditions. Such sediment profiles are not unexpected in areas of low circulation and water movement as is the case in the back of the Harbor. Probing the sand indicated several horizons of soft material before striking solid bottom. Grain size of sediment increases with proximity to the shoreline; at the beach sediment composition consisted of much coarser material than in the center of the cove. The sandy surface is marked by numerous burrow holes, probably from burrowing worms, shrimp or crabs. No corals or other benthic macrobiota were observed on the sediment surface. Consultation with SEAL personnel indicated that the soft sediment surface would not be a detriment to shallow water mine countermeasure exercises. Environmentally, this area appears to be ideal to conduct these exercises as there is no major biotic resources in the area that could be affected by the activity.

d. Polaris Point

This site is located approximately 4,000 feet to the southeast of the Drydock Island site within an embayment created by the man-made peninsula called Polaris Point. Bottom composition in the region is very fine grained calcareous sediment (silt/mud). There is also considerable fine particulate material suspended in the water column. The shoreline in the area is composed of dense mangroves. Much of the shoreline is also lined with concrete rip-rap and assorted construction debris. The region near the shoreline also contains numerous large lobate coral colonies. These corals appear to be impacted by the high level of suspended sediment as large parts of the colonies are dead, and have accumulated sediment on the dead surface. Many of the coral colonies are growing on and around the concrete structures that line the shoreline. As with Drydock Island, the soft sediment area off the shoreline appears to be a suitable region for mine countermeasure training, as the water depth is shallow. This area also appears to be environmentally favorable to training exercises as long as the mines are not deployed near the shoreline where the coral colonies occur.

e. Gabgab Beach

Gabgab Beach is located on the southern shoreline of outer Apra Harbor, approximately midway between the entrance to the inner Harbor and the main entrance of the Harbor into the open ocean. The physiographic structure of the Gabgab area is similar to the structure at the Spanish Steps site described above. The inshore region consists of a relatively shallow (2-3 feet) and gently sloping carbonate reef flat cut by shallow grooves. At the seaward end of the reef flat (8-10 feet deep), there is a sharp break in slope angle and the reef forms a steep face that drops to the Harbor floor. Coral cover on the reef flat in the nearshore region is relatively low (10-20%) of bottom cover, and increases with distance from shore. At the shelf break and down the channel wall, bottom cover consists virtually entirely of coral cover. The channel wall is composed almost entirely of large growing colonies of *Porites rus*. This area appears to be one of the most well developed coral reefs within Apra Harbor, and is the site of commercial submarine tour operations. Because of the high level of coral reef development in the area, Gabgab appears to be extremely unsuitable environmentally for any training exercises that have the potential to cause any damage to the reef community.

f. Tipalao Beach

Tipalao Beach is a small inlet on the ocean-facing side of Orote Peninsula. Off the southeastern end of the inlet is Neye Island, which is a large rock separated from the main island by a narrow channel. Tipalao Beach is a crescent beach composed of white calcareous sand. From the shoreline seaward to the limits of the embayment, the sea floor is composed of a gently sloping limestone reef platform cut by large cracks and erosional pits. Blocks of old limestone reef, likely broken from the reef platform by typhoon waves litter the floor of the inlet. Very little coral cover occurred on the reef platform, and the few corals that do occur are small flat encrusting species. Previous investigations of the Tipalao Sewage Outfall indicate that this region is regularly impacted by large typhoon-generated surf. As a result coral community development is continually disrupted with little coral accretion. Because of the low degree of reef development, the nearshore area off Tipalao Beach appears to be environmentally suitable for shallow water mine countermeasure exercises with a minimum of impact.

g. Dadi Beach

Dadi Beach is a long (approximately 1 mile) strand of beach to the south of Tipalao Beach. The southern boundary of the beach marks the southern bound of the Apra Naval Base. The shoreline of Dadi Beach consists of a narrow strand of white sand backed by beach vegetation. At several points along the beach, the vegetation extends across the sand to the water line. The inner reef flat seaward of the beach is composed of limestone platform that is covered by mats of blue-green algae. In addition to the mats of blue-green algae, extensive growth of other species of macro-algae dominates the reef flat. With distance seaward, vertical relief of the reef flat increases with pitted and eroded limestone structures that appear to be old coral colonies. While there is extensive "old" coral structure, there is relatively little living coral throughout the region. Living corals that do occur are predominantly small patches of encrusting forms growing on old carbonate structures. The overall appearance of the reef (abundant algae, predominantly dead mature coral structures) suggests that some catastrophic event, or chronic stress has recently impacted the area to cause significant change in coral community structure. However, it is not clear what such an event would be other

than typhoon impact. The seaward boundary of the reef platform is bounded by a region of large limestone boulders and reef fragments. Beyond this boundary zone, the bottom is composed of a plain of white carbonate sand. The demarcation between the sand plain and the boulder zone is a distinct drop-off with water depth of about 5 feet at the top of the boulders to 10-12 feet to the sand. The sandy area beyond the reef flat appears to be an ideal area for shallow mine countermeasure exercises as there is essentially no macrobiota in the area. Because of the limited coral community development on the reef flat, this area would also provide a suitable area for shallow mine training with little negative environmental consequences.

The Dadi Beach area also could be a site for landing craft exercises. The transition between the outer sand plain and the inner reef is not abrupt, but generally a gradation. In addition, while much of the reef flat is less than 6 feet deep, there is little live coral to be damaged by tracked vehicles crossing the reef flat. Beach area is abundant at present, and could be increased with removal of shoreline vegetation that extends to the waterline.

II. EOD TRAINING SITES

a. Existing EOD training site inside Apra Harbor adjacent to Glass Breakwater

Navy EOD training currently takes place at two sites inside Apra Harbor adjacent to Glass Breakwater. Training exercises consist of detonation of up to 20 lb. charges on the Harbor floor. Diving reconnaissance was conducted at the two sites in August 1996. Bottom characteristics at both areas was similar. Bottom composition consisted of very fine calcareous silt. Because of the very fine particle size, there was high levels of suspended sediment in the entire water column which resulted in poor visibility. The surface of the sediment was covered in part with a thin mat of blue-green algae. The only predominant macrobiota on the bottom were the green algae *Halimeda* and *Caulerpa*. *Halimeda* is a calcareous alga with paddle-shaped blades which form a predominant component of marine sands. Much of the sediment surface was covered with a layer of dead *Halimeda* blades in various stages of breakdown to sand-sized particles. No corals or other macroinvertebrates, or fish were observed on the reconnaissance dive. Because of the paucity of biotic communities, these areas appear to

be ideal locales to conduct EOD training for underwater explosives as long as a site is required within Apra Harbor.

b. Proposed EOD Sites off Dadi Beach

The new site that was selected by EOD personnel is to the south of Neye Island off Dadi Beach. EOD personnel located the area with very precise GPS coordinates. The area is 130-140' deep and consists of a sand hole approximately 100 feet in diameter within a solid fossil reef platform. The reef platform slopes rather sharply to the sand hole from a depth of approximately 60 feet. Such a steep slope does not appear to be advantageous as equipment and charges might roll downslope. Also the walls of the sand hole are several feet high in relief, which would likely be a problem because EOD training exercises require a flat field of view to scan for charges with portable sonar guns. While the sand hole appears to be a suitable setting for detonations of explosives from an environmental standpoint, the physical characteristics of the area appeared to make the sand hole a poor choice.

However, I surveyed the area from a depth of about 80' to the shoreline off of Dadi Beach (several hundred feet to the south of the EOD selected site described above). This entire area appeared optimal for EOD work. The bottom consisted of a very flat featureless sand plain that probably extended to much deeper depths. Only isolated rocks were observed in the nearshore area (less than 20' in depth). The sand plain appeared to be very extensive, and did not have any noticeable biotic community structure. As a result, it appears that the sand plain is an ideal area for EOD exercises.

B. TINIAN

1. Beach Landing Exercises

Field reconnaissance of Chulu and Babui beaches on Tinian was conducted, primarily to groundtruth aerial photographs for feasibility of conducting landing craft exercises for both AAV's and air-cushion vehicles.

a. Chulu Beach

Detailed species lists and descriptions of physiographic structure and marine biota for Chulu and Babui beaches has been provided in previous reports. At Chulu, the offshore region consists of a very shallow reef platform that terminates in a well-developed spur and groove system. These systems consist of buttresses of coral (spurs) separated by deep channels (grooves). Such spur and groove systems are typical of fringing reefs throughout the world as the region separating inner reef flats from outer reefs, and are the areas that absorb most of the energy of breaking waves. The transition zone at the spur and grooves region is abrupt--the edges of the spurs are essentially vertical walls that rise from a depth of 15-20 feet to 1-3 feet. The entire reef crest at the inner juncture of the spur and grooves is 1-3' in depth at a high tide. This shallow reef crest is the area where waves break, dissipating energy that reaches the shoreline. Reconnaissance of the entire offshore region of Chulu revealed that there are no breaks in the reef crest. The area that appears in aerial photographs to be a deep spot off the southern end of the beach is not deeper than the rest of the reef. Rather it appears to be a region where waves focus as coral cover in the area was less than along the remainder of the reef crest.

Coral is lower at the southern end than off the central area but still significant growth estimated at 25-40% of bottom cover on the outer reef crest. Also, there are no areas where the bottom comes up gradually. There is a very distinct change in depth from the deep to the shallow (1-2' deep) reef along the entire frontage. So a tracked vehicle is going to strike the reef with little chance for easing onto the reef platform. Coral community structure on the reef platform is extensive throughout the Chulu area. Hence, should a tracked vehicle manage to negotiate the sharp demarcation between the open ocean and inner reef, it is likely that substantial damage to the coral community will occur. As a result, it does not appear to be environmentally sound to recommend Chulu Beach as a site for conducting landing exercises with tracked vehicles.

b. Babui Beach

At Babui, there is significantly less coral on the inner reef platform than at Chulu because water motion is substantially greater. There is a narrow sand channel cut in the

reef rock off the beach which appears in aerial photographs, but this is pretty small to navigate through. The apparent bigger channel that appears in the aerial photographs to the south of the beach is fairly wide (25-30') and deep (25'), but it doesn't extend all the way onto the reef platform as a channel--where it stops there is an sheer wall that is the edge of the reef platform (1-2' in depth) (see description above for abrupt transition between inner and outer reef. As at Chulu, coral growth at the spur and groove transition zone is considerable, and would be impacted by tracked landing vehicles. Should a vehicle manage to negotiate the channel, it would have to make a sharp turn and go approximately 500' alongshore till it reached the small sandy area at Babui to get out of the water. The non-beach shoreline is composed of jagged limestone that is 4-6' high. It does not appear that this jagged coastline could be breached by any kind of vehicle.

While environmental considerations at Babui would not be as overriding as at Chulu, it appears that there would be considerable damage to the reef communities during landing of tracked vehicles. However, the physical structure of the transition area between shallow and deep water, and the ruggedness of the shoreline indicate that this area is definitely sub-optimal for landing exercises.

c. Tachogna Beach

Tachogna Beach is located to the south of Kammer and Taga beaches on the south coast of Tinian. Several beach pavilions are located on the shoreline. The beach consists of sloping white sand to the waters edge. At the shoreline, a beachrock slab occurs that is interspersed with pockets of sand and rubble. The zone closest to the shoreline is composed of a sand flat covered with a mat of blue-green algae. Moving seaward, corals form a well-developed accreting reef. Many of the corals occur in a massive dome-shaped growth forms that are coalesced together to form a massive reef platform. Other forms of corals include branching *Acroporas.* A result of the coalescence of colonies the formation of numerous arches. These arches form an understory that serves as the substratum for a variety of reef biota. Depth of the top of the reef is only 2-3 feet deep. At the seaward edge of the reef, there is a nearly vertical change in depth to the sandy bottom. The abrupt nature of this transition from the sand zone to the reef would provide unsuitable entry for tracked vehicles which prefer a sloping entry to

shallow water. Because of the very high level of live coral and active reef growth, the Tachogna Beach area does not appear suitable for landing craft training exercises.

II. TINIAN HARBOR

A series of 12 water samples were collected within Tinian Harbor (Table 1). Water samples were collected at 6 locations, with a surface and deep water sample collected at each station (Figure 1). Samples were collected by divers opening pre-rinsed bottles at the desired locations. Samples were analyzed for inorganic nutrients (PO_4^{3-}, NO_3^-, NH_4^+, Total N (TN), Total P (TP)) turbidity, salinity, pH and Chl a. Analysis for inorganic nutrients (NH_4^+, PO_4^{3-}, and NO_3^-) were performed using a continuous flow Technicon Autoanalyzer according to standard methods of seawater and wastewater analysis (Strickland and Parsons 1968, Technicon 1973, Clesceri et al. 1989). TN and TP were analyzed in a similar fashion following oxidative digestion. EPA methods for analyses are as follows: NH_4^+ - EPA #350.1; NO_3^-+NO_2^- EPA #353.2; TP - EPA #365.4, and TN - EPA #351.2. The level of detection for the dissolved nutrients is 7.6 µg/L for TN, 4.6 µg/L for TP, 0.42 µg/L for NO_3^- and PO_4^{3-}, and 1.4 µg/L for NH_4^+.

Turbidity was determined on subsamples analyzed with a Monitek 90-degree nephelometer, with results reported in nephelometric turbidity units (ntu). Salinity was measured with a AGE laboratory salinometer (EPA #2520B). All samples were stored on ice following collection, returned to the laboratory within 24 hours of collection and processed immediately. pH was measured in the field using a portable meter with readability of 0.01 pH units. Chl a was analyzed fluorometrically. All laboratory chemistry analyses were performed by Marine Analytical Specialists (Laboratory Certification No. HI 0009), located in Honolulu, HI.

Results of water chemistry analysis indicate that overall there is little difference in composition between any of the samples. There is little indication of vertical stratification; NO_3^- is the only constituent with consistently higher concentrations in surface relative to deep water. There is also little difference in composition between sampling stations; water within the inner harbor is similar to water near the harbor entrance. Such results suggest that exchange of water within the entire harbor is rapid, good flushing through all regions.

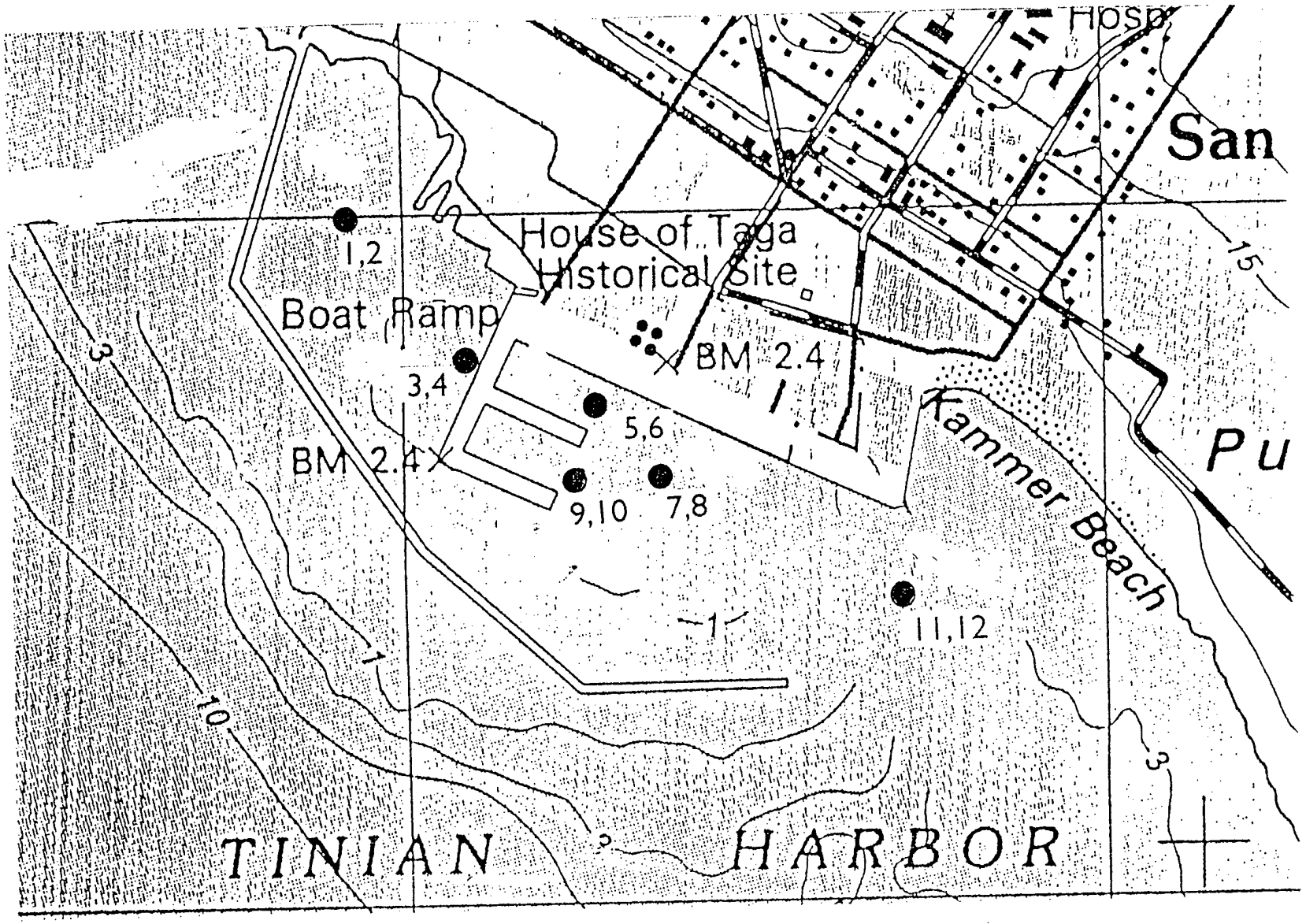


Figure 1. Map of Tinian Harbor showing locations of water sampling stations.

TABLE 1. Results of water chemistry sampling in Tinian Harbor collected on March 16, 1996. "s" denotes surface sample, "d" denotes deep sample. See Figure 1 for sampling locations.

SAMPLE NUMBER	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	Si (µg/L)	DOP (µg/L)	DON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (ntu)	SALT (o/oo)	pH (rel)	Chl-a (µg/l)
1 (s)	0.93	12.18	4.48	46.48	9.61	89.46	10.54	106.12	0.13	34.393	8.206	0.032
2 (d)	1.55	6.44	1.26	31.36	8.99	78.54	10.54	86.24	0.16	34.437	8.224	0.052
3 (s)	1.24	13.58	1.68	46.76	8.68	84.42	9.92	99.68	0.16	34.360	8.131	0.040
4 (d)	1.24	12.46	4.06	87.92	8.99	83.86	10.23	100.38	0.17	34.362	8.102	0.067
5 (s)	1.55	7.14	1.26	37.80	8.99	83.02	10.54	91.42	0.20	34.433	8.093	0.097
6 (d)	1.24	6.02	3.08	31.64	9.30	85.96	10.54	95.06	0.30	34.436	8.085	0.116
7(s)	1.24	5.60	3.22	31.64	8.99	84.70	10.23	93.52	0.14	34.442	8.112	0.099
8 (d)	1.24	5.18	0.84	26.88	9.30	80.22	10.54	86.24	0.12	34.440	8.113	0.101
9 (s)	1.24	4.76	1.26	44.52	8.99	82.18	10.23	88.20	0.16	34.443	8.110	0.118
10 (d)	1.24	2.52	1.26	46.48	8.99	80.50	10.23	84.28	0.17	34.426	8.115	0.101
11 (s)	0.93	12.32	2.10	53.76	8.99	84.84	9.92	99.26	0.19	34.366	8.102	0.083
12 (d)	1.24	5.32	2.38	44.52	9.30	79.66	10.54	87.36	0.18	34.441	8.110	0.088

Appendix J

Botanical Survey

BOTANICAL SURVEY OF THE MARIANA ISLANDS MILITARY TRAINING AREAS

by

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Prepared for

Belt Collins, Inc.
Honolulu, Hawaii

March 1996

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INTRODUCTION

The U.S. Navy maintains a number of training facilities in Guam and the Commonwealth of the Northern Marianas that have been used for many years. In addition, the Navy wants to add new sites and activities to those currently in use on lands under their jurisdiction. In order to comply with the National Environmental Policy Act (NEPA), The Navy has contracted Belt Collins Hawaii to prepare an Environmental Impact Statement (EIS) to evaluate the impact of the training activities upon the environment. As part of the EIS, a botanical survey was required for those sites with significant vegetation and flora that may be adversely affected by the training activities.

The following report is a botanical survey of the Navy training sites sites selected by Belt Collins Hawai'i because of the presence of possibly significant vegetation and flora. The field work was carried out by Isle Botanica at eight sites on Guam and Tinian. Six of the sites are on Guam, and five of these are located in the Naval Magazine: Land Navigation Site, Bivouac Area, Sniper Range, Helicopter Landing Site, and Rappelling Site. The sixth, the Riverine Training Site, is located within Apra Harbor, but was only briefly investigated since the proposed activities on the stream are not likely to impact the streamside vegetation. The remaining two sites are located on Tinian--Live Fire Weapons Range and a Parachute Drop Zone.

The field work carried out by the principal investigator (Dr. Art Whistler) and a botanical assistant during a visit to the islands from 30 January to 9 February 1996. The field team visited each site at least twice, during which time a checklist of the flora was compiled during the "walk-through" surveys, and notes were compiled about the plant communities present. In the following report, the sites are listed in the order noted above. For each of these sites, the vegetation is discussed, followed by a brief discussion of any sensitive vegetation or plant species present. That is followed by a summary discussion, and by checklists of the flora of three of the areas--Naval Magazine (all five sites), Live Weapons Firing Range, and Parachute Drop Zone.

NAVAL MAGAZINE, GUAM

Land Navigation Site

This area is an irregularly shaped parcel located at the northeast corner of the Naval Magazine, west and south of the "East Lookout Tower" and south of the cross-island road (Highway 17). The topography comprises rolling hills with scattered gullies leading downslope into the main area of the magazine. The herbaceous vegetation that covers the hills and slopes is probably maintained by periodic, accidental or intentional burning. In some places the surface is highly eroded, leaving barren areas of the red lateritic soil. There is increased erosion in the drainage areas, where barren, steep-sided gullies cut through the unprotected soil. Along the stream channel,

especially where the topography flattens out, wetlands are formed.

Four types of vegetation can be distinguished at the site: (1) Mission-grass Savanna; (2) Fernland; (3) Phragmites Marsh; and (4) Ravine forest, but the boundaries between these are not always distinct, especially between the grassland and fernland.

1. Mission-grass Savanna

The vast majority of the rolling hills and much of the flat areas are covered with grassland (Fig. 1) dominated mostly by Pennisetum polystachyon (mission grass). Other grass species, such as Dimeria chloridiformis, Chrysopogon aciculatus, Bothriochloa bladhii, and Saccharum spontaneum, and sedges, such as Fimbristylis cymosa, Fimbristylis tristachya, and Rhynchospora rubra, are also present, but except for Dimeria, are rarely dominant. Relatively little Miscanthus floridulus (sword grass) is present, but where it does occur it forms dense patches. Other herbaceous species, such as Waltheria indica, Hyptis capitata, Crotalaria retusa, Mimosa pudica (sensitive plant), Chromolaena odorata, and Bidens alba (beggar's-tick), are also common among the grasses. There are also a few scattered trees, mostly Casuarina equisetifolia (ironwood), and shrubs, such as Morinda citrifolia (Indian mulberry) and Scaevola taccada, but the overall vegetation is predominantly herbaceous.

In the central portion of this grassland habitat there is an area where saplings of timber trees, mostly Calophyllum inophyllum (Alexandrian laurel) and Acacia sp., have been planted. This area is otherwise quite barren, since it appears to have been recently weeded or sprayed with herbicide. It is adjacent to the boundary of the magazine, where there is a mature plantation forest dominated by the same Acacia species and another of the same genus.

2. Fernland

The boundary between the grasslands and fernlands is indistinct, but the fernlands tend to occupy the flatter, more highly degraded areas of lateritic soil (Fig. 2). The dominant species here is Dicranopteris linearis (false staghorn fern), along with mission grass and the endemic grass species Dimeria chloriformis. There also some savanna-like areas with clusters of trees, principally ironwood and Pandanus tectorius (screwpine), but with lesser amounts of native woody species, such as Pouteria obovata, Wikstroemia elliptica, Myrtella bennigseniana, the native subshrub Phyllanthus saffordii, and the native sedge Machaerina mariscoides. The introduced trees Melaleuca quinquenervia (paperbark) and Acacia sp. are also found here, but these are mostly restricted to the northern boundary of the magazine, where their seeds have apparently blown in from the adjacent plantation forest area.

3. Phragmites Wetland

This vegetation type is dominated by the tall, cane-like

grass Phragmites karka. In some areas this grass is entirely dominant, but in areas where the soil is not so saturated, or is periodically dry, other weedy introduced species, such as Saccharum spontaneum (wild sugarcane), Waltheria indica, Chromolaena odorata, and Calopogonium mucunoides, become common. Other species present in the wetlands are typical wetland plants, such as the delicate climbing fern Lygodium microphyllum (vining fern) and the sedges Fuirena umbellata and Fimbristylis littoralis, as well as typical weedy species, such as as Mikania scandens (mile-a-minute vine) and Bidens alba (beggar's-tick), Hyptis capitata, and Chromolaena odorata.

4. Ravine Forest

This type of vegetation occurs in the deeper ravines and gullies that contain small tributary streams to the Maemong River. These are mostly in the hilly terrain on the western portion of the site, but there is also one on the southeast side that may just be within the boundaries of the site. The shallower gullies are usually dominated by herbaceous vegetation, particularly by Phragmites karka if sufficient moisture is available. The deeper ravines and gullies are the only places on the site that are dominated by woody vegetation.

The ravine forest is highly disturbed, not so much because of recent physical disturbance, but more because of the presence of introduced species--both aboriginal and recent introduced tree species. The dominant trees in this kind of forest are Pandanus tectorius (screwpine), Hibiscus tiliaceus (beach hibiscus), Cocos nucifera (coconut), Pimenta racemosa (allspice), Areca catechu (betelnut), and Cananga odorata (perfume tree), with smaller trees such as Triphasia trifolia (limeberry) and Cycas circinalis (cycad) also being common. Along the stream itself Phragmites may also be common where there is sufficient sunlight. Lianas are also common in this forest, especially Freycinetia reineckei.

All the above tree species are either naturalized weedy species or possibly native trees that are often cultivated (coconut, perfume tree). However, the ravine forest at the southeast side of the site (Fig. 3), which as was noted above is mostly or entirely outside of the site, was dominated by most of the same plants, but had a number of other, less common native species present, such as the woody species Ochrosia mariannensis, Discocalyx megacarpa, and Decaspermum fruticosum, and the ferns Angiopteris evecta, Belvisia spicata, and Microsorium punctatum. There is a well-beaten path leading to this ravine, including steeps cut into the steep ravine slopes. At the attractive waterfall at the end of the path (Fig. 4), a bamboo platform has been constructed.

Sensitive Vegetation and Plants

The vast majority of the site is covered by grasslands dominated by introduced species, and is in no way sensitive. The wetlands, because they are wetlands, are sensitive. However, those on the site are very small in extent (limited to the margins of streams) and do not harbor many native wetland species

other than phragmites. The forests in the ravines are dominated by woody species that are either alien (introduced) or common native or aboriginally introduced species. Of the 104 species found at this site (Table 1, column 1), about 61 are indigenous, and none is threatened or endangered.

Bivouac Area Site

This area is located on the west side of the Naval Magazine, south of the "West Lookout Tower." It is reached by means of a dirt road that leads south downslope from the tower, past a proposed site for a "shooting house" and up to a flattened area between the hills and ridges. Three plant communities are found at the site: (1) Managed Land Vegetation; (2) Sword-grass Savanna; and (3) Limestone Forest.

(1) Managed Land Vegetation

This type of vegetation covers most of the flat areas at the site, and hence most of the land that is or would be used in bivouac activities. It is heavy disturbed by previous military activities, that have included bulldozing and clearing, and the vast majority of species at the site are weedy alien herbs and grasses. The dominant of these are Stachytarpheta jamaicensis (Jamaica vervain), Hyptis capitata, Mimosa pudica (sensitive plant), Polygala paniculata, Bidens alba (beggar's-tick), and Pilea microphylla (artillery plant).

(2) Sword-grass Savanna

This vegetation occurs on the slopes surrounding the flat disturbed areas and the limestone forest on the upper slopes. It is a disturbed type of vegetation that is probably maintained by periodic wildfires that ravage the area. The dominant species are Miscanthus floridulus (sword grass) and Pennisetum polystachyon (mission grass), which form a dense grass cover in which few other species are able to compete. In more open areas of this grass land on the slopes, other species such as Stachytarpheta jamaicensis, Fimbristylis cymosa, Saccharum spontaneum (wild cane), and Scaevola taccada are common. Of these, only the scaevola and Fimbristylis are native.

(3) Limestone Forest

Limestone forest is probably the original vegetation for the entire site, but the less rocky slopes and the flat areas were long ago cleared by agricultural and/or military activities or burned by fires. It presently occurs on the steeper, rocky slopes that are not subject to grassland fires and are not suitable for military activities or, formerly, agriculture.

This forest is not in the area that would be expected to be impacted by bivouac activities, only on the margins. The dominant species recorded here are Pandanus tectorius (screwpine), Pandanus dubius (pahong), Aglaia mariannensis, Ficus prolixa (banyan), Guamia mariannae, and Elaeocarpus joga.

Sensitive Vegetation and Plants

Since the area is entirely disturbed, there is no sensitive vegetation, except, perhaps, the limestone forest. However, this forest is up the slope away from the main impact area, and is unlikely to be affected by bivouac activities. Most of the plants at the site are alien species (see Table 1, column 2), and nearly all of the native species are in the limestone forest rather than on the areas that will be affected by the bivouac areas. One native tree species found in this forest, Fagraea berteroana, is rather rare in Guam. However, it is indigenous rather than endemic, and in any case is not likely to be impacted by bivouac activities, since it occurs up the slope in the limestone forest.

Sniper Range Site

This site is located at the west side of the Naval Magazine and consists of a small hill (the former site of the "West Lookout Tower") and extends southeast between 115--135° in a narrow fan shape that ends on a ridge running south-southwest about 1000 m away. The topography consists of hilltops, ridges, gentle to steep slopes, and a ravine that eventually leads down into the lower elevations of the Naval Magazine. Five plant communities can be distinguished: (1) Managed Land Vegetation; (2) Mission-grass Savanna; (3) Sword-grass Savanna; (4) Fernland; and (5) Ravine Forest. The boundaries between these communities are sometimes difficult to distinguish, except for the Ravine Forest, and may, to some degree, represent successional stages in a mosaic that is determined by land use and frequency of fires.

(1) Managed Land Vegetation

This type of vegetation covers areas that have been recently disturbed (managed) by human activities. This is mostly along and on dirt roads and at the cleared area on the hilltop (West Lookout Tower site). At the tower site (the tower is now gone), the top of the hill has been bulldozed to a flat surface, which is dominated by weedy herbaceous species, especially Pennisetum polystachyon (mission grass), Fimbristylis cymosa, Eragrostis brownii, and Stachytarpheta jamaicensis (Jamaica vervain). In some places there are patches of the wild cane Saccharum spontaneum (wild cane), especially along the edges where the bulldozing did not reach, or perhaps where it has not been cleared recently.

From the road leading to the bivouac area there is another dirt road leading SSW on a ridge top and curving around to the target area. At the terminus of the road there is a cleared area that has obviously been bulldozed (along with the road). It is dominated by common weedy species, especially Pennisetum polystachyon, Fimbristylis cymosa, and Stachytarpheta jamaicensis (generally the same dominants at the cleared top of West Lookout Tower hilltop). The vegetation along the bulldozed roads is similar, but where the soil is more impervious and wet, the tiny sedge Eleocharis geniculata is common.

(2) Mission-grass Savanna

On the other sides of the hill, and along the road that leads up to the West Lookout Tower site, are grasslands dominated in some places by sword grass, but in other places, in a mosaic pattern, by Pennisetum polystachyon (mission grass) and in other places by Saccharum spontaneum (wild cane), especially in the more highly disturbed places adjacent to the road. There are also a few scattered coconut palms and pandanus trees on the slope. The area is probably periodically burned, which keeps it in grassland rather than allowing it to revert to native forest.

The fan extends down to the road and onto a flat area, and then across a ravine and up the slope to the ridge where the sniper targets would presumably be placed. The flat area has probably been bulldozed, and is dominated by disturbed vegetation, especially by dense clumps of Saccharum spontaneum. There is even a small amount of Phragmites karka in presumably wetter places, but no actual wetland is present.

(3) Sword-grass Savanna

Down the slopes of the hill and extending up to the dirt road running perpendicular to the axis of the fan and up to the bivouac area, the vegetation is also highly disturbed (Fig. 5), but except for the dirt road leading up to West Lookout Tower, it has not been bulldozed. It is dominated by Miscanthus floridulus (sword grass), making passage through it difficult even with protection from the sharp-edged leaves. Mixed in with the sword grass are scattered individuals of Hyptis capitata and a few other weedy species that are able to grow out of the dense grassland vegetation. There are also patches of Leucaena leucocephala occurring sporadically along the slope.

The hillsides at the SSW end of the fan are dominated by the same types of grassland as the slopes of the West Lookout Tower hill, a mosaic of grasslands, dominated in some places by sword grass and in other places by mission grass, both with other scattered weedy species, especially Hyptis capitata.

(4) Fernland

In some areas, perhaps on the poorest, most eroded places, the dominant species is Dicranopteris linearis (false staghorn fern), often mixed with lesser amounts of Lycopodium cernuum. A few areas are nearly devoid of vegetation, leaving the exposed eroding red lateritic soil.

(5) Ravine Forest

This vegetation is typical of ravines in the inland areas of Guam, and is dominated by a mixture of native and introduced trees that are protected near the stream from the wildfires that periodically ravage the grasslands. At this site the ravine is part of the upper reaches of the Maulap River that drains into the Fena Reservoir.

The dominant species in this forest are Pandanus tectorius (screwpine), Hibiscus tiliaceus (beach hibiscus), and Areca catechu (betelnut). Less common are Artocarpus mariannensis (breadfruit), Cocos nucifera (coconut), and Leucaena leucocephala (tangantangan). All of these are useful plants and although some of them are native, it is likely that their presence next to the stream is associated with past human activity.

In areas that are open, Phragmites karka often dominates, as it does in wetlands all over the island. Also common in these open areas is the weedy alien Mikania scandens (mile-a-minute vine).

Sensitive Vegetation and Plant Species

Virtually all of the area is disturbed, most of it by the periodic fires that ravage the hillsides and eliminate tree species, allowing the sword grass and mission grass to dominate. Most of the native species (see Table 1, column 3) are likely to be found in the ravine forest, but no endemic species were found there. Because of this, and because the planned activity, as a sniper range, there are not likely to be any significant impact on the vegetation or flora of the site.

Helicopter Landing Site

This site is located on a ridge just south of Mt. Alifan near the northwest corner of the Naval Magazine, at an elevation of about 1000 ft. The original vegetation of the site was limestone forest, but the area is now highly disturbed by a road that runs north-south and a trail that leads to the top of Mt. Alifan. Four plant communities can be recognized at the site: (1) Managed Land Vegetation; (2) Mission-grass Savanna; (3) Scaevola shrubland; and (4) Limestone Forest.

(1) Managed Land Vegetation

This is the vegetation that covers the area of the site that is actively being used, mostly as a road (Fig. 6). The ridge appears to have been bulldozed in the past into a flat surface, upon which the road is situated, and this surface is dominated by low-growing weedy alien species that are able to survive on the compacted road surface and to withstand crushing by car tires and periodic mowing. The dominant species here are Sporobolus diander, Fimbristylis cymosa, Stachytarpheta jamaicensis (Jamaica vervain), Pennisetum polystachyon (mission grass), and Bidens alba (beggar's-tick, all of them weedy species typical of these habitats in the area.

A variation of this habitat is on the steep low roadbanks at the north end of the road. These are barren except for a few alien species, mostly the two ferns Pteris vittata and Nephrolepis hirsutula.

(2) Mission-grass Savanna

The area away from the road and its edges is apparently not

being actively disturbed at this time and is covered by a grassland vegetation dominated by Pennisetum polystachyon (mission grass). A number of other weedy alien species, especially Bidens alba, are interspersed with the dominant mission grass. This type of vegetation may be in a dynamic equilibrium with the next plant community, Scaevola shrubland, and their relative dominance may depend upon fires that may frequent the area. Much of the naval magazine is dominated by the savanna, which is maintained by periodic burning of the hillsides, which favors this grass species.

(3) Scaevola Shrubland

This shrubland is dominated by Scaevola taccada, a shrub that is more commonly dominant on seashores. Although it is native to Guam, it is probably not native to this area, but thrives in the open habitat created by the removal of the original limestone forest. In addition to Scaevola, the other dominant species are the two ferns Nephrolepis hirsutula and Phymatosorus scolopendria, and various weedy alien herbaceous species. In a few places there are patches of Caesalpinia major (gray nickers), a scrambling shrub with nasty thorns that make passage through it extremely difficult. There are also scattered Casuarina equisetifolia trees in the area.

There are no distinct boundaries between this and the Mission-grass savanna, and the two form somewhat of a mosaic pattern (Fig. 7). The shrubland is probably more susceptible to wildfires and not as able as mission grass to become re-established after burning.

(4) Limestone Forest

The native vegetation of this site was limestone forest, but this has all been removed in the areas used for various military activities (probably both Japanese and American). The remaining limestone forest occurs on the steeper slopes and is probably out of the area that will be actively used during helicopter landings.

The forest is not pristine, and is quite ragged, possibly due to the effects of recent hurricanes, or from past disturbance during the last World War. The dominant species include Aglaia mariannensis, Pandanus tectorius (screwpine), and Guamia mariannae. Other native tree species included Guettarda speciosa, Ficus prolixa (banyan), Intsia bijuga (ifil), Premna serratifolia, Macaranga thompsonii, and Psychotria mariana.

Sensitive Vegetation and Plant Species

The first three communities are dominated by alien weedy species (Table 1, column 4), and are in no need for any particular concern. Most of the native species at the site are in the limestone forest, which is usual for Guam. Since this forest lies on the periphery of the site, it will probably not be very impacted by helicopter landings, unless larger areas downslope and at either end are needed. Limestone forest is one

of the few remaining types of native vegetation on Guam, and is dominated by native species. Thus care should be taken to ensure that it is not removed without compelling reasons.

Rappelling Site

This site is located near the northwest corner of the Naval magazine, between Mt. Alifan and the main entrance to the magazine. It is situated in a borrow pit or quarry that appears to be in current usage. The proposed rappelling would be down the artificially created cliff (Fig. 8) at the edge of a quarry. Because of the small size of the site, its highly disturbed condition, and its current usage, only two plant communities can be distinguished: (1) Managed Land Vegetation, and (2) Cliff-face Scrub.

(1) Managed Land Vegetation

The bottom of the borrow pit is almost devoid of vegetation, since this is where the limestone rock has been quarried and where gravel trucks and bulldozers maneuver, and is currently covered with crushed limestone. The only vegetation present is near the margins at the base of the cliff, and its component species are all common weeds such as Bidens alba (beggar's-tick), Pennisetum polystachyon (mission grass), Stachytarpheta jamaicensis (Jamaica vervain), and Chamaesyce hypericifolia.

(2) Cliff-face Scrub

Since the face of the cliffs is a smooth artificial surface formed by quarrying activities, it does not offer a very hospitable habitat for plants, as would a natural cliff formed by weathering and erosion. Consequently, the vegetation is sparse and is comprised of only a few species that are able to colonize the cliff face. The dominant species here are scattered individuals of Casuarina equisetifolia (ironwood) and Scaevola taccada that find a tenuous hold in the inhospitable surface. Also present are some clumps of the non-native fern Pteris vittata.

Sensitive Vegetation and Plant Species

Cliffs are usually good places to find rare and endangered species on islands, since these may be the only place where goats and other browsers are not able reach and consume the vegetation. However, this cliff is recent and man-made, and although all three species present are either native or ancient introductions, they are all common plants in Guam (Table 1, column 5). Consequently, no sensitive plants and no threatened or endangered plant species are found at this site.

APRA HARBOR, GUAM

Riverine Training Site

This site is located outside of the Naval Magazine just north of Apra Harbor. Where the stream joins the ocean, the area is dominated by mangroves. The stream continues inland, where the mangrove gives way to disturbed vegetation dominated by Hibiscus tiliaceus (beach hibiscus) and Pandanus tectorius (screwpine), with lesser amounts of trees such as Casuarina equisetifolia (ironwood) and Leucaena leucocephala (tangantangan).

This vegetation lining the stream is highly disturbed, and does not contain any sensitive vegetation or plant species, except for the mangroves, which are protected since they are on wetlands. However, the proposed use for the site involves boating upstream, and this is unlikely to affect any of the vegetation.

TINIAN

Live Fire Weapons Range

This site is located on the north end of Tinian, east of the North Field complex and west of the main north-south road (Broadway), and the plan calls for the creation of a live fire weapons range. The site has been heavily disturbed in the past, since it is adjacent to the airfield complex that during the latter part of World War II was one of the busiest in the world. Nearly all of the area was cleared for the airfield, living quarters, and storage facilities. However, since the war the area has fallen into disuse, and there is little current disturbance to the vegetation present, except along the sides of the roads. Five plant communities can be distinguished here: (1) Managed Land Vegetation; (2) Leucaena Scrub Forest; (3) Disturbed Littoral Shrubland; (4) Casuarina Woodland; and (5) Littoral Vegetation. A checklist of the flora of the site is found in Table 2.

(1) Managed Land Vegetation

A half century ago, virtually the whole site was probably in this category, but now it is limited to the sides of the road, mostly along the main road (Broadway). This vegetation is disturbed by cars that travel the road, and probably by road crews that keep the roadsides free of woody vegetation. The dominant species found here include Bidens alba (beggar's-tick), Bothriochloa pertusa, Digitaria ciliaris, Stachytarpheta jamaicensis (Jamaica vervain), Chamaesyce hirta, Passiflora suberosa, and numerous other weedy alien species. There are virtually no native species in this habitat.

(2) Leucaena Scrub

The vast majority of the site is covered with a scrub forest

of Leucaena leucocephala (tangantangan), that probably accounts for over 95% of the biomass of the community. In the northern portion of the site, north of the cross road leading from Broadway to the airfield complex, this forest is between 5 and 8 m in height. Few other species--trees or herbaceous species--are found here. The most frequent woody species are Thespesia populnea (milo), Albizia lebbek, Melanolepis multiglandulosa, and Carica papaya (papaya). Two of these, Thespesia and Melanolepis are indigenous, the other two are aliens. The most common herbaceous species is Passiflora suberosa, a weedy alien species of passionfruit. Much less common is Jasminum marianum, a native vine. Several other herbaceous species are found here, such as Passiflora foetida, Capsicum frutescens (chili pepper), Lantana camara (lantana), Blechum brownei, and Desmanthus virgatus, but these weedy aliens are found mostly on the edge of the scrub forest where sufficient sunlight is available.

At the south end of the site, south of the cross road, the Leucaena scrub forest is shorter in stature (2--4 m in height), probably because of its proximity to the sea and the absence of a buffer to protect it from the salty sea winds. Some of the area appears to have a "dieback" caused by these winds. Leucaena is by far the dominant species in this area, with small amounts of woody species, such as Morinda citrifolia (Indian mulberry) and Callicarpa candicans, and herbaceous species such as Passiflora suberosa, Passiflora foetida, Blechum brownei, and Lantana camara. With the exception of the Jasminum and the Callicarpa, all of the species in this community are aliens.

(3) Disturbed Littoral Shrubland

There is a small area of what would be best described as littoral shrubland along the west side of Broadway several hundred meters north of the cross road. This is probably an area that was bulldozed fairly recently, and instead of Leucaena scrub forest becoming re-established, a low herbaceous or shrubby vegetation predominates, somewhat like that found on the east side of the road (and outside the study site).

The dominant species in the community are Wollastonia biflora, which is a native littoral shrub, and Cardiospermum halicacabum (balloon vine), a weedy alien species. Also common here are the native subshrub Senna sophera, the weedy alien Passiflora suberosa, and to a lesser extent, a mixture of native, mostly littoral species, such as Phyllanthus marianus, Cassytha filiformis, and Mariscus javanicus, and weedy alien herbs and subshrubs, such as Stachytarpheta jamaicensis (Jamaica vervain), Oxalis corniculata (wood sorrel), and Digitaria ciliaris. Inland from the road, this vegetation dominated by dense thickets of the weedy noxious shrub Lantana camara (lantana).

(4) Casuarina Woodland

This type of vegetation is dominated by tall Casuarina equisetifolia (ironwood) trees up to 18 m in height, forming an open canopy. It is mostly concentrated just to the south of the cross road. In addition to the ironwood trees, Thespesia

populnea is also common in this area, with lesser amounts of Albizia lebbek, Morinda citrifolia, and Premna serratifolia. There is also some Leucaena leucocephala, which dominates in the areas surrounding this woodland.

The forest floor is rather open and covered with a thick accumulation of ironwood "needles." The most common herbaceous species are the alien weed Blechum brownei, the native grass Lepturus repens, and the native shrub Callicarpa candicans, with lesser amounts of other native species, such as Achyranthes aspera and Deeringia amaranthoides, and various weedy alien species, such as Vernonia cinerea, Pennisetum polystachyon (mission grass), and Passiflora suberosa.

There is also a patch of this woodland near the southeast corner of the airfield complex. It includes a number of native species, some of which were not seen elsewhere at the site, including Neisosperma oppositifolium, Ficus prolixa (banyan), Melanolepis multiglandulosa, Premna serratifolia, Pandanus tectorius (screwpine), Capparis cordifolia, Callicarpa candicans, and Eugenia palumbis.

(5) Littoral Vegetation

The cliff and slopes that run roughly perpendicular to the proposed Live Fire Weapons Range at its southern end are covered with native littoral vegetation. This area is not within the boundaries of the site, but the vegetation was briefly examined to assess its value as native forest and as a site for native species, some of which were reported to be used medicinally by the inhabitants.

On the cliffs and slopes near the shore, the vegetation is scrubby and sparse, and is dominated by littoral species that find a tenuous hold in this inhospitable habitat. The dominant species are Bikkia tetrandra, Pemphis acidula, and Phyllanthus marianus, with lesser amounts of Lepturus repens, Hedyotis sp., Capparis cordifolia, and Fimbristylis cymosa. In more hospitable areas littoral forest trees dominate, the most common of which is Hernandia nymphaeifolia (Chinese lantern tree). Also present but less dominant are Tournefortia argentea (tree heliotrope), Cordia subcordata (cordia), Barringtonia asiatica (fish-poison tree), and Terminalia catappa (tropical almond).

All of these are native species that are typical of makatea (karst) coastlines of the Marianas.

Sensitive Vegetation and Plants

Since virtually the whole site is dominated by disturbed vegetation, there is no sensitive vegetation present, except for the native littoral vegetation beyond the south end of the site. The best of vegetation present on the site is the Casuarina woodland, where a number of native species are found, particularly in the woodland at the southeast corner of the airfield complex. None of the species encountered at the site (Table 2) or in the adjacent littoral vegetation is rare or endangered in the Northern Marianas.

Parachute Drop Zone

The parachute drop zone site on Tinian comprises a rectangular area measuring 700 x 1400 yards, with the long sides aligned in a north-south direction. It lies just to the east of the runway of Tinian Airport, beginning about two hundred yards from the main north-south road (Broadway).

The original vegetation of the site has been entirely removed, without a trace of what it originally was (probably limestone forest). This probably happened centuries ago as the Chamarros used the flat topography for farming and villages. The whole island was subsequently disturbed by military activities during World War II, and probably by sugar cane farming. More recently (and perhaps before the war) it has been utilized for cattle grazing. Only one type of plant community is currently present at the site, Managed Land Vegetation.

Managed Land Vegetation

The entire area is currently covered with pasture, with occasional solitary trees and small groves. The most common tree species are Pithecellobium dulce (Manila tamarind) and Acacia confusa (Formosan koa), with lesser amounts of Albizia lebbek, Casuarina equisetifolia (ironwood), and Leucaena leucocephala (tangantangan). At the northern end, there is a large bamboo (Bambusa vulgaris) stand.

Two variations of pasture occur at the site, one that is currently being used for grazing and one that appears to have been abandoned. Originally the area appears to have been planted with pasture grasses, such as Panicum maximum (Guinea grass) and Brachiaria subquadripara, but now these have been joined by the often more common weedy species. The weedy species most frequently found in the areas currently used for grazing are Stachytarpheta jamaicensis (Jamaica vervain), Stachytarpheta urticifolia (blue rat's-tail), Sida acuta, Ipomoea triloba, Malvastrum coromandelianum, Centrosema pubescens, Momordica charantia (balsam pear), Mimosa invisa (giant sensitive plant), and Desmanthus virgatus. In the abandoned areas, weedy species completely dominate, the most common of which are are the two thorny species, Mimosa invisa and Lantana camara (lantana).

Sensitive Vegetation and Plants

There is no native vegetation at the site. It was removed long ago and the land has been in use for farming and grazing of cattle for many decades. A total of 70 plant species were recorded at the site (see Table 3). Of these, only seven or fewer are native, none of which are endemic. All of these native species are weedy or semi-cultivated, and none could be considered rare or endangered. This is to be expected in an area as highly disturbed as this pasture is.

DISCUSSION

Nearly the whole area included in the botanical survey is covered with disturbed vegetation. Even those areas of native vegetation present are highly disturbed and their native species intermixed with weedy alien species. The only vegetation that could be considered to be sensitive would be wetlands, which are protected under U.S. laws. These are mainly along the streams in the area in the "ravine forest."

It is does not appear that the activities planned for the various sites would be detrimental to native vegetation. The only sites of any concern in the Naval Magazine would be the ravine forest, but this would not likely be impacted by the proposed land navigation and sniper range activities. Limestone forest is present at the Bivouac Site and Helicopter Landing Site, but these are marginal to the probable area of activity, since they are on steep or rugged slopes. But if the area of activity is to be expanded into these area, care should be taken not to damage this native limestone forest.

The Rappelling Site in the Naval Magazine and the Parachute Drop Zone on Tinian have no native vegetation at all. Although the Live Fire Weapons Range has no native vegetation, the Casuarina woodland does have certain aesthetic interest and is home to a number of native species. If would be advisable to avoid using the woodland if at all possible, especially the one at the southeast corner of the airfield complex.

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LIST OF FIGURES

1. Land Navigation Site with grassland vegetation covering the hills and ravine forest in the distant ravines.
2. Land Navigation Site with eroded soil and fernland vegetation.
3. Land Navigation Site ravine forest.
4. Land Navigation Site with waterfall in ravine forest.
5. Sniper Range Site with grassland vegetation covering the hills and ravine forest in the gullies.
6. Helicopter Landing Site with managed land vegetation on an old road.
7. Helicopter Landing Site with a mosaic of vegetation.
8. Rappelling Site with sparse vegetation on the cliff.

CHECKLISTS OF THE FLORA OF THE STUDY SITES

Table 1. Checklist of the Flora of the Naval Magazine Sites, Guam.

The species are arranged in four groups: (1) ferns; (2) gymnosperms; (3) monocots; and (4) dicots. Within each of these groups the species are arranged in alphabetical order by family, and in alphabetical order within the families.

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1 2 3 4 5
FERNS (PTERIDOPHYTES)			
ADIANTACEAE (Maidenhair-fern Family)			
Pityrogramma calomelanos (L.) Link	X	-----	X - - - -
Pteris quadriaurita Retz.	I	-----	- - X - -
Pteris vittata L.	X	-----	- X X X X
DAVALLIACEAE (Leather-fern Family)			
Davallia solida (Forst. f.) Sw.	I	leather fern, pagua-machena	X - X - -
Humata heterophylla (Smith) Desv.	I	-----	- - X - -
Nephrolepis hirsutula (Forst. f.) Presl	I	sword fern	X X X X -
GLEICHENIACEAE (Gleichenia Family)			
Dicranopteris linearis (Burm.) Underwood	I	false staghorn	X - - X -
LINDSAEACEAE (Lacefern Family)			
Lindsaea ensifolia Sw.	I	-----	X - - - -
LYCOPODIACEAE (Clubmoss Family)			
Lycopodium cernuum L.	I	club moss	X - X - -
MARATTIACEAE (Marattia Family)			
Angiopteris evecta (Forst. f.) Hoffm.	I	king fern	X - - - -
POLYPODIACEAE (Common Fern Family)			
Belvisia spicata (L. f.) Mirb. ex Copeland	I	-----	- - X - -
Phymatosorus scolopendria (Burm. f.) Pichi Serm.	I	-----	X - X X -
Pyrrosia lanceolata (L.) Farw.	I	-----	- - X - -
Microsorium punctatum (L.) Copeland	I	-----	X - - - -
SCHIZAEACEAE (Schizaea Family)			
Lygodium microphyllum (Cav.) R. Br.	I	-----	X - X - -

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1	2	3	4	5
THELYPTERIDACEAE (Downy Woodfern Family)							
Amphineuron opulentum (Kaulf.) Holtum	I	-----	X	X	-	-	-
Christella parasitica (L.) Léveillé	I	-----	X	-	X	-	-
Sphaerostephanos unitus (L.) Holttum	X	-----	X	X	X	-	-
VITTARIACEAE (Ribbon-fern Family)							
Vittaria incurvata Cav.	I	-----	X	-	-	-	-
GYMNOSPERMS							
CYCADACEAE (Cycad Family)							
Cycas circinalis L.	I	cycad, fadang	X	X	X	X	-
MONOCOTS							
ARECACEAE (Palm Family)							
Areca catechu L.	X	betel-nut, pagua	X	-	X	-	-
Cocos nucifera L.	I	coconut, niyog	X	-	X	X	-
CYPERACEAE (Sedge Family)							
Carex fuirenoides Gaudich.	X	-----	X	-	X	-	-
Cyperus compressus L.	X	-----	-	-	X	-	X
Cyperus aff. compressus	X	-----	-	-	X	-	X
Eleocharis geniculata (L.) R.& S.	I?	-----	-	X	X	-	-
Fimbristylis autumnalis (L.) R. & S.	I	-----	-	X	X	-	-
Fimbristylis cymosa R. Br.	I	-----	X	X	X	X	-
Fimbristylis dichotoma (L.) Vahl	I	-----	X	X	X	X	-
Fimbristylis littoralis Gaudich.	I	-----	X	-	-	-	-
Fimbristylis tristachya R. Br.	I	-----	X	-	-	-	-
Fuirena umbellata Rottb.	I	-----	X	-	-	-	-
Kyllinga brevifolia Rottb.	I	chaguan lemae	-	-	X	-	-
Machaerina mariscoides (Gaudich.) J.H. Kern	I	-----	X	-	-	-	-
Pycreus polystachyos (Rottb.) Beauv.	X	-----	X	-	X	X	-
Rhynchospora rubra (Lour.) Makino	I	-----	X	-	-	-	-
Scleria lithosperma (L.) Swartz	I	-----	X	-	X	-	-
Scleria polycarpa Boeck.	I	-----	X	-	X	-	-
FLAGELLARIACEAE (Flagellaria Family)							
Flagellaria indica L.	I	false ratan	X	-	X	X	-
LILIACEAE (Lily Family)							
Curculigo orchioides Gaertn.	I	yellow-eyed grass	X	-	-	-	-
Dianella saffordiana Fosb. & Sachet	I	-----	X	-	-	-	-

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1	2	3	4	5
ORCHIDACEAE (Orchid Family)							
Arundinaria graminifolia (D. Don) Hochr.	X	bamboo orchid	X	-	-	-	-
Bulbophyllum guamense Ames	E	cebollo halumtano	-	-	X	-	-
Dendrobium guamense Ames	E	-----	-	-	X	-	-
Geodorum densiflorum (Lam.) Lindl.	X	-----	X	-	-	-	-
Spathoglottis plicata Bl.	X	Philippine ground orchid	X	-	X	X	-
Taeniophyllum mariannense Schlechter	E	kamuke-annofe	X	-	X	-	-
PANDANACEAE (Screwpine Family)							
Freycinetia reineckei Ward.	I	fianiti	X	-	X	-	-
Pandanus dubius Spreng.	I	pahong	X	X	X	X	-
Pandanus tectorius Parkinson	I	screwpine, kafu	X	X	X	X	-
POACEAE (Grass Family)							
Centosteca lappacea (L.) Desv.	I	-----	X	-	-	-	-
Chloris virgata Sw.	X	-----	-	-	-	-	X
Chrysopogon aciculatus (Retz.) Trin.	I	-----	X	-	-	-	-
Dichantium bladhii (Retz.) Clayton	X	-----	X	X	X	X	-
Dimeria chloridiformis (Gaud.) K. Schum. & Laut.	E	-----	X	-	X	-	-
Eragrostis brownii (Kunth) Nees ex Steud.	X	-----	-	-	X	-	-
Eustachys petraea (Sw.) Desv.	X	-----	-	-	X	X	X
Imperata conferta (Presl) Ohw	X	-----	-	-	X	-	-
Miscanthus floridulus (Labill. Warb. ex K. Schum. & Laut.	I	sword grass, neti	X	X	X	-	-
Oplismenus hirtellus (L.) P. Beauv.	I	-----	X	-	X	-	-
Paspalum conjugatum Berg.	X	T-grass	-	X	X	X	-
Paspalum fimbriatum Kunth	X	-----	-	-	-	-	X
Paspalum orbiculare Forst. f.	I	rice grass	X	-	-	-	-
Pennisetum polystachion (L.) Schult.	X	mission grass	X	X	X	X	X
Phragmites karka (Retz.) Trin. ex Steud.	I	reed, karriso	X	-	X	-	-
Pogonantherum crinitum (Thunb.) Kunth	X	-----	-	-	X	-	-
Saccharum spontaneum L.	I	wild cane	X	X	X	-	-
Sacciolepis indica (L.) Chase	X	-----	-	X	-	-	-
Sporobolus diander (Retz.) P. Beauv.	I	dropseed	-	-	-	X	-
Sporobolus fertilis (Steud.) Clayton	I	rat-tail dropseed	-	-	X	-	-
Zoysia matrella (L.) Merr.	I	Manilla templegrass	-	-	-	X	-
DICOTS							
ANACARDIACEAE (Cashew Family)							
Mangifera indica L.	X	mango, mangga	X	-	-	-	-

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1	2	3	4	5
ANNONACEAE (Soursop Family)							
Cananga odorata (Lam.) Hook. f. & Thoms.	X	ilang-ilang	X	-	-	-	-
Guamia mariannae (Safford) Merr.	E	pai-pai	-	X	-	X	-
APIACEAE (Carrot Family)							
Centella asiatica (L.) Urb.	X	Asiatic pennywort	X	X	X	-	-
APOCYNACEAE (Dogbane Family)							
Cerbera dilatata Markgraf	E	chiute	-	-	X	-	-
Ochrosia mariannensis A. DC.	E	langiti	X	-	-	-	-
ASCLEPIADACEAE (Milkweed Family)							
Asclepias curassavica L.	X	asuncion, milkweed	-	-	-	X	-
ASTERACEAE (Sunflower Family)							
Ageratum conyzoides L.	X	mumutung	X	X	X	-	-
Bidens alba (L.) DC.	X	beggar's-tick	X	X	X	-	-
Chromolaena odorata (L.) King & Robin.	X	masigsig	X	X	X	X	-
Conyza canadensis (L.) Cronq.	X	Canadian fleabane	-	X	X	X	-
Elephantopus mollis Kunth	X	elephant's-foot	X	-	-	-	-
Emilia sonchifolia (L.) DC.	X	emilia	-	X	-	-	-
Mikania scandens (L.) Willd.	X	mile-a-minute vine	X	X	X	X	-
Pluchea carolinensis (Jacq.) D. Don	X	pluchea	-	-	X	-	-
Synedrella nodiflora (L.) Gaertn.	X	saigon	X	-	-	-	-
Vernonia cinerea (L.) Less.	I	ironweed	-	X	-	-	-
BARRINGTONIACEAE (Barringtonia Family)							
Barringtonia racemosa (L.) Bl. ex DC.	I	langasat	-	-	X	-	-
BORAGINACEAE (Heliotrope Family)							
Heliotropium procumbens Mill.	I	huning-tasi	-	-	-	-	X
CAMPANULACEAE (Bluebell Family)							
Hippobroma longiflora (L.) G. Don	X	-----	-	-	X	X	-
CARICACEAE (Papaya Family)							
Carica papaya L.	X	papaya	-	-	-	X	-
CASSYTHACEAE (Cassytha Family)							
Cassytha filiformis L.	I	agasi	X	-	-	X	-
CASUARINACEAE (Ironwood Family)							
Casuarina equisetifolia L.	I	ironwood, gagu	X	-	-	X	-

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1	2	3	4	5
CLUSIACEAE (Mangosteen Family)							
Calophyllum inophyllum L.	I	Alexandrian laurel, da'og	X	-	X	-	-
CONVOLVULACEAE (Morning-glory Family)							
Ipomoea littoralis Bl.	I	-----	X	-	-	X	-
Ipomoea triloba L.	X	fofgu-sabana	X	-	X	-	-
Stictocardia tiliifolia (Desr.) Hall. f.	I	-----	-	X	X	-	-
ELAEOCARPACEAE (Elaeocarpus Family)							
Eleocarpus joga Merr.	X	yoga	-	X	-	-	-
EUPHORBIACEAE (Spurge Family)							
Chamaesyce hypericifolia (L.) Millsp.	X	-----	-	-	-	X	X
Euphorbia heterophylla L.	X	-----	X	-	-	-	-
Glochidion marianum Muell. Arg.	I	chosga	X	-	X	-	-
Macaranga thompsonii Merr.	I	pengua	-	-	-	X	-
Phyllanthus marianus Muell. Arg.	I	gaogao-uchan	-	X	-	X	-
Phyllanthus saffordii Merr.	E	-----	X	-	-	-	-
FABACEAE (Pea Family)							
Abrus precatorius L.	X	rosary pea	X	-	-	-	-
Acacia sp.	X	-----	X	-	-	-	-
Acacia sp.	X	-----	X	-	-	-	-
Alysicarpus vaginalis (L.) DC.	X	-----	X	-	X	-	-
Caesalpinia major (Medic.) Dandy & Exell	I	gray nickers, pakao	-	-	-	X	-
Calapogonium mucunoides Desv.	X	akankan-guakag	X	-	-	-	-
Centrosema pubescens Benth.	X	-----	X	-	-	-	-
Chamaecrista nicitans (L.) Moench	X	Japanese tea-senna	-	X	X	-	-
Crotalaria retusa L.	X	-----	X	-	-	X	-
Desmodium heterophyllum (Willd.) DC.	X	-----	-	-	X	-	-
Desmodium triflorum (L.) DC.	X	agsom	X	-	X	-	-
Entada pursaetha DC.	I	snuff-box bean, gayi	X	-	-	-	-
Intsia bijuga (Colebr.) Kuntze	I	ifil	-	-	-	X	-
Leucaena leucocephala (Lam.) de Wit	X	wild tamarind, tangantangan	X	X	X	X	X
Mimosa pudica L.	X	sensitive plant	X	X	X	X	-
Pueraria phaseoloides (Roxb.) Benth.	X	tropical kudzu	X	-	-	-	-
Vigna adenantha (G.F.W. Meyer) Maréchal	X	akangkang-kalatun	-	X	-	-	-
GOODENIACEAE (Goodenia Family)							
Scaevola taccada (Gaertn.) Roxb.	I	nanaso	X	X	X	X	X

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1	2	3	4	5
LAMIACEAE (Mint Family)							
Hyptis capitata Jacq.	X	botones	X	X	X	-	-
Hyptis suaveolens (L.) Poir.	X	-----	X	-	-	-	-
LOGANIACEAE (Logania Family)							
Buddleja asiatica Lour.	X	-----	-	-	-	-	X
Geniostoma micranthum A. DC.	E	anasser	X	-	-	-	-
Fagraea berteroana A. Gray ex Benth.	I	-----	-	-	X	-	-
Polypremnum procumbens L.	X	-----	-	-	-	X	-
MALVACEAE (Mallow Family)							
Hibiscus abelmoschus L.	X	kamang	X	-	-	-	-
Hibiscus tiliaceus L.	I	hibiscus, pago	X	-	X	X	-
Sida acuta Burm. f.	X	escobilla papago	X	-	-	-	-
MELASTOMACEAE (Melastoma Family)							
Medinilla medinilliana (Gaudich.) Fosb. & Sach.	E	gafus	X	-	X	-	-
Melastoma malabathricum L.	I	gafau	X	-	X	-	-
MELIACEAE (Mahogany Family)							
Aglaia mariannensis Merr.	E	mapunyao	-	X	-	X	-
MORACEAE (Mulberry Family)							
Artocarpus mariannensis Trécul	I	dokdok	-	-	X	-	-
Ficus prolixa Forst. f.	I	banyan, nunu	-	X	-	X	-
Ficus tinctoria Forst. f.	I	dyer's fig	-	-	X	-	-
MYRSINACEAE (Myrsine Family)							
Discocalyx megacarpa Merr.	E	otot	X	-	-	-	-
MYRTACEAE (Myrtle Family)							
Decaspermum fruticosum Forst.	I	-----	X	-	X	-	-
Melaleuca quinquenervia (Cav.) Blake	X	paperbark	X	-	-	-	-
Myrtella bennigseniana (Volk.) Diels	I	-----	X	-	-	-	-
Pimenta racemosa (Willd.) J.W. Moore	X	bay rum	X	-	-	-	-
Psidium guajava L.	X	guava, abas	-	X	X	-	-
PASSIFLORACEAE (Passionflower Family)							
Passiflora foetida L.	X	love-in-a-mist	X	-	-	-	-
Passiflora suberosa L.	X	-----	X	-	X	X	-
PIPERACEAE (Pepper Family)							
Piper guahamense C. DC.	E	wild piper	-	-	X	X	-
POLYGALACEAE (Milkwort Family)							
Polygala paniculata L.	X	-----	X	X	X	X	-

FAMILY Scientific name	Status[1]	Common Name	Distribution[2] 1	2	3	4	5
RUBIACEAE (Coffee Family)							
Guettarda speciosa L.	I	panao	-	-	-	X	-
Morinda citrifolia L.	I	Indian mulberry, lada	X	X	X	X	-
Psychotria mariana Bartl. ex DC.	I	-----	-	-	-	X	-
Spermacoce assurgens R. & P.	X	-----	X	X	X	X	-
Spermacoce ernstii Fosb. & Powell	X	-----	X	X	X	X	-
Timonius nitidus (Bartling) F.-Vill.	I	-----	X	-	-	-	-
RUTACEAE (Citrus Family)							
Triphasia trifolia (Burm f.) P. Wils.	I?	limeberry, limon-china	X	X	X	X	-
SAPOTACEAE (Sapodilla Family)							
Pouteria obovata (R. Br.) Baehni	I	lalahag	X	-	-	-	-
SCROPHULARIACEAE (Snapdragon Family)							
Buchnera floridanus Sm.	X	-----	-	-	-	X	-
SOLANACEAE (Nightshade Family)							
Cestrum diurnum L.	X	day cestrum, tinta'n-china	-	X	X	-	-
STERCULIACEAE (Cacao Family)							
Waltheria indica L.	X	escobilla sabana	X	-	-	X	-
THYMELAEACEAE (Mezereum Family)							
Wikstroemia elliptica Merr.	I	gapit atayake	X	-	-	-	-
URTICACEAE (Nettle Family)							
Pilea microphylla (L.) Liebm.	X	-----	-	X	X	X	X
Pipturus argenteus (Forst. f.) Wedd.	I	amahadyan	-	-	-	X	X
VERBENACEAE (Verbena Family)							
Clerodendrum inerme (L.) Gaertn.	I	lodugao	X	-	X	-	-
Premna serratifolia L.	I	ahgao	-	-	-	X	-
Stachytarpheta jamaicensis (L.) Vahl	X	Jamaica vervain	X	X	X	X	X
Vitex parviflora Juss.	X	-----	-	-	X	X	-

[1] Status: E = Endemic (to the Marianas); I = indigenous (native); X = Alien (non-native)

[2] Distribution: 1 = Navigation range; 2 = Bivouac area; 3 = Firing range; 4 = Helicopter landing site; and 5 = Rappelling site.

Table 2. Checklist of the Flora of the Live Fire Weapons Range Site, Tinian.

The species are arranged in three groups: (1) ferns; (2) monocots; and (3) dicots. Within each of these groups the species are arranged in alphabetical order by family, and in alphabetical order within the families.

FAMILY Scientific name	Status[1]	Common Name
FERNS (PTERIDOPHYTES)		
POLYPODIACEAE (Common Fern Family)		
Phymatosorus scolopendria (Burm. f.) Pichi Serm.	I	-----
MONOCOTS		
COMMELINACEAE (Spiderwort Family)		
Zebrina pendula Schnizl	X	wandering Jew
CYPERACEAE (Sedge Family)		
Fimbristylis cymosa R. Br.	I	-----
Fimbristylis dichotoma (L.) Vahl	I	-----
Mariscus javanicus (Houtt.) Merr. & Metcalfe	I	-----
PANDANACEAE (Screwpine Family)		
Freycinetia reineckei Ward.	I	fianiti
Pandanus dubius Spreng.	I	pahong
Pandanus tectorius Parkinson	I	screwpine, kafu
POACEAE (Grass Family)		
Bothriochloa bladhii (Retz.) S.T. Blake	X	-----
Bothriochloa pertusa (L.) A. Camus	X	pitted beardgrass
Cenchrus echinatus L.	X	bur grass
Chloris barbata (L.) Sw.	X	finger grass
Chrysopogon aciculatus (Retz.) Trin.	I	-----
Cynodon dactylon (L.) Pers.	X	Bermuda grass, grama
Dactyloctenium aegyptium (L.) Willd.	X	crowfoot grass
Dichantium caricosum (L.) A. Camus	X	-----
Digitaria ciliaris (Retz.) Koel.	I	-----
Digitaria insularis (L.) Mez	X	sourgrass
Eleusine indica (L.) Gaertn.	X	goose grass, umog
Eragrostis ciliaris (L.) R. Br.	X	love grass
Eragrostis tenella (L.) P. Beauv. ex R. & S.	I?	love grass
Eustachys petraea (Sw.) Desv.	X	-----
Lepturus repens (Forst.) R. Br.	I	lesaga
Panicum maximum Jacq.	X	Guinea grass
Paspalum paniculatum L.	X	-----
Pennisetum polystachion (L.) Schult.	X	mission grass
Rhynchelytrum repens (Willd.) Hubb.	X	Natal redtop
Sporobolus fertilis (Steud.) Clayton	I	rat-tail dropseed

FAMILY Scientific name	Status[1]	Common Name
DICOTS		
ACANTHACEAE (Acanthus Family)		
Blechum brownei Juss.	X	yerbas babui
AMARANTHACEAE (Amaranth Family)		
Achyranthes aspera L.	I	chichitun
Deeringia amaranthoides (Lam.) Merr.	I	-----
APOCYNACEAE (Dogbane Family)		
Neisosperma oppositifolium (Lam.) Fosb. & Sachet	I	fago
ASTERACEAE (Sunflower Family)		
Bidens alba (L.) DC.	X	beggar's tick
Chromolaena odorata (L.) King & Robin.	X	masigsig
Tridax procumbens L.	X	coat buttons
Vernonia cinerea (L.) Less.	I	ironweed, chaguan Santa Maria
Wollastonia biflora (L.) DC.	I	masigsig
BORAGINACEAE (Heliotrope Family)		
Heliotropium procumbens Mill.	I	huning-tasi
CAPPARIDACEAE (Caper Family)		
Capparis cordifolia Lam.	I	atkaparas
CARICACEAE (Papaya Family)		
Carica papaya L.	X	papaya
CASSYTHACEAE (Cassytha Family)		
Cassytha filiformis L.	I	agasi
CASUARINACEAE (Ironwood Family)		
Casuarina equisetifolia L.	I	ironwood, gagu
CONVOLVULACEAE (Morning-glory Family)		
Ipomoea pes-caprae (L.) R. Br.	I	beach morning-glory, alalag-tasi
Ipomoea triloba L.	X	fofgu-sabana
Operculina ventricosa (Bert.) Peter	X	-----
CUCURBITACEAE (Gourd Family)		
Momordica charantia L.	X	balsam pear, almagosa
CUSCUTACEAE (Dodder Family)		
Cuscuta campestris Yuncker	X	dotter

FAMILY Scientific name	Status[1]	Common Name
EUPHORBIACEAE (Spurge Family)		
Acalypha indica L.	X	hierba del cancer
Chamaesyce hirta (L.) Millsp.	X	garden spurge
Chamaesyce hyssopifolia (L.) Small	X	-----
Chamaesyce prostrata (Ait.) Millsp.	X	prostrate spurge,
Euphorbia cyathophora Murray	X	wild poinsettia
Jatropha gossypifolia L.	X	-----
Melanolepis multiglandulosa (Reinw. (Reinw. ex Bl.) Rchb. f. & Zoll.	I	alom
Phyllanthus amarus Sch. & Th.	X	maigo-lalo
Phyllanthus marianus Muell. Arg.	I	gaogao-uchan
FABACEAE (Pea Family)		
Abrus precatorius L.	X	rosary pea, kolales halomtano
Albizia lebbeck (L.) Benth.	X	trongkon-mames
Alysicarpus vaginalis (L.) DC.	X	-----
Clitoria ternata L.	X	bukike, butterfly pea
Crotalaria pallida Ait.	X	kaskabeles, rattlepod
Desmanthus virgatus (L.) Willd.	X	-----
Desmodium triflorum (L.) DC.	X	agsom
Leucaena leucocephala (Lam.) de Wit	X	wild tamarind, tangantangan
Pithecellobium dulce (Roxb.) Benth.	X	kamachile
Rhychosia calosperma Warb.	X	-----
Senna occidentalis (L.) Link	X	coffee senna
Senna sophera (L.) Roxb.	I	amot-tumaga
GOODENIACEAE (Goodenia Family)		
Scaevola taccada (Gaertn.) Roxb.	I	nanaso
MALVACEAE (Mallow Family)		
Abutilon indicum (L.) Sweet	X	matbas, mallow
Malvastrum coromandelianum (L.) Garcke	X	-----
Sida acuta Burm. f.	X	escobilla papago
Thespesia populnea (L.) Sol. ex Corr.	I	milo, banalo
MORACEAE (Mulberry Family)		
Ficus prolixa Forst. f.	I	nunu, strangler fig
MYRTACEAE (Myrtle Family)		
Eugenia palumbis Merr.	I	agatelang
NYCTAGINACEAE (Four-o'clock Family)		
Boerhavia repens R. Br.	I	dafao
OLEACEAE (Olive Family)		
Jasminum marianum DC.	E	banago

FAMILY Scientific name	Status[1]	Common Name
OXALIDACEAE (Woodsorrel Family)		
Oxalis corniculata L.	X	wood sorrel, agsom
PASSIFLORACEAE (Passionflower Family)		
Passiflora foetida L.	X	love-in-a-mist
Passiflora suberosa L.	X	-----
PORTULACACEAE (Purslane Family)		
Portulaca australis Endl.	I	-----
Portulaca oleracea L.	X	purslane, botdolagas
RUBIACEAE (Coffee Family)		
Hedyotis corymbosa (L.) Lam. X -----		
Morinda citrifolia L.	I	Indian mulberry, lada
Psychotria mariana Bartl. ex DC.	E	aplokating
SAPINDACEAE (Soapberry Family)		
Cardiospermum halicacabum L.	X	balloon vine
SOLANACEAE (Nightshade Family)		
Capsicum frutescens L.	X	chili pepper, doni-sali tomate chaca
Solanum americanum Mill.	X	black nightshade
TILIACAEAE (Linden Family)		
Muntingia calabura L.	X	Panama cherry, calabura
URTICACEAE (Nettle Family)		
Pilea microphylla (L.) Liebm.	X	-----
Pipturus argenteus (Forst. f.) Wedd.	I	amahadyan
VERBENACEAE (Verbena Family)		
Callicarpa candicans (Burm.f.) Hochr.	I	qualitay
Lantana camara L.	X	lantana
Premna serratifolia L.	I	ahgao
Stachytarpheta jamaicensis (L.) Vahl	X	false verbena

[1] STATUS: E = Endemic (to the Marianas); I = indigenous (native); X = Alien (non-native).

Table 3. Checklist of the Flora of the Parachute Drop Zone Site, Tinian.

The species are arranged in three groups: (1) ferns; (2) monocots; and (3) dicots. Within each of these groups the species are arranged in alphabetical order by family, and in alphabetical order within the families.

FAMILY Scientific name	Status[1]	Common Name
FERNS (PTERIDOPHYTES)		
POLYPODIACEAE (Common Fern Family)		
Phymatosorus scolopendria (Burm. f.) Pichi Serm.	I	-----
MONOCOTS		
COMMELINACEAE (Spiderwort Family)		
Commelina benghalensis L.	X	-----
CYPERACEAE (Sedge Family)		
Cyperus compressus L.	X	-----
Cyperus rotundus L.	X	nutgrass
POACEAE (Grass Family)		
Bambusa vulgaris Schrad. ex Wendl.	X	bamboo
Bothriochloa bladhii (Retz.) S.T. Blake	X	-----
Bothriochloa pertusus (L.) A. Camus	X	pitted beardgrass
Brachiaria subquadripara (Trin.) Hitchc.	X	-----
Chloris barbata (L.) Sw.	X	finger grass
Cynodon dactylon (L.) Pers.	X	Bermuda grass, grama
Dactyloctenium aegyptium (L.) Willd.	X	crowfoot grass
Dichanthium caricosum (L.) A. Camus	X	-----
Digitaria ciliaris (Retz.) Koel.	I	-----
Digitaria insularis (L.) Mez	X	sourgrass
Eleusine indica (L.) Gaertn.	X	goose grass, umog
Eragrostis tenella (L.) P. Beauv. ex R. & S.	I?	love grass
Panicum maximum Jacq.	X	Guinea grass
Paspalum paniculatum L.	X	-----
Sorghum bicolor (L.) Moench.	X	broomcorn
Sporobolus diander (Retz.) Beauv.	X	dropseed
DICOTS		
ACANTHACEAE (Acanthus Family)		
Blechum brownei Juss.	X	yerbas babui

FAMILY Scientific name	Status[1]	Common Name
AMARANTHACEAE (Amaranth Family)		
Amaranthus spinosus L.	X	kuletes, spiny amaranth
Amaranthus viridis L.	X	kuletes apaka
ASCLEPIACACEAE (Milkweed Family)		
Asclepias curassavica L.	X	asuncion, milkweed
ASTERACEAE (Sunflower Family)		
Bidens alba (L.) DC.	X	beggar's tick
Chromolaena odorata (L.) King & Robin.	X	masigsig
Mikania scandens (L.) Willd.	X	mile-a-minute vine
Synedrella nodiflora (L.) Gaertn.	X	saigon
Vernonia cinerea (L.) Less.	I	ironweed, chaguan Santa Maria
BORAGINACEAE (Heliotrope Family)		
Heliotropium procumbens Mill.	I	huning-tasi
CARICACEAE (Papaya Family)		
Carica papaya L.	X	papaya
CASUARINACEAE (Ironwood Family)		
Casuarina equisetifolia L.	I	ironwood, gagu
CONVOLVULACEAE (Morning-glory Family)		
Ipomoea obscura (L.) Ker-Gawl.	X	-----
Ipomoea triloba L.	X	fofgu-sabana
CUCURBITACEAE (Gourd Family)		
Momordica charantia L.	X	balsam pear, almagosa
EUPHORBIACEAE (Spurge Family)		
Acalypha indica L.	X	hierba del cancer
Chamaesyce hirta (L.) Millsp.	X	garden spurge
Jatropha gossypifolia L.	X	-----
Phyllanthus amarus Sch. & Th.	X	maigo-lalo
FABACEAE (Pea Family)		
Acacia confusa Merr.	X	Formosan koa
Aeschynomene indica L.	X	-----
Albizia lebbeck (L.) Benth.	X	trongkon-mames
Centrosema pubescens Benth.	X	-----
Crotalaria retusa L.	X	-----
Desmanthus virgatus (L.) Willd.	X	-----
Leucaena leucocephala (Lam.) de Wit	X	wild tamarind, tangantangan
Macroptilium lathyroides (L.) Urb.	X	cowpea

FAMILY Scientific name	Status[1]	Common Name
FABACEAE (cont'd.)		
Mimosa invisa Mart.	X	giant sleeping-grass
Mimosa pudica L.	X	sensitive plant
Pithecellobium dulce (Roxb.) Benth.	X	kamachile
Senna alata (L.) Roxb.	X	candlebush, andadose
Senna occidentalis (L.) Link	X	coffee senna
MALVACEAE (Mallow Family)		
Malvastrum coromandelianum (L.) Garcke	X	-----
Sida acuta Burm. f.	X	escobilla papago
Sida rhombifolia L.	X	escobilla dalili
MORACEAE (Mulberry Family)		
Ficus tinctoria Forst. f.	I	dyer's fig, hoda
MYRTACEAE (Myrtle Family)		
Psidium guajava L.	X	guava, abas
NYCTAGINACEAE (Four-o'clock Family)		
Boerhavia repens R. Br.	I	dafao
PASSIFLORACEAE (Passionflower Family)		
Passiflora foetida L.	X	love-in-a-mist
Passiflora suberosa L.	X	-----
PORTULACACEAE (Purslane Family)		
Portulaca oleracea L.	X	purslane, botdolagas
RUBIACEAE (Coffee Family)		
Spermacoce assurgens R. & P.	X	-----
SAPINDACEAE (Soapberry Family)		
Cardiospermum halicacabum L.	X	balloon vine
SOLANACEAE (Nightshade Family)		
Capsicum frutescens L.	X	chili pepper, doni-sali
Physalis angulata L.	X	wild cape-gooseberry, tomate chaca
Solanum americanum Mill.	X	black nightshade
Solanum torvum Sw.	X	-----
VERBENACEAE (Verbena Family)		
Lantana camara L.	X	lantana
Stachytarpheta jamaicensis (L.) Vahl	X	false verbena
Stachytarpheta urticifolia (Salisb.) Sims	X	blue rat's-tail

[1] STATUS: E = Endemic (to the Marianas); I = indigenous (native); X = Alien (non-native).

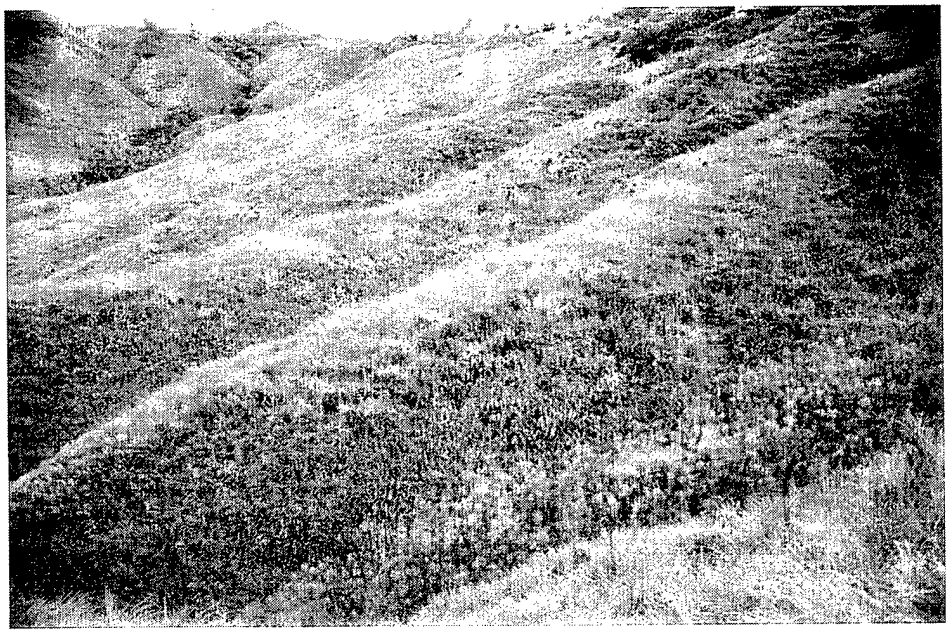


Figure 1. Land navigation site, NAVACTS Ordnance Annex



Figure 2. Land navigation site, NAVACTS Ordnance Annex

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Figure 3. Land navigation site ravine forest, NAVACTS Ordnance Annex



Figure 4. Land navigation site waterfall, NAVACTS Ordnance Annex



Figure 5. Sniper range site, NAVACTS Ordnance Annex



Figure 6. Helicopter landing site, NAVACTS Ordnance Annex

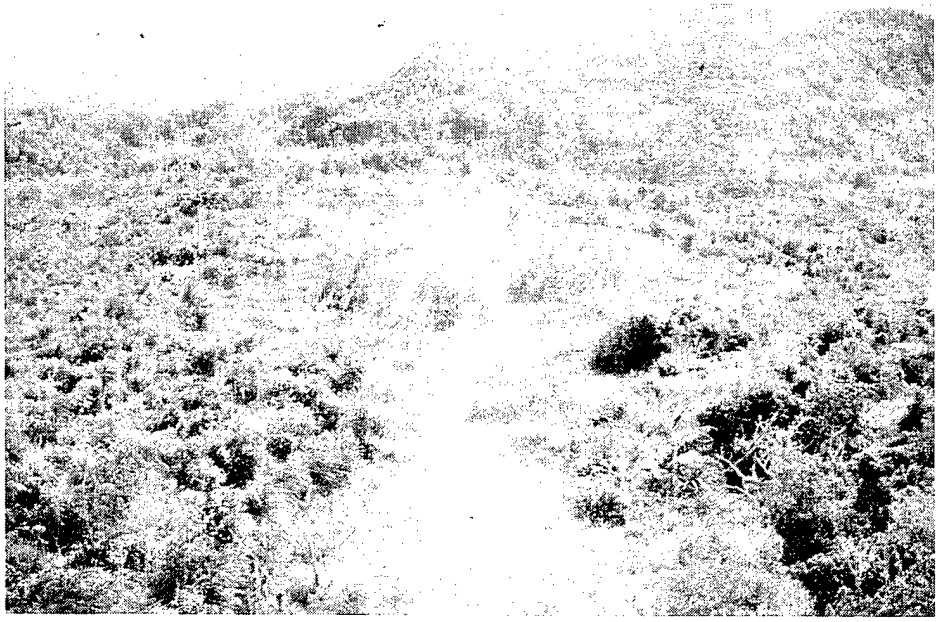


Figure 7. Helicopter landing site, NAVACTS Ordnance Annex



Figure 8. Rappelling site, NAVACTS Ordnance Annex

Appendix K

Report of a Faunal (Bird and Mammal) Survey of the NAVACTS Guam Ordnance Annex Proposed Training Site and Portions of the Atantano River

REPORT OF A FAUNAL (BIRD AND MAMMAL) SURVEY OF THE NAVACTS GUAM ORDINANCE ANNEX PROPOSED TRAINING SITE AND PORTIONS OF THE ATANTANO RIVER.

Prepared for

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by

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17 May 1996

INTRODUCTION

The purpose of this report is to summarize the findings of a three day (1-3 April 1996) bird and mammal field survey of a proposed training sites on NAVACTS Guam Ordinance Annex and the Atantano River, Guam (Fig. 1). Also included are references to pertinent literature as well as unpublished reports.

The objectives of the field survey were to:

1- Document what bird and mammal species occur on the property or could utilize the range of available habitats.

2- Where necessary supplement these findings with published and/or unpublished data.

3- Evaluate the possible impacts to wildlife that might occur as a consequence of the proposed project.

GENERAL SITE DESCRIPTIONS

The NAVACTS site presently contains dense second growth forest and grasslands with some native vegetation, predominantly along the western boundary (Fig. 1). A small wetland adjoins portions of the

road leading to Almagosa Spring. Small streams meander through the property impacted by the proposed project. The understory vegetation in some areas showed signs of feral mammal activity. The vegetation along the Atantano River is dense, making access to the river's edge virtually impenetrable. The portions of the river examined in this brief visit were too deep for wading birds.

Weather during the field survey was variable with occasional passing showers and some clear periods.

STUDY METHODS

Field observations were made with the aid of binoculars and by listening for vocalizations. Attention was also paid to the presence of tracks and scats as indicators of wildlife activity.

On 1 April the NAVACTS Site and surrounding areas were surveyed by driving along existing roads with brief stops at a few locations. The 2 April survey focused on the proposed training area. Walking surveys traversed the property north of Almagosa Springs road and around the West Tower and bivouac site. In addition, a portion of the Almagosa River was also surveyed on foot.

The Atantano River was studied at the section which crosses Route 1 and at the river's mouth at Apra Harbor.

All birds and mammals seen or heard on each survey day were tallied and are reported on Table 1. Tracks and scats also provided information about wildlife activity in this region.

Scientific names used herein follow those given in the most recent American Ornithologists' Union Checklist A.O.U 1983), Field guide to the Birds of Hawaii and the Tropical Pacific (Pratt et al. 1987) and Mammal species of the World (Honacki et al. 1982).

RESULTS AND DISCUSSION

Non-endangered Birds:

The only species seen on or near the NAVACTS site were Cattle Egret (Bubulcus ibis), Yellow Bittern (Ixobrychus sinensis), Black Francolin (Francolinus francolinus), Pacific Golden-Plover (Pluvialis fulva) and Siberian Tattler (Heteroscelus brevipes). The identification of the Tattler was made when the bird gave the two noted whistle which diagnostically separates it from the similar Wandering Tattler (Heteroscelus incanus). Only One Siberian Tattler was seen and heard near Almagosa Spring. Table One gives the total number of birds seen at and near this site over the course of two survey days.

The three species seen at the Atantano River between Highway One and Apra Harbor were: Yellow Bittern; Eurasian Tree Sparrow (Passer

montanus) and Black Drongo (Dicrurus macrocercus). The numbers of each of these species are given in Table One.

Non-endangered Mammals:

Tracks, scats, habitat disturbance and visual sightings were used to identify three species of mammals at NAVACTS: feral pig (Sus scrofa), Guam Deer (Cervus unicolor) and Carabao (Bubalus bubalis). All three species are apparently common to abundant. The understory vegetation and ground cover were disturbed in many areas visited on the survey. Apparently fires are sometimes set by poachers to burn off mature vegetation and allow new grass to grow and attract deer at NAVACTS according to Jennings Bunn, Cultural Resources Manager, NAVACTS (pers. comm.).

Endangered Birds and Mammals:

No endangered species were found on the survey. Reports of sightings of the Mariana Crow (Corvus kubaryi) and Mariana Fruit Bat (Pteropus mariannus) in this region by archeologists (pers. comm.) suggest that these two endangered species occur in the area. G. Wiles of Government of Guam Division of Aquatic and Wildlife Resources (pers. Comm.) indicated that such sightings may represent foraging animals. The bat is apparently seen at the Ordinance Annex more frequently than the Crow. G. Wiles (pers. comm.) did not know of any nesting or roosting areas for these species on NAVACTS. The Common Moorhen (Gallinula chloropus guami) occurs on Fena Valley Reservoir and could use the small wetland adjacent to Almagosa Spring road. To date none have been seen there

according to Jennings Bunn. The Island Swifflet (Aerodramus vanikorensis bartschi) nests in caves in the northeast section of the Ordinance Annex and forages around the southern end of Fena Valley Reservoir.

CONCLUSIONS

The NAVACTS proposed training site is covered in a mixture of grasslands and forest. Few Birds were seen on or near the site. The only mammals in the area are introduced species which may be causing damage to the understory vegetation and could impact the site by increasing erosion. No endangered species were recorded but the Mariana Crow and fruit bat forage on occasion in this region. The Common Moorhen and Island Swifflet occur around Fena Valley Reservoir.

One significant impact that could occur as a result of using this site for live fire training is the chance of stray rounds starting fires. The topography and dense vegetation could create extreme challenges in controlling a fire. The grass would regenerate and the cycle of fires would likely continue. The deer population would profit by new feeding areas and their increase could further impact the remaining forest.

The Atantano River should not be impacted by the proposed use of boat traffic. Few birds were seen in this area and no endangered species were encountered.

TABLE 1

Birds recorded at NAVACTS and Atantano River, Guam. Number indicates total seen or heard and NAV= NAVACTS while AR= Atantano River.

COMMON NAME	SCIENTIFIC NAME	NUMBER RECORDED
Cattle Egret	Bubulcus ibis	NAV= 29
Yellow Bittern	Ixobrychus sinensis	NAV= 2 AR= 3
Black Francolin	Francolinus francolinus	NAV= 5
Pacific Golden-Plover	Pluvialis fulva	NAV=12
Siberian Tattler	Heteroscelus brevipes	NAV= 1
Eurasian Tree Sparrow	Passer montanus	AR= 3
Black Drongo	Dicrurus macrocercus	AR= 2

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Appendix L

Fire Prevention and Response Plan

FIRE PREVENTION AND RESPONSE PLAN

Grass fires are regular occurrences on Tinian. However, there have been no fires since the summer of 1993 due to very rainy weather. Some fires appear to be the result of the local method of clearing forested land for grazing, i.e., burning with inadequate controls, or of careless use of campfires or cigarettes. Some fires appear to have been the result of military use of pyrotechnics. Fires spread rapidly through the grasslands; field observations indicate the fires burn out once they hit the tangantangan. Fires appear to burn more readily in "pristine" forests on the limestone cliffs than in the tangantangan. There is a greater fire danger during the dry season (February to April) than in the wet season (July to October).

Exercise activities with the potential to cause fires include use of smoke grenades and pyrotechnics. Other than heating individual field rations with heat tabs, no cooking will be performed in the exercise area; meals will be prepacked in trays and heated in portable units (similar to those used in commercial aircraft food service).

Fire prevention will be practiced by restricting open fires and pyrotechnics to North Field, where existing runways and taxiways can act as fire breaks and fire access roads, and vegetation is primarily tangantangan.

Fire response will be coordinated by standard communication nets, which will be established a month prior to the start of major exercises. The nets will be managed by the Joint Exercise Control Group (JECG) using standard military communications, including satellite uplinks and telephone lines. A command post and reception center will be established at West Field by COMNAVMARIANAS to coordinate with fire response assets and supporting agencies on Guam, as requested by JECG.

For operations involving fixed-winged personnel and cargo landings at North Field, a P19E Crash Fire Rescue Truck with six-man crew will be airlifted to Tinian in the first cargo to arrive from Guam.[1] It will also be available to respond to brush fires within a limited distance from access roads. The truck will be equipped with fire fighting foam used for aircraft fire response at North and West fields. The 45th Corps Support Groups (U.S. Army) will provide a five ton truck with 1,000-gallon water container, together with a crew and shovels. During the exercise, additional fire response capability will be provided by two U.S. Marine Corps (31 MEU) CH-46 helicopters with fire buckets, stationed on an amphibious ship offshore of Tinian. Prior to the fleet's arrival, HC-5 (Guam) will provide standby crews on Guam to fly fire protection, including two fire buckets carried by CH-46 helicopter.

In addition to military fire response assets, the Tinian Fire Department maintains a 300-gallon pump truck and fire crew to respond to wildfires. The Fire Department also maintains a 750-gallon pumper truck and crew in San Jose to respond to and provide fire service for the southern portion of the island, including backup crash-fire-rescue at West Field. Request for use of these assets will be made through the COMNAVMARIANAS command post at West Field.

Source: Belt Collins Hawaii (November 1994) *Environmental Assessment, Military Exercise, Island of Tinian: Tandem Thrust 95.* Prepared for Commander, Pacific Division, Naval Facilities Engineering Command.

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[1]Note: Lesser measures will be taken during small unit training evolutions, such as National Guard weekend training. They will not have a P19E on call.

Appendix M

Preliminary Archaeological Reconnaissance and Assessment of Farallon de Medinilla, Mariana Islands

PRELIMINARY ARCHAEOLOGICAL RECONNAISSANCE AND ASSESSMENT OF FARALLON DE MEDINILLA, MARIANA ISLANDS

by

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Scope of Work

At the request of Belt Collins Hawaii, an archaeological survey was conducted on the island of Farallon de Medinilla as part of the assessment of military training activities in the Mariana Islands. Farallon de Medinilla is a small, low-lying island located north of Saipan in the Commonwealth of the Northern Mariana Islands (CNMI). The survey is a part of the background work being conducted by Belt Collins Hawaii and its subconsultants for an Environmental Impact Statement being prepared for the Navy assessing the effect of these activities. The survey was conducted as part of a general island research visit arranged by the Commander, Naval Forces, Marianas (COMNAVMAR) for assessment studies of the island. The archaeological research was conducted in conjunction with assessments of biological resources and the effects of human actions on these resources by an ornithologist, botanist, and marine biologists.

The project scope of work for the archaeological study consisted of the following:

1) Perform a reconnaissance archaeological survey of the island for evidence of prior human occupation or use of the island in historic or prehistoric times.

2) Summarize available literature concerning the history of the island.

3) Evaluate changes from natural conditions caused by military or other human activity.

4) Evaluate potential for significance of any sites observed on the island.

Investigations in the Marianas were conducted between 3 and 12 November 1996, with several interruptions due to typhoons and holidays. Tasks carried out during this preriod included fieldwork preparation, transport to the island, field survey, consultations with the CNMI Historic Preservation Office (HPO), and background research on Saipan and Guam. The actual field survey was conducted on one day, 5 November, by a single archaeologist, the project principal investigator, David J. Welch, Ph.D.

The principal investigator conducted background research of historic documents concerning Farallon de Medinilla and the northern islands of the Marianas in general. This included a review of documents and maps at the CNMI HPO, the Micronesian Area Research Center (MARC) at the University of Guam, and documents on file at the IARII offices in Honolulu and Guam. He was assisted by Myra Tomonari-Tuggle, who reviewed archival materials at Maxwell AFB, Alabama, during research for another project; Jolie Liston, who reviewed materials at the University of Hawaii Hamilton Library Pacific and Map Collections; and Richard Olmo, who researched additional materials at MARC.

Following the survey, the principal investigator met in Saipan with Scott Russell, the CNMI Deputy Historic Preservation Officer, and with Mike Fleming, former CNMI Historic Preservation Officer. Discussions with Mr. Russell concerned the scope of the survey, historic documents relating to the island, the survey results, and recent archaeological and archival research conducted on the other CNMI islands north of Saipan. Mr. Fleming provided local information concerning the island.

Setting

Farallon de Medinilla is located in the Mariana Islands within the jurisdiction of the Commonwealth of the Northern Mariana Islands. The sixth island from the south in this north-south chain of 15 islands, it is located at approximately 16° N latitude and 146° E longitude 40 km north of Saipan and 30 km southeast of Anatahan. The island is approximately 2,700 m long by 500 m wide. Covering an area of approximately 84 hectares (207 acres), it is the smallest of the Mariana islands (Fig. 1).

The island is an uplifted coralline reef platform, from which rocky cliff faces drop abruptly to the sea around the entire island. These are the source of the first part of the island's name: *farallon* translates as cliff in Spanish. The island rises to 50 to 80 m above sea level along the top of the east cliff face. The terrain then slopes gradually downward to the west, ending in cliffs about 20 to 40 m above sea level on the west side. A narrow peninsula of land, only about 200 m wide, extends south from the main portion of the island.

The prevailing winds are from the northeast and blow strongly across the exposed island most of the time. The island, especially on the windward side, is being eroded by strong waves and at many locations the cliffs have been severely undercut as a result of wave action. In some places openings from the surface extend down to sea level. The leeward coast is less exposed to severe wave action and a few small rocky beaches are sometimes present. A few isolated limestone cliffs rise from the land on the northern end of the island.

The soil is generally a wind-eroded, shallow, slightly gravelly, dusky red loam, exposed in many places along the high east ridge. Most of the island is covered with low vegetation, mainly grasses, *Capparis*, and *Ipomoea pes-caprae* (beach morning glory). The dominant plant in many areas, especially in low-lying pockets, is a lily (*Crinum asiaticum*) which reaches several feet in height. Sea birds and migratory birds, of which up to 18 species are present, nest throughout the island.

The project area consists of the entire island. However the terrain precludes survey in several places. The southern peninsula is cut off by steep, rocky, crumbly terrain that is impassable on foot. The edges of the cliffs are composed of loose, crumbly rock; and large openings in the surface constitute an additional survey hazard. The presence of unexploded ordnance, from years of use of the island as a bombing target, make many areas of the island unsafe for pedestrian survey.

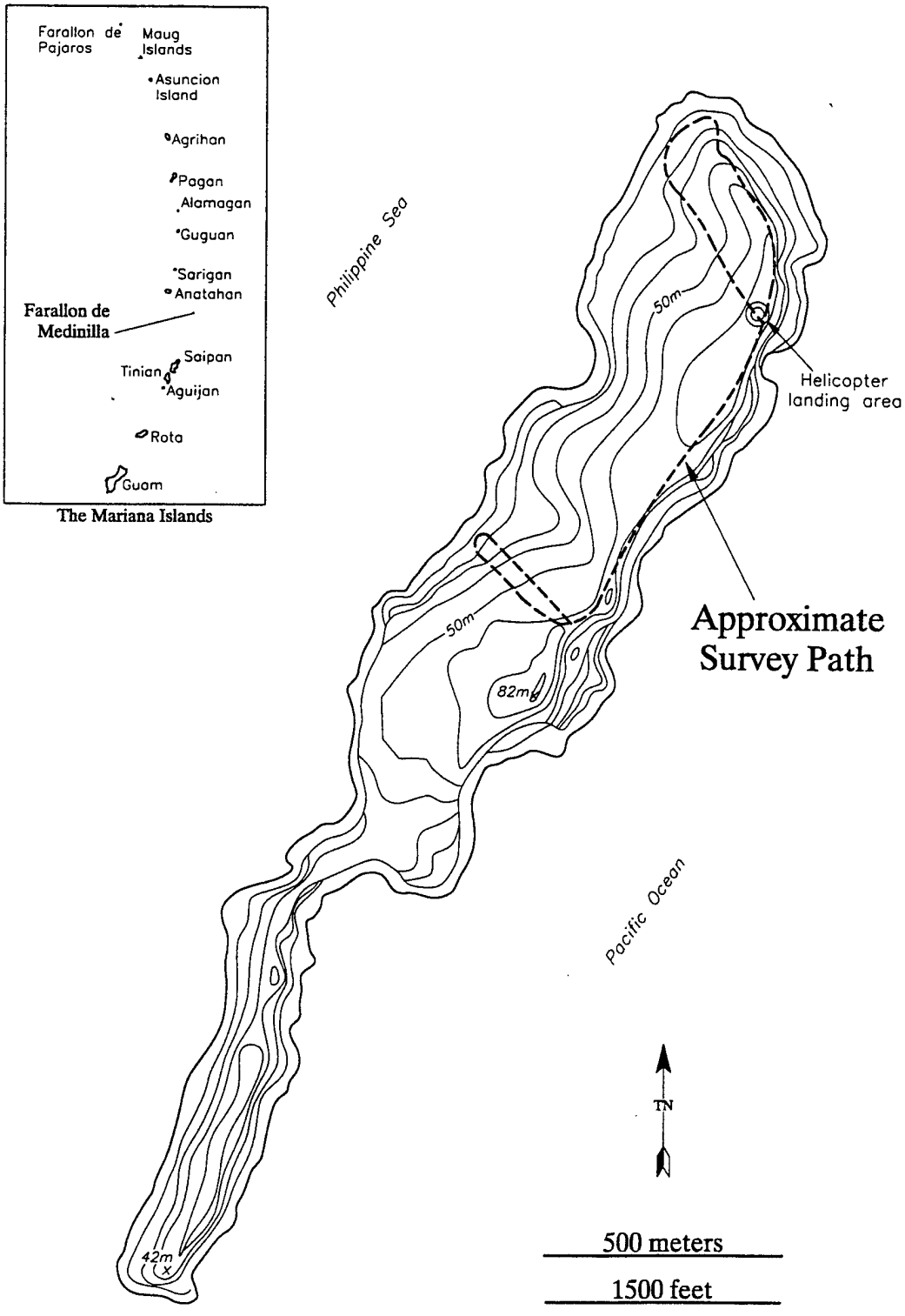


Figure 1. Map of Farallon de Medinilla showing location of reconnaissance survey path.

History of the Island

The first western landing in the Marianas was in 1521 by Ferdinand Magellan who probably sailed south of Farallon de Medinilla between Guam and Rota. One of the ships of Magellan's fleet, the *Trinidad*, attempted to return to Spain from the Moluccas in 1522 by sailing back across the Pacific. The ship, under the command of Captain Gomez de Espinosa, landed at Ascuncion and the Maug Islands at the northern end of the Mariana chain. Sailing south along the west side of the Marianas, Espinosa recorded 14 islands, which means that he probably did not see Farallon de Medinilla, the smallest and easternmost of the 15 islands in the archipelago (Lévesque 1992: 305-310).

Three sailors deserted from the *Trinidad* while in the Marianas. In 1526 a ship of the Loaysa expedition, the *Santa Maria de la Victoria*, under the command of Alonso de Salazar landed in Guam, where the one surviving deserter, Gonzalo de Vigo, was found. He too would have sailed past all the Mariana islands on his journey from the Maug Islands to Guam. He returned to Spain on the *Santa Maria*. A Portuguese map of the Marianas dating from approximately 1545 shows and names the 14 islands in the Marianas reported by Espinosa (Lévesque 1992: 332-333). Espinosa's names were confirmed by Gonzalo de Vigo.

The first reference to Farallon de Medinilla may be in the accounts of the Villalobos expedition, which reached the Marianas in 1543. On an attempted return to Mexico from the Philippine island of Mindanao, the *San Juan* under Bernard de la Torre reached the northern Marianas before turning around. Accounts state that several islands north of the *Ladrones* (Marianas) were passed. According to Juan Gaytan, one survivor of the voyage, an island was discovered at 16° N latitude. The small island, which they named Abriojos (Keep your eyes open), was almost level with the sea. The description and the location, as Andrew Sharp (1960:29-30) observes, suggest that the island seen was Farallon de Medinilla. Other islands were later seen to the north. The descriptions suggest that these were several of the northern Mariana and Bonin islands.

The next probable reference to the island is on the map of the Mariana Islands by Father Alonso Lopez, one of the early Jesuit missionaries, drawn in 1671 or early 1672. An islet labeled "Rocher" (Rock) is placed on the map in approximately the right location relative to Saipan to suggest that it is Farallon de Medinilla that is being mapped (Lévesque 1995: 382).

In 1742 Anson's ship, the *Centurion*, sailing along the Marianas on its way to Tinian passed too far west of the island to spot it (Barratt 1988:11).

The first unambiguous reference to the island is found in the writings of Corte y Ruano Calderon (1875:39) who says that the island was named by Captain Louis de Freycinet in 1819. The island is however not mentioned in the primary account of Freycinet's voyage written by Arago (1823). This would suggest that the island was not seen on a two week journey that Arago and two others made to Rota and Tinian while their ships were docked in Guam. The island may then have been sighted by Freycinet on the

subsequent voyage from Guam to Hawai'i. Corte says that Freycinet named the island after Don Joseph Medinilla y Pineda who was governor of the Guam while he was there.

According to Corte the island was never used by the Chamorro or by the Spanish. He states (in translation):

> It does not seem possible to make any use whatever of this rock for not even the primitive inhabitants of the Marianas occupied it nor does Padre Sanvitores make mention of it.

Georg Fritz (1989), the German governor of the Marianas in the early 1900s, includes the island in his list of Mariana islands. In contrast to Corte's statements, Fritz in his description says that artifacts had been found on the island. He unfortunately elaborates no further on this statement.

No Japanese maps of the Marianas that show the island are known. A World War II U.S. military map entitled "Enemy Installations in the Western Carolines, the Marianas, and Related Areas" includes the island, but does not show any Japanese military installations on it.

An intensive search of the National Archives and military archives would presumably turn up evidence concerning the use of the island for target practice in the last year of World War II, but the author has not seen any records documenting this use of the island. A 1950 document of the 19th Bomb Wing (Wing Intelligence Office 1950) from the archives at Maxwell AFB mentions the dropping of two bomb bay tanks painted white on the island to provide visible targets. The U.S. military has continued to use Farallon de Medinilla for target practice until the present, resulting in the placement of numerous pick-up trucks on the island as targets and the dispersal of ordnance across the surface of the entire island.

Research Expectations and Design

The environmental and historical information concerning Farallon de Medinilla suggested that it is highly improbable that a permanent population has ever resided on the island. The lack of permanent sources of water most effectively prohibits long-term settlement on the island. In addition, the unprotected exposure of the island to high winds, the difficulty of landing on the island with its steep cliffs, and the general poverty and shallowness of the soil would have made difficult any permanent residence. Only the presence of a single small beach on the leeward side and the presence of a few low-lying wetland areas on the island suggest that any use was possible for the island.

The island did possess some resources which may have attracted temporary visitors. The waters around the island which are placed above a submerged reef platform could be expected to be rich in marine resources; present-day knowledge of the area indicates the presence of numerous species of fish and sharks. These resources may have attracted

Chamorro populations from Saipan or other of the northern Mariana islands. The island is populated today by as many as 18 species of birds and expeditions to the island to hunt for birds or bird eggs might have occurred. In addition the island may have provided a temporary refuge for boats lost at sea or caught in storms between Saipan and the inhabited islands to the north or simply as a stopping off point on a voyage between islands.

While today access to the island's plateau from the ocean is almost impossible, informants on Saipan report that in the past a path led from the beach on the south leeward coast up to the plateau. Thus, while the possibility of long term residence on the island would seem to be precluded unless conditions were very different in the past from those today, the possibility of temporary camp sites or activity areas on the island cannot be ruled out. While none of the early European sailors who visited the northern Marianas report anybody living on or using the island, the German governor Fritz reports that artifacts were found on the island.

On the basis of this information, the possibility of discovering some evidence of past human use of the island could not be completely discounted. The use would have been quite temporary, probably with no one staying on the island for more than a day or two (unless unable to leave), and therefore evidence of such occupation would be expected to be extremely scarce. The recent use of the island as a bombing target might also have resulted in the destruction of some sites.

A survey strategy was therefore developed which involved three steps:

1) a preliminary reconnaissance of the island to obtain first-hand information of conditions, determine the potential for archaeological remains on various parts of the island, and identify areas for priority investigations.

2) more intensive survey of areas that might be expected to have the highest potential for archaeological remains, such as cliff lines, caves or rock shelters in cliff faces, the areas near wetlands, or locations protected from high winds.

3) sample survey of a few selected areas which could be covered intensively using transects.

All these strategies are of course limited by factors of safety, which precludes entry to certain portions of the island to conduct survey because of the danger from unexploded ordnance.

Field Survey

The preliminary reconnaissance survey was conducted by the author on the island on November 5, 1996. Accompanied by EOD specialists and other members of the survey team, a pedestrian survey of portions of the island was conducted over a 6 hour period (see Fig. 1).

The team first covered the area along the east edge of the island following the coastline northward from the helicopter landing zone toward the northern tip of the island. The north end of the island includes some exposed limestone cliffs which rise up to 20 m above the surrounding landscape. Portions of these cliffs were explored and several sheltered areas and small caves were investigated for any possible cultural remains.

The team continued down to the northwest coast where the sea cliff rises only 20 m or so from the sea. The team then proceeded southeastward across the island on the south side of the limestone cliffs. This path passed near one of the wetlands, but the dense and relatively high vegetation dominated by lilies, precluded a careful check of this area. The team returned by this path to the helicopter landing area.

Survey was then conducted along the east edge of the island toward the south, a fairly open area with some areas of exposed red silt soil, others in low grass, and some in lilies. Just south of the middle of the island one transect was made across the island to the west coast. The team then returned to the helicopter zone by approximately the same route.

At this point the threat of an approaching typhoon resulted in the cessation of the survey.

Results and Evaluation

Of the three planned survey steps, only the first, the preliminary reconnaissance was conducted in the time available on the island. No archaeological sites or isolated non-modern artifact finds were recorded during the course of the survey. The only cultural materials observed were numerous pieces of ordnance, several pick-up trucks, and a collapsed tower near the north end of the island.

All items relate to the use of the island as a bombing target by the U.S. military since the last year of World War II. None of these remains constitute significant historic resources. Except for the first targets placed on the island (and what these may be and whether still extant is unknown), all are less than 50 years old and therefore not eligible for the National Register of Historic Places. Neither do any possess integrity of place nor are they of any value for research purposes.

Recommendations

While the preliminary reconnaissance survey failed to turn up any evidence of prehistoric or early historic human activity on the island, the extent of the survey was far too limited to confirm that such evidence is not present or very unlikely to be present. The expected scarcity of any archaeological remains necessitates a more intensive survey to confirm their presence or absence and the past and potential future impacts of the military use of the island.

The second two steps of the proposed survey would need to be completed to draw reasonably well-supported conclusions concerning past human use of the island. First, areas with the best potential to contain cultural materials, such as the cliff faces at the north end of the island, would need to be explored in more depth. Second one or two areas elsewhere on the island that would be considered safe and representative of the island should be subject to more intensive transect survey to provide a sample from which inferences could be more safely drawn concerning the presence or absence of cultural remains. Without this information, it is difficult to evaluate the probability that the island was used in the past, whether any cultural remains are still present, and what impact military training on the island has had and may continue to have on the island's cultural resource base. It is estimated that approximately two days of survey would be required to complete this work. A third day would be required only in the unlikely event that a significant site requiring detailed recording is found.

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Appendix N

Revised Prefinal Military Exercises and Historic Sites in Military Training Areas on the Island of Guam: An Archaeological Assessment

— revised prefinal —

MILITARY EXERCISES AND HISTORIC SITES IN MILITARY TRAINING AREAS ON THE ISLAND OF GUAM: AN ARCHAEOLOGICAL ASSESSMENT

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December 1996

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ACKNOWLEDGMENTS

We would like to thank Ms. Amy Sheridan, Mr. David Stefansson, Mr. John Goody, and Ms. Vanessa Kawamura of Belt Collins Hawaii for discussions of the planned military training activities on the island and keeping us up-to-date on the planning proposals.

We are very grateful to Mr. David DeFant for providing preliminary information on the findings of the PHRI survey at the Ordnance Annex prior to the submittal of the prefinal report, assisting us in the early planning of protection measures for the survey area. Ms. Annie Griffin, NAVFACENGCOM archaeologist, assisted our work in a number of ways, discussing site protection concerns and providing copies of the necessary reports and advance copies of certain essential maps and letter reports.

Mr. Richard Davis, Guam Historic Preservation Officer, shared us with his concerns regarding site protection and military exercises. Ms. Annie Flores and Mr. Victor Torres provided the guidance we needed in searching the HPO files for information on recorded sites.

We are especially appreciative of the efforts of the base resource managers who willingly took a great of their time to assist us in the field assessments on Guam. Mr. Jennings Bunn, cultural resource manager for NAVACTS, arranged our field visit to the Ordnance Annex and accompanied us on our visits to Orote Peninsula and the Ordnance Annex, and discussed his views and those of the Navy on several of the management issues in regard to the sites on NAVACTS installations. Ms. Heidi Hirsh, natural and cultural resource manager at Andersen AFB, and LT Eric Waters, environmental engineer, also assisted us with obtaining permission to visit restricted areas, accompanied us on site visits to Tarague and Northwest Field, and shared their insights into the site protection needs at the air base.

Mr. Roger Blankfein and Ms. Judith R. McNeill prepared the maps used in this report.

EXECUTIVE SUMMARY

The present document is an archaeological assessment of proposed training areas on the island of Guam related to the development of an Environmental Impact Statement for military training.

The training areas are located on the U.S. Naval Activities (NAVACTS) Guam Waterfront Annex (formerly Naval Station Apra Harbor Complex), NAVACTS Guam Ordnance Annex (formerly Naval Magazine), Naval Computer and Telecommunications Area Master Station (NCTAMS) WESTPAC Finnegayan and Barrigada sections, and Andersen Air Force Base (including Andersen South). Many of the proposed training areas have been covered by archaeological surveys, but of varying levels of intensity; however several of the areas have never been surveyed. Archaeological sites on the bases have been summarized in several draft overview survey reports and prefinal cultural resource management plans.

The results of the various archaeological surveys are summarized, the archaeological site inventory for all the installations is listed, and the significance of those sites which have been given a recommended evaluation following the surveys or during the preparation of the management plans is presented in the site table. Sites which have been placed on the National Register and Guam Register of Historic Places are identified. The definition of site and the means by which sites are organized varies from survey to survey. Duplicate site designations are eliminated where possible, but no attempt has been made to redefine sites in a manner that would make the inventory consistent.

There are 374 archaeological sites in the inventory for these bases, of which 253 have been evaluated as eligible for the National Register. Eight sites are listed on the National Register, and these and nine additional sites are on the Guam Register. These sites range from prehistoric ceramic scatters to ruins of World War II structures, and reflect many of the significant events and characteristics of the island's history. These sites include the largest cluster of *latte* sets recorded on Guam, numerous coastal and inland *latte* sets, caves with prehistoric artifacts and art, and World War II Japanese bunkers and defensive caves.

In order to avoid or mitigate the potential impacts of military training on sites eligible for the National Register, a set of protective measures is recommended. These measures include the evaluation of training areas in terms of their archaeological sensitivity related to potential impacts, with suggested constraints for each area. These potential adverse impacts to sites in each of the training areas are discussed and measures to protect significant sites recommended.

INTRODUCTION

Purpose

The present document is an assessment of the historic resources (archaeological sites and historic structures) in proposed training areas on the military bases on the island of Guam, prepared as a background document for the Environmental Impact Statement developed for military training in these areas. The areas of concern are located on the U.S. Naval Activities (NAVACTS) Guam Waterfront Annex (formerly Naval Station Apra Harbor Complex), NAVACTS Guam Ordnance Annex (formerly Naval Magazine), Naval Computer and Telecommunications Area Master Station (NCTAMS) WESTPAC Finnegayan and Barrigada sections, and Andersen Air Force Base (including Andersen South) (Fig. 1).

Preparation of this assessment has been based on information derived from existing survey reports, overview survey reports, draft and final cultural resource management plans, and consultation with archaeological contractors conducting surveys in proposed training areas. These include consultations with Paul H. Rosendahl, Inc. (PHRI) concerning archaeological survey in the southern portion of the Ordnance Annex (D. DeFant, pers. com.), and with International Archaeology, Inc. (IAI) archaeologists concerning the archaeological portion of Tarague Embayment Legacy survey (J. Liston and R. Olmo, pers. com.). In addition, International Archaeological Research Institute, Inc. (IARII) archaeologists undertook a one week in-field assessment of selected sites and training areas on the military bases on Guam and consultation with the Guam Historic Preservation Officer (GHPO) and base cultural resources managers.

The Undertaking and the Area of Potential Effect

Military training on Guam may involve Guam-based elements of the US Navy, US Air Force, US Army Reserve-Marianas, Guam Army National Guard, and Guam Air National Guard (Belt Collins Hawaii 1996). The following summarizes the proposed training exercises on each of the military bases.

The exercises proposed for NAVACTS Guam Ordnance Annex are the use of a sniper range, a land navigation course, small unit patrolling, bivouacs, field exercises, parachute drops, military police security training, and helicopter landing and rappelling. Areas to be used in training include strips of land in the northeast section and the northwest section, and a large portion of the south part of the annex (Belt Collins Hawaii 1996: 20, Figure 3).

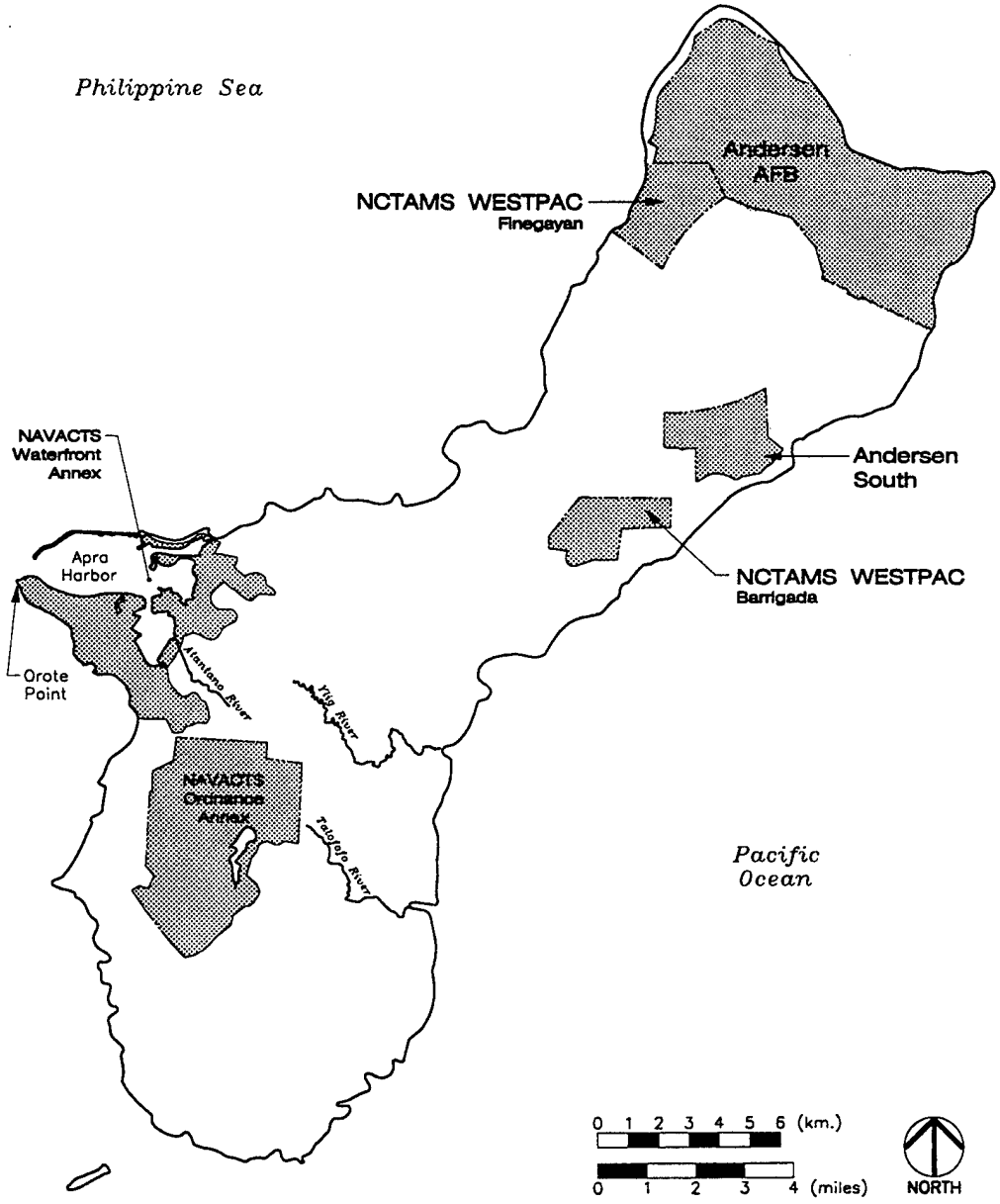


Figure 1. Map of Military Base Areas Included in this Study.

The exercises proposed for NAVACTS Guam Waterfront Annex at Apra Harbor include both activities in the harbor itself and land based activities on Orote Peninsula. Proposed Apra Harbor exercises are combat swimmer training, limited charge surface and underwater demolition training, water parachute drops, helicopter swimmer insertions and recovery, riverine training, and assault craft landings. On Orote Peninsula proposed training consists of small arms fire and maneuver and sniper training at the existing rifle and pistol ranges and shooting house, unit bivouacs, nuclear, chemical, and biological (NBC) gas mask training, helicopter and fixed-wing personnel and cargo parachute operations on the old runway, and combat swimmer insertions from the harbor (Belt Collins Hawaii 1996: 20-21, Figure 4).

At Andersen AFB the proposed exercises are aviation training, airfield security exercises, TRUE training, NBC training, helicopter-operations, and parachute drops. The main airfield at Andersen AFB will also be used as a staging area for assembly of troops and equipment for large joint-service exercises in the Marianas region. In the Northwest Field area small unit bivouacs and maneuvers, land navigation, C-130 aircraft flight crew training, and parachute operations are proposed. On the Tarague coastal plain swimmer insertions are planned along with continued use of the firearms range and the EOD range (Belt Collins Hawaii 1996: 21, Figure 5).

The southern portion of Andersen South is proposed as the location for bivouacs, land navigation, field maneuvers, and defensive tactics (blank fire only) (Belt Collins Hawaii 1996: 21, Figure 5).

Proposed training at NCTAMS Finegayan will be mainly restricted to the coastal plain along the west coast below the cliff line. Exercises proposed are swimmer insertions at Haputo and Double Reef Beaches and overland maneuvers along the coastal strip to Andersen AFB Northwest Field. The small arms range will be used for pistol and rifle firing. At NCTAMS Barrigada, small unit bivouac and maneuvers are proposed, but no specific training area has been defined (Belt Collins Hawaii 1996: 21, Figure 5).

Research and Consultation Activities

Preparation of this document has been based on a review by Judith McNeill, project director, of the five draft overview survey reports prepared by Ogden for military bases on Guam (Craib and Yoklavich 1992a,b,c,d, Yoklavich and Craib 1992) and one prefinal overview survey report (Craib and Yoklavich 1996), the draft Cultural Resource Management Plan (CRMP) for Andersen AFB (Schilz 1996), the draft CRMP for NAVACTS Waterfront Annex (Naval Station Apra Harbor Complex) (Lauter-Reinman 1995), and the draft management plan for World War II Resources (Lauter-Reinman 1994). Several archaeological survey reports were also reviewed.

Between March 23 and 31 and on April 16, 1996 IARII archaeologists, David Welch, principal investigator, and McNeill conducted inspections of proposed military

training areas and associated archaeological sites on Guam. Welch conducted an inspection of Orote Peninsula (closed in March) on August 9, 1996. In addition to the field inspections, consultations were held with Richard Davis, Guam Historic Preservation Officer, Jennings Bunn, NAVACTS cultural resources manager, Heidi Hirsh, cultural and natural resources manager for Andersen AFB, and LT Eric Waters, Andersen AFB environmental engineer. IARII archaeologists also met with David DeFant, PHRI Guam projects manager, to discuss the PHRI survey of the southern portion of the NAVACTS Ordnance Annex.

Field inspections were conducted at NAVACTS Waterfront Annex and the Ordnance Annex, at NCTAMS, and at Andersen AFB. Mr. Bunn assisted with the NAVACTS inspections, accompanying the archaeologists on the tour of the Ordnance Annex and portions of Apra Harbor and discussing areas of concern from his point of view. Ms. Hirsh and LT Waters assisted with the Andersen AFB inspections. Certain areas could not be inspected. These included southern portions of the Ordnance Annex because of the difficulties of access and the Gab Gab Beach area on Orote Peninsula (closed for ammunition unloading throughout the entire fieldwork period).

In addition to the site inspections, literature reviews were conducted at the IARII Guam office, the NAVACTS Cultural Resources Management office, and the Guam Historic Preservation Office. Site files at the GHPO were checked to collect site information not included in the overview survey reports and CRMPs and to reconcile discrepancies in site numbering within and between reports. The site inventory list was checked and copies of the lists of Guam Register sites and site reports were obtained.

During a meeting with Richard Davis, HPO, the following concerns were raised:

1. NAVACTS Waterfront Annex: The HPO and COMNAVMARIANAS disagree on the significance of Orote Airfield. However the Airfield has been placed on the National Register. Therefore the HPO is treating it as a significant site and will be concerned about any potential impacts to the airfield from training exercises. The HPO accepts that a redefinition of boundaries is in order.

2. NAVACTS Ordnance Annex. The PHRI survey has discovered what appears to be the largest and best preserved *latte* set on Guam, associated with several other potentially significant sites. Any training in this area will require careful evaluation.

3. NCTAMS. While the Seal landings at Haputo Beach in the vicinity of a major *latte* complex are an ongoing activity, the potential effects of these activities have never been evaluated.

4. Andersen AFB. Northwest Field has been evaluated as significant in the Ogden CRMP. Previously the National Park Service had determined it eligible for

nomination as a National Historic Landmark and prepared a National Register nomination form for the site. The HPO reviewed the nomination and concluded that the significance evaluation was not adequately justified. The form was never revised, and the status of the field remains a question that needs resolution. If the field is considered a significant site, then rapid runway repair training might not be an acceptable training activity at the airfield.

5. Andersen AFB. The Explosive Ordnance Disposal (EOD) Range includes burials and significant cultural resources. Activities, as stated in a letter to Roy Tsutsui, Andersen AFB, dated 6 March 1995, will have no effect as long as they are restricted to approved locations and follow agreed upon procedures. Any changes will require a new assessment of potential effects.

HISTORIC RESOURCES INVENTORY AND SIGNIFICANCE EVALUATIONS

Archaeological Research on Guam Installations

Reviews of previous archaeological research on Guam's military bases and summaries of the historic resources are included in the series of cultural resource management overview survey reports prepared by Ogden Environmental and Energy Services Co. in 1992. In addition, historic resources and evaluations of their significance are presented in the cultural resource management plans prepared by Ogden for NAVACTS Waterfront Annex and Andersen AFB and in the management plan for World War II resources on Guam.

The location of archaeological surveys conducted on Guam military bases is shown on Figures 2 through 4. These maps do not include several of the earliest surveys, which tended to be general surveys and not confined to particular bounded survey areas. In any event most of the pre-1970 reports do not include maps showing areas of survey coverage. Also, Spencer Mason Architects has completed inventories of the historic buildings on all the military installations on Guam, but these are not shown on the map, since the surveys were not confined to specific bounded areas. The following section discusses the surveys conducted on each installation, the level of coverage, the approximate area covered in the survey, and the primary results.

Previous Archaeological Surveys

Hornbostel surveyed and conducted excavations in several areas now under military jurisdiction including Andersen AFB and NAVACTS Ordnance Annex (Thompson 1932). However it is not possible to systematically map the survey coverage for the present project. Other early work includes the coastal surveys of Osborne (1947) and Reinman (1977), which found numerous coastal prehistoric sites, generally with *latte*.

More recently, Shun (1988) surveyed 7 acres in the NAVACTS Ordnance Annex in a disturbed area along Norton Road. He identified no sites, but did encounter isolated surface finds of prehistoric ceramics. Four very small parcels, totaling 0.8 acres, were surveyed in the north central portion of the Ordnance Annex by IARII (Tuggle 1993). No sites and no cultural materials were encountered. Craib conducted two surveys in the Ordnance Annex. The first (Craib 1993) included three parcels with a total area of 35 acres of hilly grasslands near the northern boundary. The survey team identified several surface artifact scatters. A second survey (Craib and Nees 1995) of 310 acres distributed among five parcels located 41 *latte* sites and two rockshelters. PHRI recently completed survey in the southern one-third of

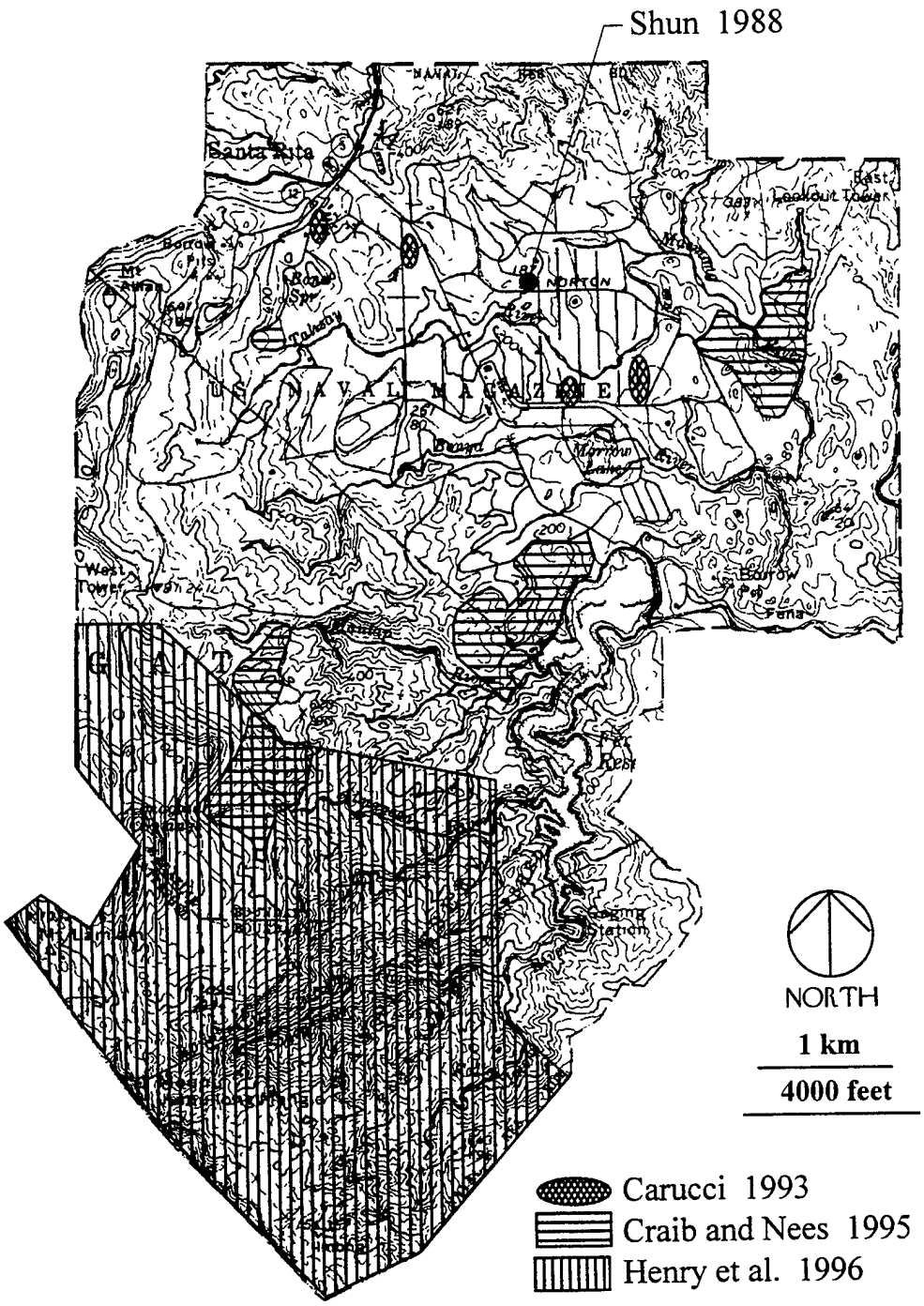


Figure 2. Location of Archaeological Surveys at NAVACTS Ordnance Annex.

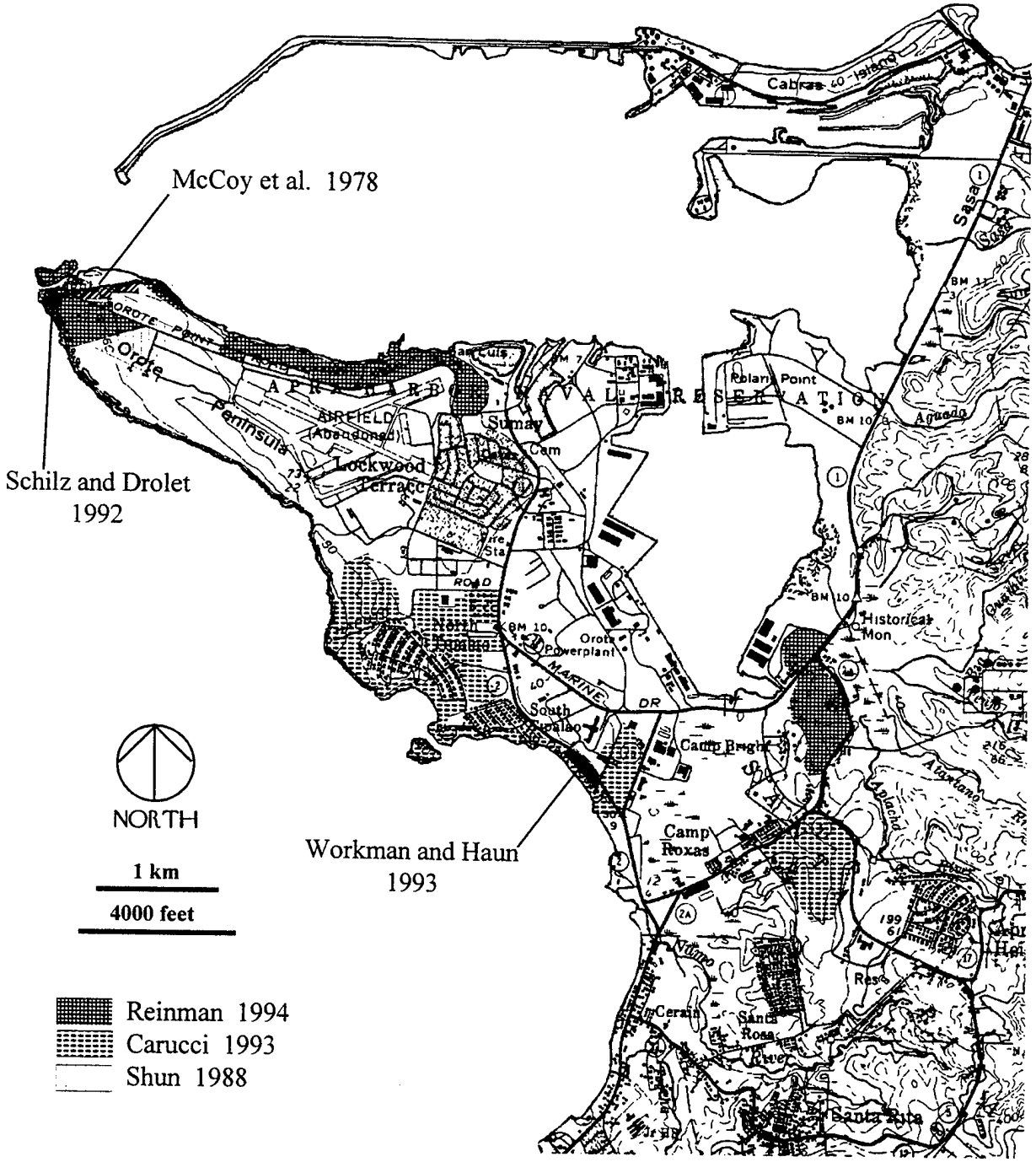


Figure 3. Location of Archaeological Surveys at NAVACTS Waterfront Annex.

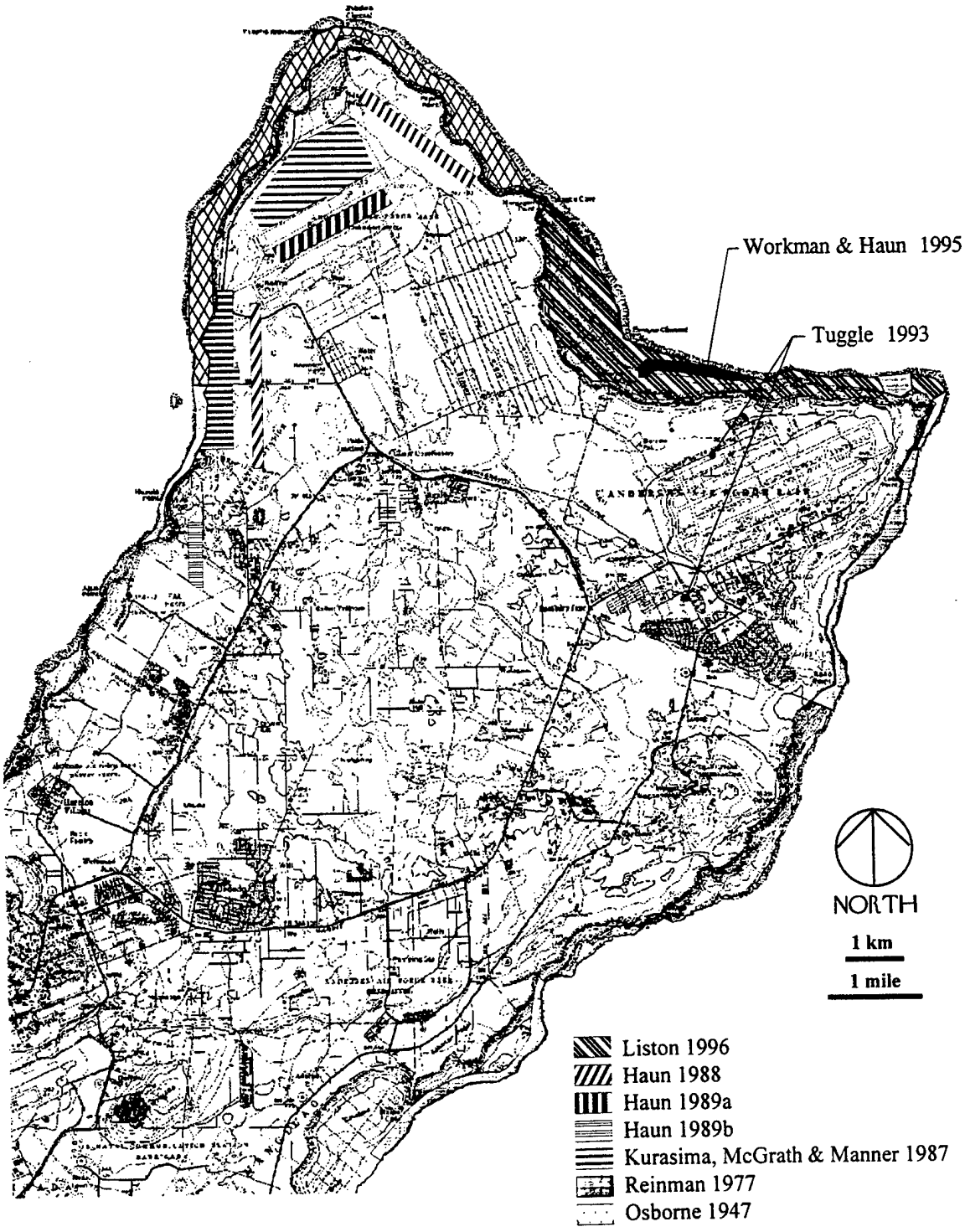


Figure 4. Location of Archaeological Surveys at Andersen AFB and NCTAMS.

the Ordnance Annex, identifying 122 sites, of which 114 are prehistoric sites. Among these are 48 *latte* sites, including one of the largest *latte* complexes yet identified on Guam (Henry et al. 1996).

Within the boundaries of the Waterfront Annex, in 1978, a Bishop Museum survey at the western end of Orote Peninsula identified nine surface pottery scatters and one previously recorded rockshelter site (McCoy, Price, and Craig 1978). IARII's survey (Shun 1988), also toward the western end of the peninsula, produced 8 sites from the Japanese and World War II periods within a generally disturbed 71 acre area. Near the tip of the peninsula in a 2 acre parcel, Schilz and Drolet (1992) identified historic period features only. Another small parcel, 3 acres between Shoreline Drive and Dadi Beach, produced 30 post World War II features (Workman and Haun 1993). Two larger scale surveys have been conducted, one by Ogden and one by IARII. The IARII survey (Carucci 1993) covered 250 acres, in several parcels south of Marine Drive. Thirty sites and 18 potential sites, both prehistoric and WWII era, were recorded. Ogden (Reinman 1994) surveyed several areas including Orote Island, Gab Gab Beach, and San Luis Point totaling 540 acres. The work yielded 39 new features and relocated 10 known sites, most of which are from the WWII era.

At Andersen AFB University of Guam and Bishop Museum (Kurashina, McGrath and Manner 1987) surveyed 900 acres in two parcels near Urano Point and Falcona Beach. They identified 14 surface prehistoric pottery scatters, but found no associated buried deposits or surface structures. Additional survey conducted in the Northwest Field area of Andersen by PHRI (Haun 1988, 1989a) included 3 parcels totaling 600 acres. Six surface prehistoric pottery scatters and two isolated sherds were recorded on Andersen AFB property. In addition to field surveys, extensive archival documentary research, primarily of World War II documents, has been carried out by PHRI in regard to Northwest Field (Dili and Haun 1991).

Tuggle (1993) reported finding no sites during survey of 8.3 acres in the maintenance hanger and fuel storage tank areas of North Field. Two survey projects have recently been conducted in the Tarague area of Andersen AFB. Work in a long narrow parcel of 7.5 acres along the EOD access road produced one feature and several surface ceramic scatters as well as evidence of buried cultural deposits (Workman and Haun 1995). International Archaeology, Inc. (IAI) has recently conducted survey of a 950 acre parcel in the Tarague embayment. Within the survey area, 140 sites with surface features and artifact scatters were recorded (Liston 1996).

Kurashina, McGrath and Manner's (1987) survey areas 2 and 2A extended into NCTAMS were an additional 3 prehistoric pottery scatters were identified. A portion of one of the PHRI Andersen AFB survey areas also extended into NCTAMS (Haun 1988). Two prehistoric pottery scatters, one with subsurface materials, and an isolated *Tridacna* adze fragment were identified on the NCTAMS property. As part of the same overall project, PHRI (Haun 1989a) surveyed a ca 200 acre area that extended from NCTAMS into the adjoining FAA property to the southwest. They found only a single site, a prehistoric pottery scatter located in the NCTAMS portion of the survey area.

Except for research for the Andersen AFB CRMP, no archaeological surveys have been conducted of Andersen South.

Archaeological Sites on Guam Military Bases

Appendix A lists the sites recorded on the military installations on Guam which will be involved in the training exercises. Sites are ordered by location, with the sites from each installation grouped together. The location is indicated in column 2. The table lists the common name by which each site is referred to, a brief description of the site, and the exact or approximate age of the site.

Because of variation in the way researchers have identified and grouped sites, it is difficult to precisely enumerate the total number of sites on most of the bases. What is counted as one site with several features in one report may be broken down into several sites in another report. In several cases differences in the description or the indicated location between one report and another make it impossible to be certain if two descriptions refer to a single site or to two separate sites. In some cases a second survey team in a survey area has been unable to relocate sites identified in a previous survey.

Site numbering poses a number of problems and conflicts. A few sites, primarily those listed on the National or Guam Registers, have permanent GHPO site numbers (these are found in column 3 of the table). However most sites are identified only by the temporary numbers used in particular reports. It is common for each new survey to assign new (temporary) numbers to sites that have already been assigned (temporary) numbers by previous researchers. Single sites may have two or three temporary numbers. Even when permanent GHPO site numbers are assigned to sites, the temporary numbers are sometimes still used in subsequent reports. Thus combining the reported sites into a single list using the temporary site numbers assigned by the various researchers can result in a great deal of confusion in site labeling.

Because most researchers begin their temporary series with "1" and number sites in order, there is a great deal of repetition of these temporary numbers. The overview survey reports in general did not refer to sites by number, but simply by name. Each Cultural Resource Management Plan numbered the sites included in the plan with a new set of numbers beginning with 1. Even though the CRMPs may contain descriptions and references to the same site, that site will have been assigned a different reference number in each report.

While assigning new temporary site numbers for this report may seem to be simply repeating the same mistake and compounding the confusion, we see little choice in order to maintain clarity in this report. Therefore each site covered in this assessment is assigned a unique number starting with "1" for purposes of this report. This is the number listed in column 1 of the Appendix A table and is the number used to identify sites on the site maps. Column 8 lists the numbers used for sites in previous reports; a number listed in column 8 is the number for the site used in the reference cited on the same line in column 7.

Significance Assessments

Archaeological sites are evaluated for significance in terms of their ability to meet the criteria of eligibility for nomination to the National Register of Historic Places (NR). To be considered eligible sites must possess integrity and meet at least one of following four criteria of historic value:

A: The site is associated with events that have made a significant contribution to the broad patterns of our history.

B: The site is associated with the lives of persons significant in our past.

C: The site embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.

D: The site has yielded, or may be likely to yield, information important in prehistory or history.

Significance evaluations as determined during previous surveys or during the preparation of the overview surveys and CRMPs are listed in Appendix A column 9. Column 9 also lists the criterion of significance where this is included in the report. For historic buildings, the Navy National Register Resource Treatment Category is also listed in this column. Comments in column 10 are those of the researchers making the evaluations. No attempt is made in this report to resolve the contradictions between reports in the significance assessments of some sites. Columns 11 and 12 note those eligible sites which have been placed on the National Register of Historic Places (NR) and the Guam Register of Historic Places (GR).

The National Park Service at one point prepared a nomination form to designate Northwest Field at Andersen AFB as a National Historic Landmark. This however was never approved. The Air Force now intends to nominate Northwest Field for the National Register (Hirsh, personal communication).

There are eight sites on the Guam military bases considered in this report that are listed on the NR. All these sites plus an additional nine sites are listed on the GR. NAVACTS Waterfront Annex includes 7 NR sites plus 3 GR sites, while the Ordnance Annex includes only 1 GR site. Andersen AFB possesses 2 NR sites and 5 GR sites, and NCTAMS Finegayan contains 1 NR site.

Archaeological Sites at NAVACTS Ordnance Annex

Prior to this past year's PHRI survey of the southern portion of the Ordnance Annex, 21 sites (counting those sites that form complexes as a single site) had been identified on the base. These are listed in Appendix A and their locations shown in Figure 5. Most of these

are historic sites dating to World War II and associated with the U.S. military build-up on Guam in the last year of the war. Seven of the U.S. World War II military structures have been determined eligible to the National Register. One structure, the Maanot Water Reservoir, dates to before World War II; its eligibility to the National Register remains undetermined, pending further study.

In the 1992 overview survey eight site complexes were reported to include prehistoric remains or to have a high potential (e.g. cave sites) for possessing prehistoric remains. At that time three sites were reported to have been destroyed; three others could not be relocated and the information concerning them was minimal. A survey in 1994 (Craib and Nees 1995) relocated all six of these sites, plus evidence of a *latte* site with an associated artifact scatter and three caves/rockshelters at Maemong, one of the potential site complexes. The survey also found portions of three surviving *latte* at San Isidro, another previously reported site believed to have been destroyed. All these complexes include *latte* sites, containing 1 to 13 *latte* sets. The Alifan Ridge Complex in the northwest corner of the Annex was not surveyed; it includes caves which are reported to contain prehistoric deposits as well as Japanese military artifacts and features.

One of the prehistoric sites, the West Bonya Complex (Site 30) with 7 *latte* sets has been determined eligible for the NR and has also been placed, combined with the East Bonya Complex (Site 29), consisting of 6 *latte*, under a single site number (2-0145), on the GR. In total, there were seven to nine prehistoric site complexes reported prior to the PHRI survey, depending on whether one divides the Laquet and Bonya complexes into two separate complexes.

The survey conducted by PHRI (Henry et al. 1996) has resulted in the identification of 122 sites in the southern portion of the Ordnance Annex. The vast majority of these, 114 in all, are prehistoric sites; 48 of these sites include a *latte* set or sets. Only 7 historic sites, mostly artifact scatters, were found during the survey, although 18 prehistoric sites also include a historic component, and one modern structure was recorded. Other common site types were overhangs, caves, and artifact scatters. All sites are evaluated as eligible for the National Register under Criterion D because of their information content. In addition, two cave sites containing pictographs are also significant under Criterion C and culturally significant. One other site, a set of prehistoric chiseled steps, is assessed as significant under Criterion C as a unique site type.

Archaeological Sites at NAVACTS Waterfront Annex

The Apra Harbor Waterfront Annex contains the largest number of previously reported sites of the bases being investigated. In part this reflects a greater intensity of survey in this area. Recent intensive surveys at the Ordnance Annex and Andersen AFB have resulted in a great increase in the number of sites on these installations. Recorded sites at the Waterfront Annex are indicated in Appendix A. Sites that are listed on the National Register

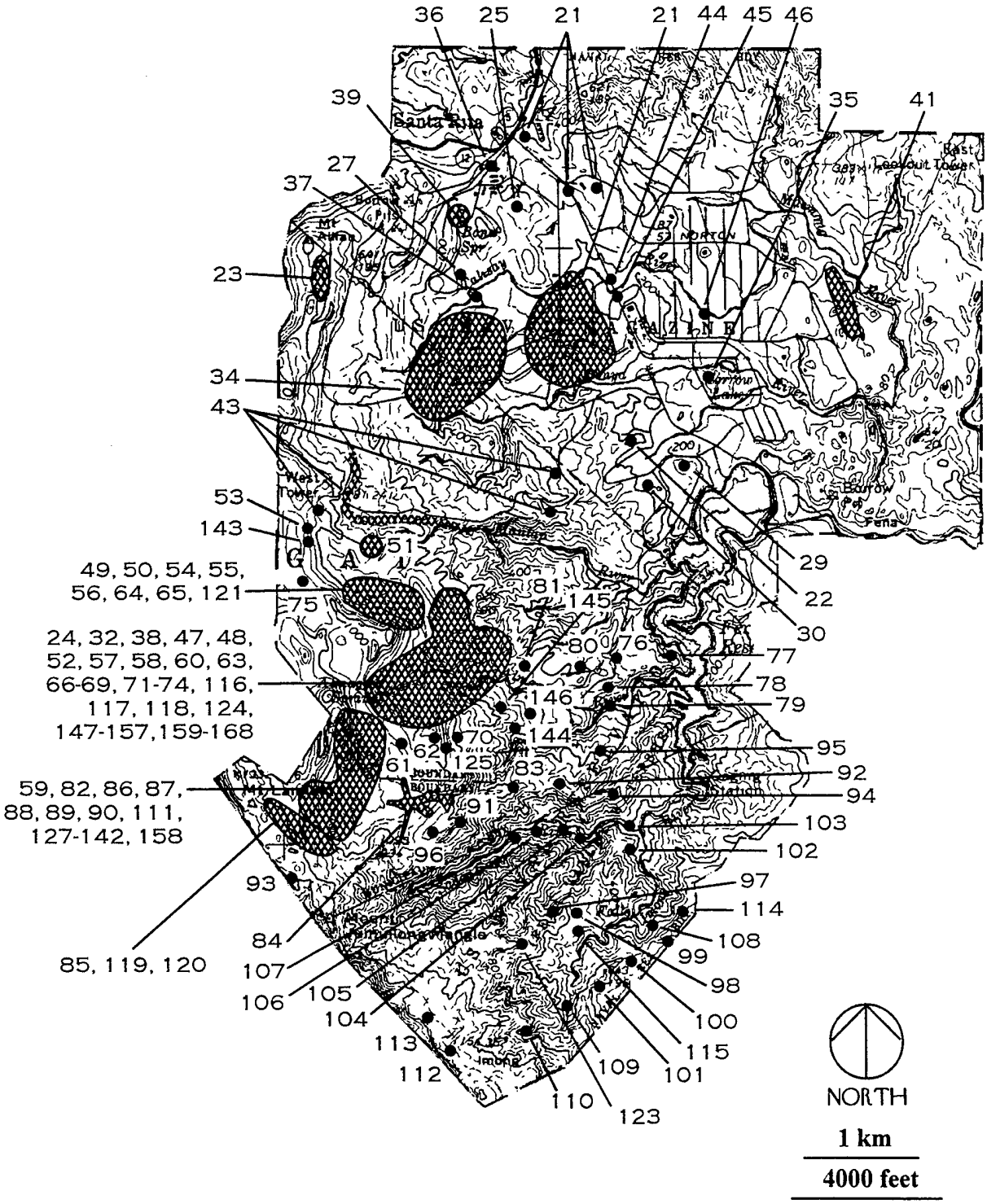


Figure 5. Archaeological Sites at NAVACTS Ordnance Annex.

or on the Guam Register or that have been assigned a GHPO site number, all submerged vessels, and all sites that have been evaluated as eligible to the National Register are shown in Figure 6. These include approximately 70 of the 198 sites at Apra Harbor, of which six are listed on the NR and nine on the GR. Reference should be made to the cultural resource management maps in the Apra Harbor CRMP for locations of all sites.

There are several areas of site concentrations which have been proposed as historic districts in the CRMP. The Sumay Historic District would include the archaeological remains of the former village of Sumay, GHPO Site 3-1038 (Site 319), the Sumay Cemetery, GHPO Site 3-1041 (Site 318), as well as GHPO Site 3-1043, the Pan Am cable station (Site 194), hotel (Site 269) (GHPO Site 3-1042), and seaplane landing ramp remains. The cable station is listed on the National Register; it and the cemetery and hotel are listed on the Guam Register. In the general vicinity of this district are a number of World War II Japanese sites: a mass grave site, GHPO Site 3-1092 (Site 250), cave sites, POW steps, and an anti-aircraft gun. There are also several Quonset huts dating to US military re-occupation of Guam found to the east of Sumay in the Ship Repair Facility; and a Quonset hut, office and shop buildings, and a former outdoor theater to the south.

A second concentration of sites is found at the end of Orote Peninsula. Both the prehistoric and historic features here have been grouped together as GHPO Site 3-1009, the Orote Historic Complex (Site 265). This complex consists of the Spanish steps, the Spanish well, a cave with midden and artifacts, and pottery scatters. The Orote Historic Complex is listed on the Guam and National Registers. Several U.S. and Japanese military defensive features are also found along the cliffline on the peninsula. The Gab Gab Beach area on the north coast of the peninsula may contain prehistoric deposits (Site 229) as well as two Japanese defensive structures (Site 227). Also, on the peninsula, GHPO Site 3-1066, Orote Airfield (Site 264), built by the Japanese during World War II, is listed on the NR and GR.

Outer Apra Harbor contains the remains of at least 27 sunken vessels, most of them dating to World War II. Those include four vessels which have been evaluated as significant historical resources: the Kitsugawa Maru (GHPO Site 3-1154, Site 355), the Tokai Maru (GHPO Site 3-1089, Site 359), the Nichiyu Maru (GHPO Site 3-1155, Site 356), and the SMS Comoran (3-1037, Site 358). The Tokai Maru is listed on the NR and the GR and the SMS Cormoran on the GR. The other submerged vessels have not been evaluated.

Finally, ten significant sites are located along the Dadi Beach coastline. These include GHPO Site 2-1302, a prehistoric rockshelter (Site 278), five Japanese World War II defensive caves, GHPO Site (Sites 243-247), three Japanese bunkers, GHPO Sites 2-1303 and 1301 (Sites 237 and 238), and GHPO Site 2-1300, the remains Camp Bright (Site 306), an American WWII camp.

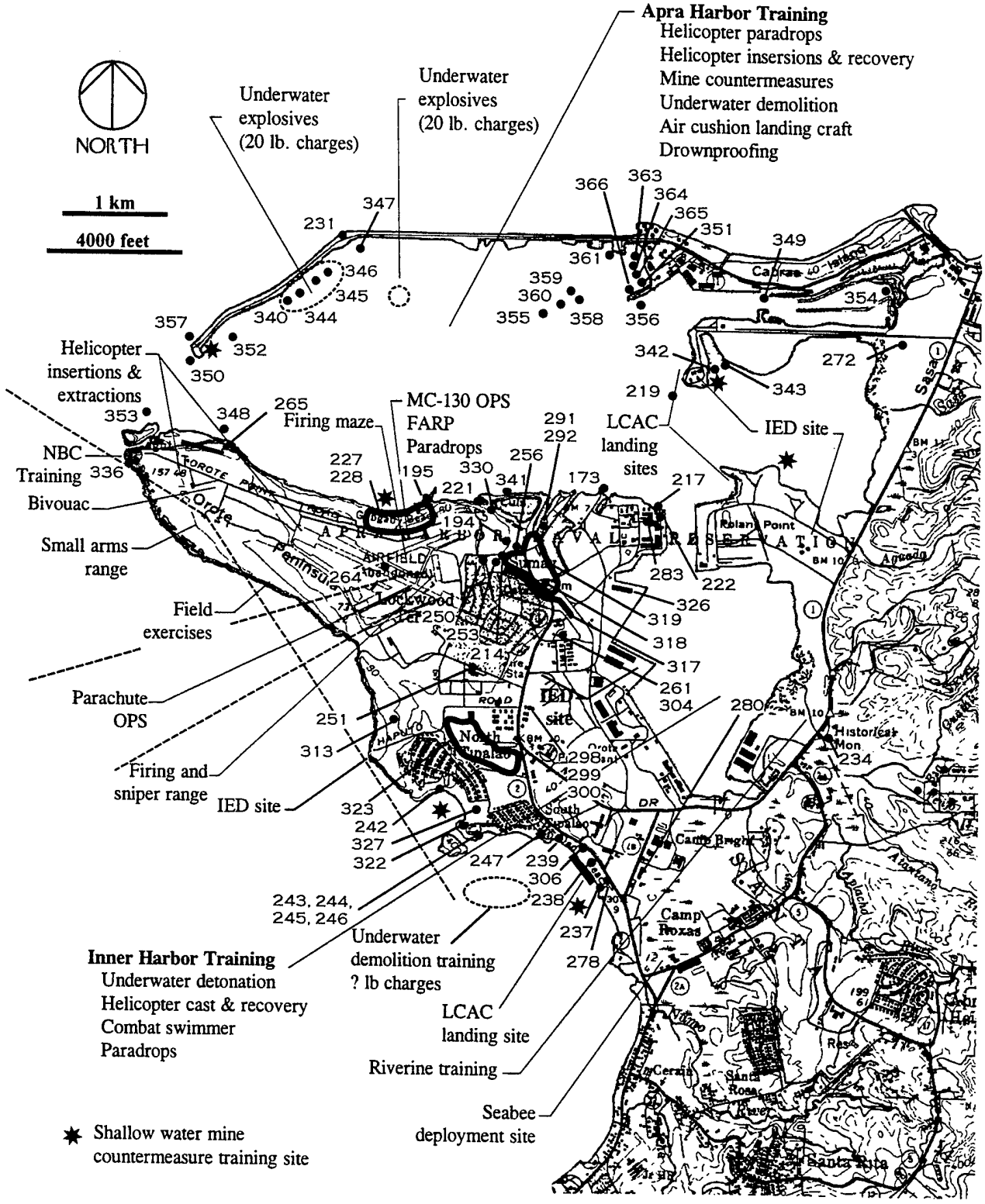


Figure 6. Selected Archaeological Sites at NAVACTS Waterfront Annex.

Other sites, mostly historic military sites, both Japanese and American World War II sites, are scattered throughout the base. These include structures, concrete structure foundations, bunkers, caves, gun positions, and aircraft remains. Some are consider eligible to the NR; others are not. The remaining site listed on the GR, GHPO Site 3-1088, is the Japanese submarine (Site 251), which is on display in the Lockwood area.

Archaeological Sites at Andersen AFB

The Andersen AFB CRMP lists nine prehistoric sites and nine historical sites on the main base (Schilz 1996). These are identified in Appendix A and located on Figure 7. The majority of sites are located on the coastal plains directly behind the beaches and below the steep cliffs which characterize most of the coast. Almost all of these sites are complexes consisting of several latte sets, pottery scatters, and associated cultural deposits. All have been determined eligible for the National Register, except for the Lafac pottery scatter, for which no determination has been made.

Kurashina, McGrath and Manner identified 14 sites. Five sites were found within survey area 1/1A to the north of the Northwest Field runway area. The area appears to have been extensively modified, but there are remnant areas of the original limestone forest. Sites 398 to 401 and 409 are all surface finds of prehistoric pottery sherds. Small test excavations were conducted at each locality, but no subsurface materials were encountered. The northern half of survey area 2/2A lies with Andersen AFB property. Survey area 2/2A is predominately pristine limestone forest, with little evidence of disturbance. No surface structures were encountered, however 10 additional surface scatters of prehistoric pottery were identified (Sites 402 to 411). These scatters vary in area from approximately 16 to 1200 m^2 and produced as few as 1 to over 30 sherds at a single locality. Subsurface testing, conducted at most localities, failed to produce subsurface cultural materials.

PHRI (1988, 1989a) surveyed three areas on Andersen AFB property. In the P-002 survey area near Ritidian Point, they identified two 10-15 m in diameter surface scatters of prehistoric pottery, with sherd densities of 3-6 sherds per m^2. Survey of the P-223 project area, located within Northwest Field, failed to identify any prehistoric archaeological sites, but did note various historic remains and structures. The P-225 survey area overlaps Andersen AFB and NCTAMS properties. Sites 383 through 389 were identified in the Andersen portion. All of the sites are surface finds of prehistoric pottery. One site, Site 386, also produced a *Tridacna* adze fragment. Subsurface materials were encountered at two of the sites.

None of the sites identified by Kurashina, McGrath, and Manner or the PHRI surveys are included in the Andersen AFB CRMP. No significant evaluations were included in the original survey documents.

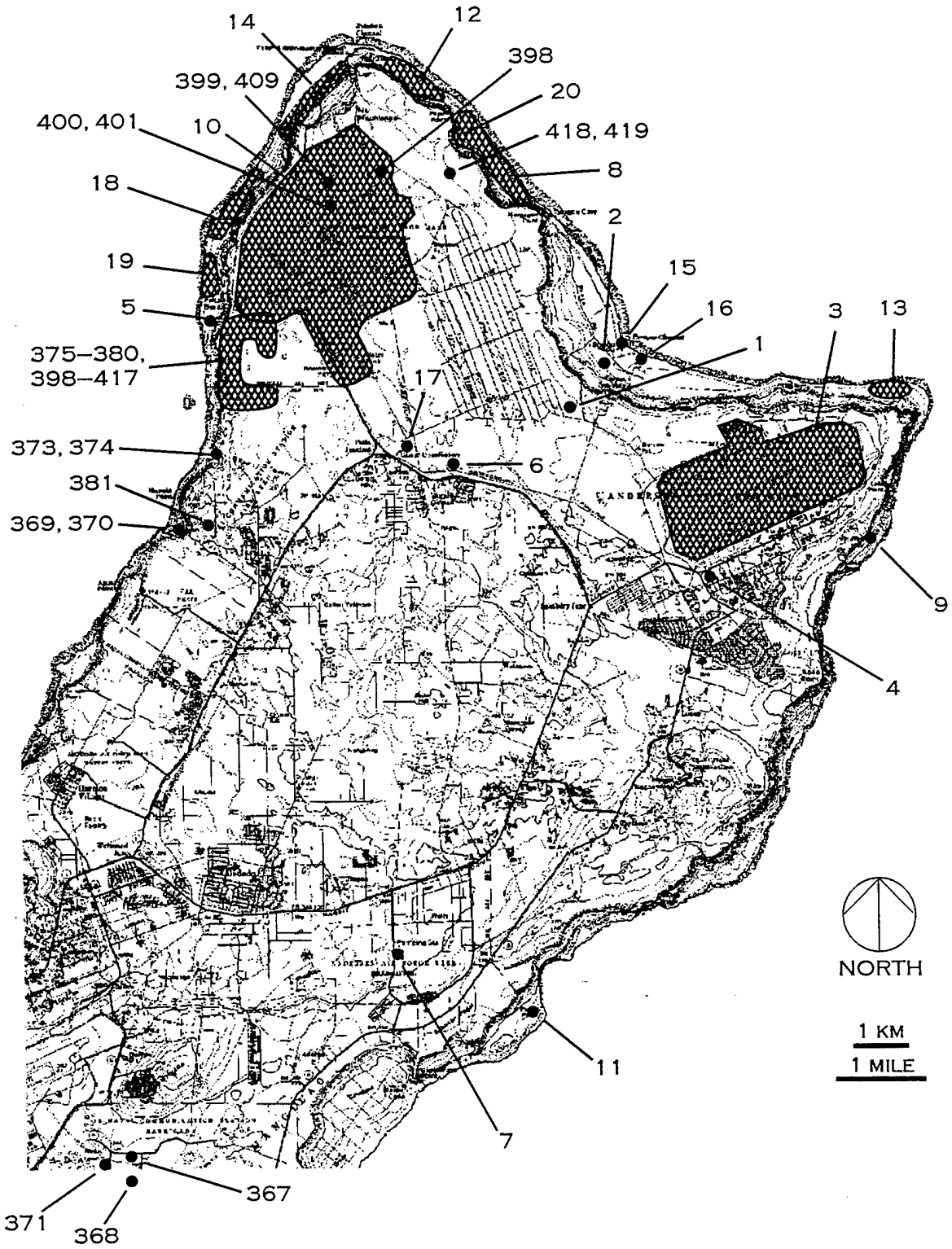


Figure 7. Archaeological Sites at Andersen AFB and NCTAMS.

The original Tarague site has been nominated to the NR and was placed on the GR in 1974. The recent intensive archaeological survey conducted by IAI at Tarague has vastly expanded the number of identified sites in the area. The former prehistoric site number 7-0015 (Site 16) was intended to include all the prehistoric features along the beach. These alone consist of at least four separate village clusters. Survey has now been conducted of the entire Tarague plain from the beach strand to the cliff line. The survey has resulted in the identification of 139 additional sites comprised of 311 features. These sites include 38 multi-feature complexes, generally composed of one or more rock mounds and rock alignments adjacent to or near a block rock shelter with an artifact scatter of Latte Period pottery sherds within or immediately outside the rock shelter. Other prehistoric sites include 24 rock alignments, 20 artifacts scatters, 16 rockshelters, seven bedrock mortars, six water-bearing caves, three caves, three trails, one sink and one remnant *latte* set. Ten historic sites were recorded, including three World War II refuge caves used by Japanese soldier stragglers. Many of the sites may have been used in both prehistoric and historic times (Liston 1996).

Each site identified during the Tarague survey has been assigned a GHPO site number. All the Tarague sites were evaluated as significant for their information content. Nine sites that also are associated with important World War II events are considered significant under Criterion A. Six sites are evaluated as unique or as excellent examples of a site type (significant under Criterion C): a coastal village site with a prehistoric well (GHPO Site 7-1614), a large inland block rockshelter complex (GHPO Site 8-1588), an inland agricultural complex (GHPO Site 7-1637), a well-preserved trail (GHPO Site 7-1638), the Tarague Cave with its pictographs (GHPO Site 8-1514), and a Japanese World War II straggler's cave (GHPO Site 8-1515) (Tomonari-Tuggle 1996: 123-128).

Two sites are listed on Andersen South (sometimes referred to as Marbo Annex). The Pagat Point *latte* site, the one prehistoric site, is actually on the east edge of the base. The only historic site is Building 01125 located in the middle of the base; its eligibility status has not been determined and will require more detailed architectural and historical study.

Archaeological Sites at NCTAMS WESTPAC

Four archaeological sites have been recorded at the Finegayan section and three sites in the Barrigada section. All the sites at Finegayan are located on the coastal plain or along the coastal cliff face. The Haputo Beach *latte* site, GHPO Site 8-0007 (Site 370) is an extensive village behind Haputo Beach with at least 20 *latte* sets identified. It has been placed on the NR and the GR. The other three sites, which consist of two rockshelters at Pugua Point, one of them Tweed's Cave, and a site at which human remains and World War II artifacts have been found, are significant sites, potentially eligible for the NR.

Portions of both Kurashina, McGrath, and Manner's (1987) and PHRI's (1988) Andersen AFB surveys extended into NCTAMS property. Approximately half of another survey conducted by PHRI (1989b) was also on NCTAMS property. A total of 7 prehistoric sites were identified (Sites 375 to 381), one with evidence of subsurface materials. In

addition to pottery, the remains included a *Tridacna* adze fragment. None of these sites are included in the CRMP documents examined.

Three potentially eligible sites, all dating to the historic World War II period, are located on the Barrigada section. The Barrigada Battlefield, GHPO Site 4-1059 (Site 367), would clearly be significant, but there are no known physical remains and the location of the most important feature in the battle, the Barrigada well, is unknown. The significance of the Officers Country Club entry gates and the golf course has not been determined.

POTENTIAL EFFECTS AND RECOMMENDED PROTECTION MEASURES

General Potential Adverse Effects

The military exercises proposed for Guam could adversely impact sites in a number of ways. The most serious threat would result from activities associated with any new construction; with area clearance (such as bulldozing for landing zones); with the use of vehicles off established roads (all-terrain vehicles, bulldozers, landing vehicles); with maneuvers that involve the digging of foxholes, latrines, and other subsurface excavations; and with the use of live fire and underwater explosives. Other damage to the historic resources could come from the presence of large numbers of individuals and involve removal of historic artifacts and vandalism.

Potential Adverse Effects at NAVACTS Ordnance Annex

Training at the Ordnance Annex will cover a broad area with potential impact on numerous sites. Most of the historic structures as well as the one site listed on the GR (the Fena massacre site) are located in the central area of the base and outside the primary training areas. Evaluation of potential effects in the northern part of the annex is difficult because much of the training is concentrated in areas that have not been surveyed but have a high potential for sites. Archaeological survey of these training areas to address potential adverse effects should be a priority concern.

Helicopter landings and bivouacs are planned in the northwest section of the annex. The helicopter landing site currently indicated does not lie within a site area and should pose no danger of adverse impact. However use of the slopes of the Alifan Ridge for bivouac activities could potentially impact the prehistoric and historic remains of the Alifan Ridge Complex. This area has only been cursorily surveyed, and a detailed inventory survey is highly recommended for this area before bivouac activities are permitted.

Small unit bivouac is also planned along the east half of the northern boundary of the annex. No survey has been conducted of this area, so the potential impacts are uncertain. Again it is recommended that archaeological survey be conducted of this area. It is likely that, with a few restrictions, training should not pose a major danger in this zone. In the meantime, no restrictions should be placed on land navigation, but the use of the area for bivouac should await results of the survey.

The recent completion of the PHRI survey of a large portion of the southern part of the annex allows a more informed evaluation of the potential adverse effects of training in this area.

The small unit patrol and land navigation activities in the southern third of the annex as now planned should not have a significant impact on archaeological sites. However, because the area contains a large number of sites evaluated as eligible for the National Register, the unit patrolling will need to be conducted in a way that will avoid impacts to the sites. A large number of *latte* sets are scattered through the northern part of the survey area and several are found near the southeast corner. Caves and overhangs are particularly numerous in the central west portion of the survey area along the east slope of Mount Almagosa. Special constraints will be placed on the way rockshelters and caves are used, with strict prohibitions against digging, artifact collection, or other disturbance in these areas.

Four site areas, two major *latte* set complexes and two caves should be placed off-limits. On the ridges above the Lost Marsh wetland is a *latte* village (Site 84) consisting of a cluster of 46 *latte* sets. It is recommended that the location of this large *latte* site, perhaps the largest and the best preserved in Guam, an island on which most of these features have been destroyed, be considered off-limits to all exercises. A second large latte group (Site 51), consisting of 12 sets, is also recommended as an off-limits area. Two caves (Sites 122 and 152), which contain undisturbed deposits, prehistoric artifacts, and pictographs, have been evaluated as significant for their information content, as excellent examples of a site type, and as culturally significant (Henry et al. 1996: 143), and should be placed off-limits.

A sniper and firing range is planned near the annex west boundary with targets placed to the south. The range will consist of two firing positions, a breaching house, and two target areas. The breaching house will serve both as a target and firing position. According to current plans, the range would only be used as a sniper range with targets placed approximately 400 to 1400 m from the firing area and the impact limited to the immediate vicinity of the targets.

The two firing positions and the breaching house contain no known sites and there should be no constraints on the use of these areas. There are also no known sites in the locations selected for the target areas and there should be no adverse effect from setting up targets at these positions. The range safety arc covers an area containing approximately 100 significant archaeological sites, including Site 84, the large off-limits *latte* set, although most of these sites would be protected from any possible damage by distance, by intervening high land, or by their positioning relative to the range. However the range, as currently designed, could potentially have adverse impacts on three significant archaeological sites within the immediate range area. All are *latte* sites, containing both standing and disturbed *latte* stones, with associated prehistoric artifacts and midden deposits. Testing has shown that subsurface cultural deposits are present and there is a high potential that burials could be present not far below the surface. Figure 8 shows the archaeological sites potentially impacted by activities at the sniper and firing range.

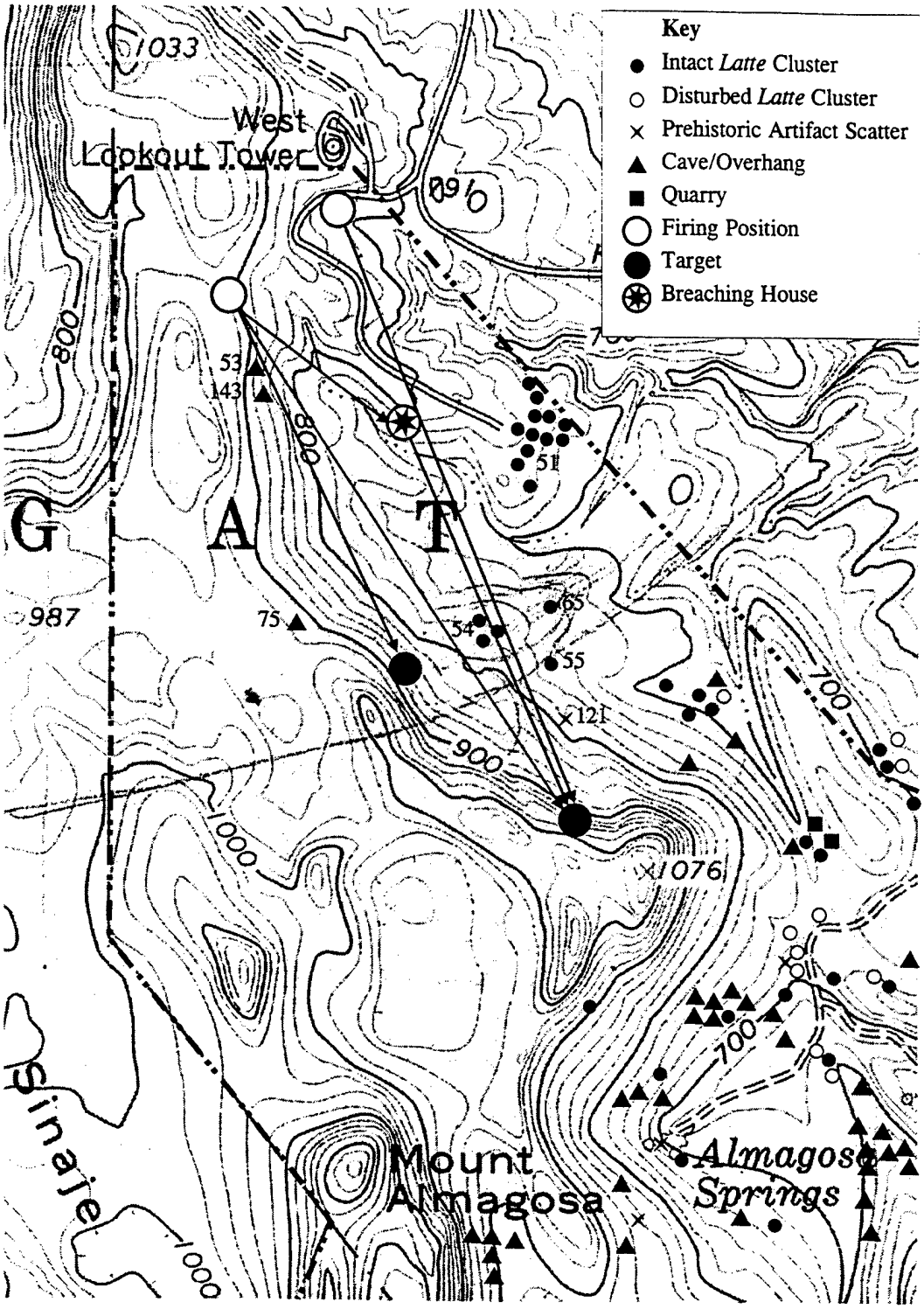


Figure 8. Archaeological Sites Potentially Impacted by the ORDANX Firing Range.

Shots fired from the firing positions toward the west target would appear to pose no danger to archaeological sites. Two overhang sites (Sites 53 and 143) near the southwestern firing position are oriented in such a way that they should not be impacted by the firing. However shots fired from the southwestern firing position toward the breaching house and from all three positions toward the east target could potentially impact Sites 51, 54, and 55.

Site 51, east of the range, is a large complex of 12 *latte* sets, comprising an area recommended as off-limits because of the importance of this major site and its sensitivity. All 12 sets have standing stones, often nearly complete sets. The site is located about 300 m behind the target area, and the southern portion of the site extends to a position almost directly in line with the firing line. There is a potential for shots passing over the target and slightly to the left to impact the southern portion of this site. Whether factors of topography, such as heavy vegetation and the position of the site in a valley would protect it during training exercises, is difficult to determine simply from maps.

Shots fired from the breaching house toward the east target area will pass directly over or through Site 54, a prehistoric site containing three *latte* sets with intact standing *latte* stones up to 1 m high. The site includes a basalt mortar near the Feature A *latte* set. Shots from the southwest firing position will pass not far west of Site 54, while shots from the firing position near the West Lookout Tower will also pass even closer to Site 54 and also close to Site 55, a single latte set. There is a potential for adverse impacts from shots fired short, low, or slightly off line to impact these sites. The potential for damage to Site 54 would seem to be particularly high.

It is recommended that adjustments be made in the location of the firing positions, breaching house, or target areas to lessen the potential impacts to these sites. Whatever the configuration of the range, the NAVACTS cultural resource specialist and an archaeologist familiar with the location of Sites 51, 54, and 55 should be present during the laying out of the range. Determination should be made in the field whether the range can be designed to avoid potential impacts to these sites and to move target areas and firing positions in ways that would lessen the impacts to the archaeological sites. If the range is configured in a way that would still pose a danger of adverse impacts to any of these sites, data recovery recording and excavations should be conducted in areas likely to be impacted, and protective measures should be taken to prevent damage to *latte* stones and basalt mortars.

Potential Adverse Effects at NAVACTS Waterfront Annex

No training activities are planned within the major concentration of significant historic resources located around the old village of Sumay. However there are three areas of major concern in regard to the proposed training at Apra Harbor.

The first area of concern is Orote Peninsula. In general this is an area with a number of historic structures and foundations, but a low potential for prehistoric sites. Thus training with limited constraints, primarily no digging within 3 feet of structures, should be permitted

and should not pose a threat to the historic properties on the peninsula. However there are three locations which will require special treatment.

First Orote Airfield has been placed on the National Register and the Guam Register as a significant World War II site. Because of this, the HPO has expressed concern over the use of the area around Orote Airfield for firing and sniper ranges, particularly firing across the runway. The runway has to some extent clearly lost its physical integrity through years of repaving, but the HPO remains concerned that adequate concern is given to the site's significance as an important part of our World War II heritage. Placement of a buffer zone of 5 meters along the runway with a restriction on any ground disturbing or potentially ground disturbing activities within the buffer zone might resolve this issue. This is an issue requiring resolution between the Navy and the HPO.

Near the far west end of Orote Peninsula, the Orote Historic Complex contains several historically important features, including a prehistoric cave site which is already suffering from vandalism and pot-hunting. Any training activities in the area of the complex should be constrained, limited to pedestrian access with no digging and strong prohibitions on any artifact collection, digging, or other disturbance in the cave. Bivouac activities are planned in the nearby area; these should not impact the site area.

Gab Gab Beach, along the north shore of Orote Peninsula, contains a prehistoric deposit behind the beach, Japanese defensive fortifications, and World War II American recreational facilities. Primarily because of the danger of impacting subsurface deposits of the prehistoric beach site, it is recommended that ground disturbance and the use of vehicles off-road in this area be forbidden. Exercises on Orote Peninsula outside these last two areas and the Airfield should have no major impact on archaeological sites.

The second area of concern is the potential effect of activities in the harbor on underwater resources. There are four submerged ships which have been evaluated as eligible to the National Register. These are all located near the east end of the breakwater, and no underwater demolition should take place in the vicinity of these vessels. The setting of underwater explosives along the Cabras Island breakwater and possibly mine countermeasures could potentially impact some of these ships. The areas now designated for underwater explosives and mine countermeasures should have no adverse effect with one exception. The underwater demolition training area nearest the breakwater would take place directly over several sunken barges and a Val dive bomber (Site 340). No determination has been made concerning the eligibility of these sites for the National Register. In the absence of a determination, the area with these vessels should also be considered as one in which the use of explosives is restricted. On the other hand, no resources are reported in the Inner Harbor area or offshore from Dadi and Tipalao Beaches and underwater detonation in these areas would not seem likely to impact any historic resources.

The third area of concern is Dadi Beach, where LCAC landings are proposed. While landings on the beach should pose no danger to historic properties, vehicular traffic should be

prohibited behind the beach where significant cultural deposits occur both within and in front of the caves and rockshelters behind the coastline.

The IED sites appear to lie in areas with no cultural resources, except for one location at the west end of Inner Apra Harbor, which is near Quonset hut 1686 (Site 304). Care should be taken that no damage occurs to the structure. The Seabee deployment area should result in no impact, but again care should be taken to avoid damage to any historic structures in this area, which appears to include Camp Roxas. Foundations of some historical structures remain in this area.

Potential Adverse Effects at Andersen AFB

The main areas of concern in regard to the proposed training activities are the potential impact on prehistoric resources in the coastal areas that will be involved and on the historic resources at Northwest Field. Activities in the built-up area at the east end of the base should not have any potential adverse effect on cultural resources.

At Taragué, activities at the small arms range and the EOD range are ongoing and should continue to be conducted in accordance with agreements with the GHPO. The EOD range does include several sites, including burials, along the beach berm and the remains of a village site on the first terrace behind the beach. Therefore any changes in activity areas should involved further consultation with the HPO. Vehicle access should be restricted to the established road; vehicles leaving the road to turn around have damaged part of one site. Training activities at Taragué are restricted to swimmer insertions and should therefore have no adverse effect on the sensitive cultural resources of the Taragué embayment.

Communications exercises and True training are planned for Ritidian Beach area. These lie outside the Ritidian site area as currently defined and involve an abandoned building which is not eligible to the NR. No adverse impact is anticipated.

The Air Force considers Northwest Field a significant site because of its role in World War II and therefore consultation should be conducted with the HPO concerning exercises in this area. The planned exercises in this area would seem to have a very limited potential for damaging prehistoric or historic sites. Ongoing rapid runway repair exercises could damage a portion of the runway, which is a major component of Northwest Field as a significant archaeological site. Consultation should be held with the HPO concerning these exercises. The proposed bivouac area was a developed part of the Northwest Field complex during the last year of World War II and the post-war years, but only structural foundations and roads remain in the area today. These foundations have not yet been adequately recorded. However, as long as these foundations are avoided during bivouacking and there is no digging within 3 feet of the structures, then there should be no adverse effect from the training.

At Andersen South only one historic site, Building 1125 has been listed as having any potential significance. It is not in an area of proposed training. However no archaeological survey has been conducted of the undeveloped portion of the base. Bivouac, field maneuvers, land navigation, and defensive tactics are planned for this area. Bivouacking in particular could potentially impact any sites that might be present. Archaeological survey of the proposed training area is recommended to determine if significant sites are present.

Potential Adverse Effects at NCTAMS WESTPAC

The Finegayan portion of NCTAMS will see only minimal training activities. The major activity, currently being conducted, is swimmer insertion and maneuvers conducted by Navy Seals. Landings take place at Haputo Beach and then the members of the landing party make their way along the coast to Andersen AFB.

The plain behind the Haputo landing beach is the location of the Haputo *latte* complex, an extensive *latte* village site, that is listed on the NR. Farther north the troops will pass by the Pugua Point rockshelter and Tweed's Cave, both NR eligible sites. Constraints should be placed on any activities in these areas which might impact these sites.

In the Barrigada portion, maneuvers and bivouacs are planned. However, in the absence of any specified locations for the training and in the absence of previous archaeological survey of the station, it is difficult to determine potential impacts of these exercises.

It is recommended that archaeological survey be conducted of the undeveloped portions of the station in which training may occur to identify if historic properties are present.

GENERAL SITE PROTECTION PLANNING

Recommended Protection Measures

The following measures are recommended for the mitigation of potential adverse impacts on the historic resources of Guam as a result of military exercises.

I. Identification and Marking of Site Protection Areas.

It is recommended that the proposed training areas be divided into Site Protection Areas, based on site sensitivity. Proposed boundaries for the Site Protection Areas are presented in Figures 9-11. It should be noted that only those areas that are shaded in on the maps have been evaluated. Land areas in white are those in which no training activities are proposed in the Belt Collins 1996 scoping document or the 1996 Draft EIS. These areas have not been evaluated for their archaeological resources and constraints on training activities and would require evaluation if training exercises in the future are planned for these areas. Water areas, on the other hand, should be considered unconstrained, unless specifically marked as constrained in some way. Following a final and accepted definition of the site protection areas, they should be clearly marked on the ground and identified on appropriate operational military maps.

The categories of the protection areas are:

Category 1. Off-limits areas.

Restrictions: No military use of these areas would take place except for troop and vehicular movement on established roads. These roads would be marked on maps and identified on the ground with appropriate right-of-way signs.

Areas: Four site areas in the Ordnance Annex are considered Category 1, off-limits areas. These include two large *latte* complexes and two caves. The two caves each contain prehistoric artifacts, pictographs, and their integrity remains unaltered. Because of the high integrity and value of these caves, they should be placed off-limits. Site 51 is an unusually large cluster of *latte* sets, with several well-preserved sets, and it is recommended that the site be placed off-limits. Site 84 is the largest preserved *latte* set in the Mariana Islands. It is particularly unusual in that most inland *latte* sets on Guam outside the Ordnance Annex have been destroyed by 20th century military, agricultural, and development activities. The site has high research, cultural, and interpretive value. It is associated with some of the earliest evidence of rice cultivation in the Mariana Islands. To insure its protection, the site should be placed off-limits.

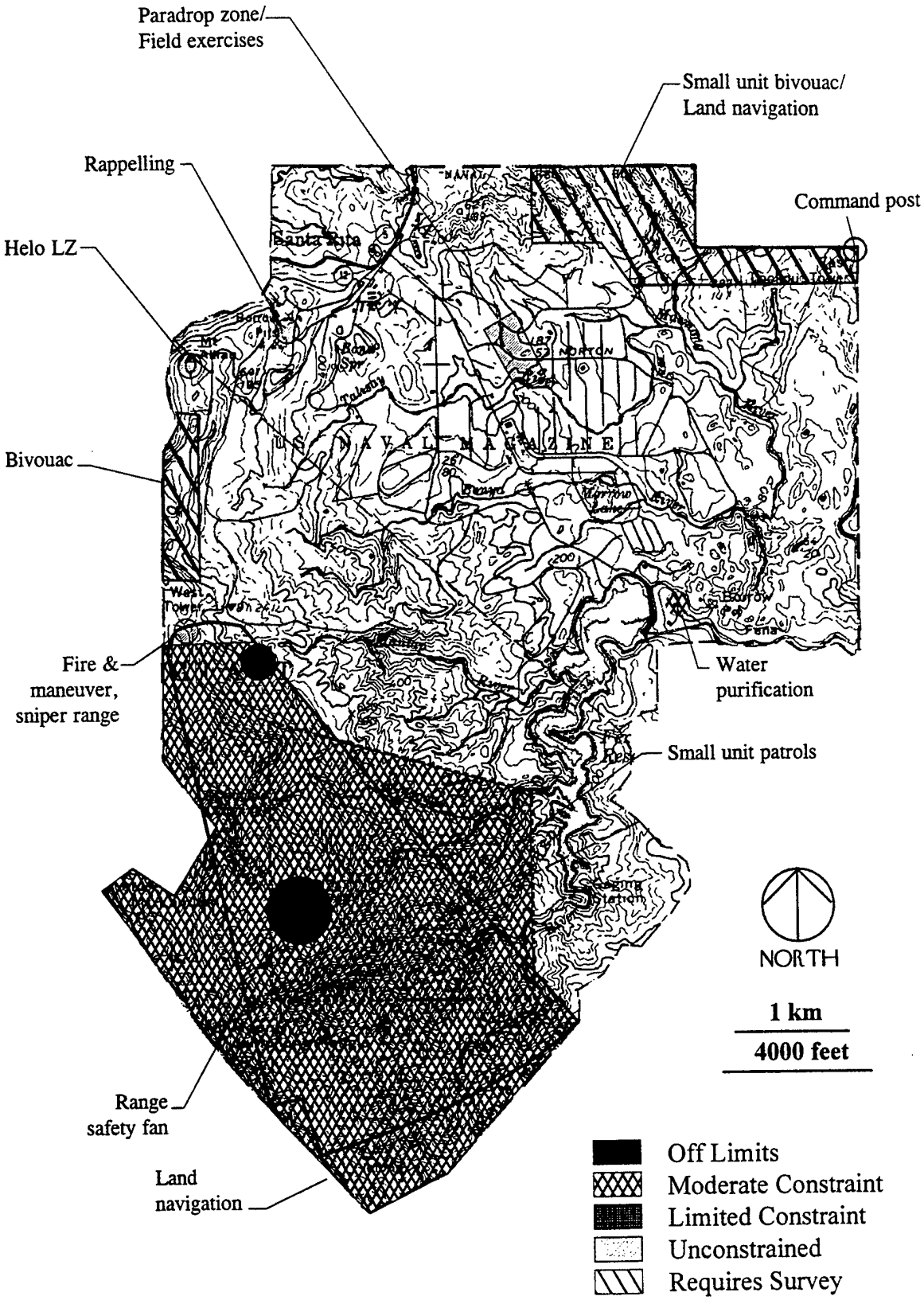


Figure 9. Site Protection Areas for NAVACTS Ordnance Annex Training.

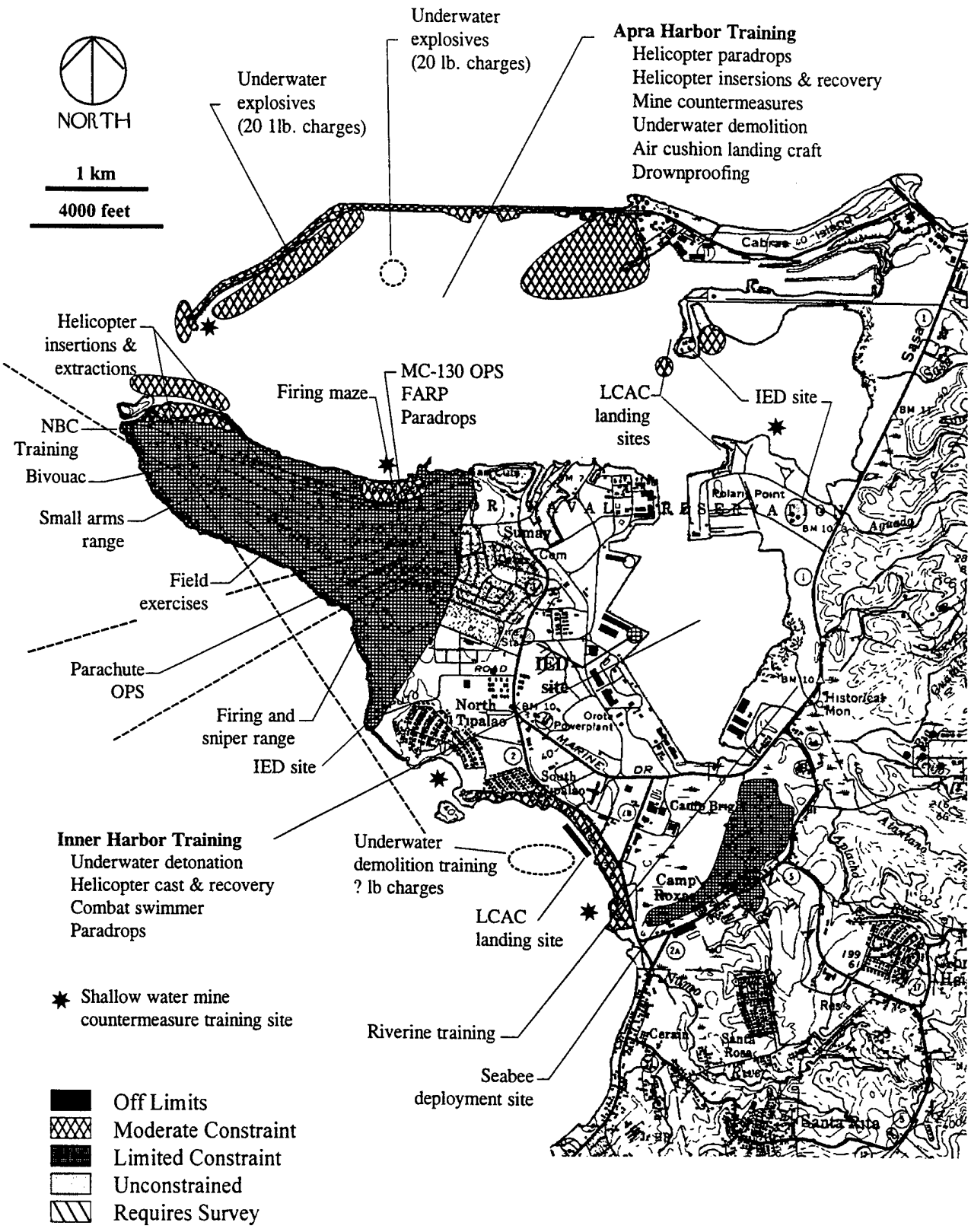


Figure 10. Site Protection Areas for NAVACTS Waterfront Annex Training.

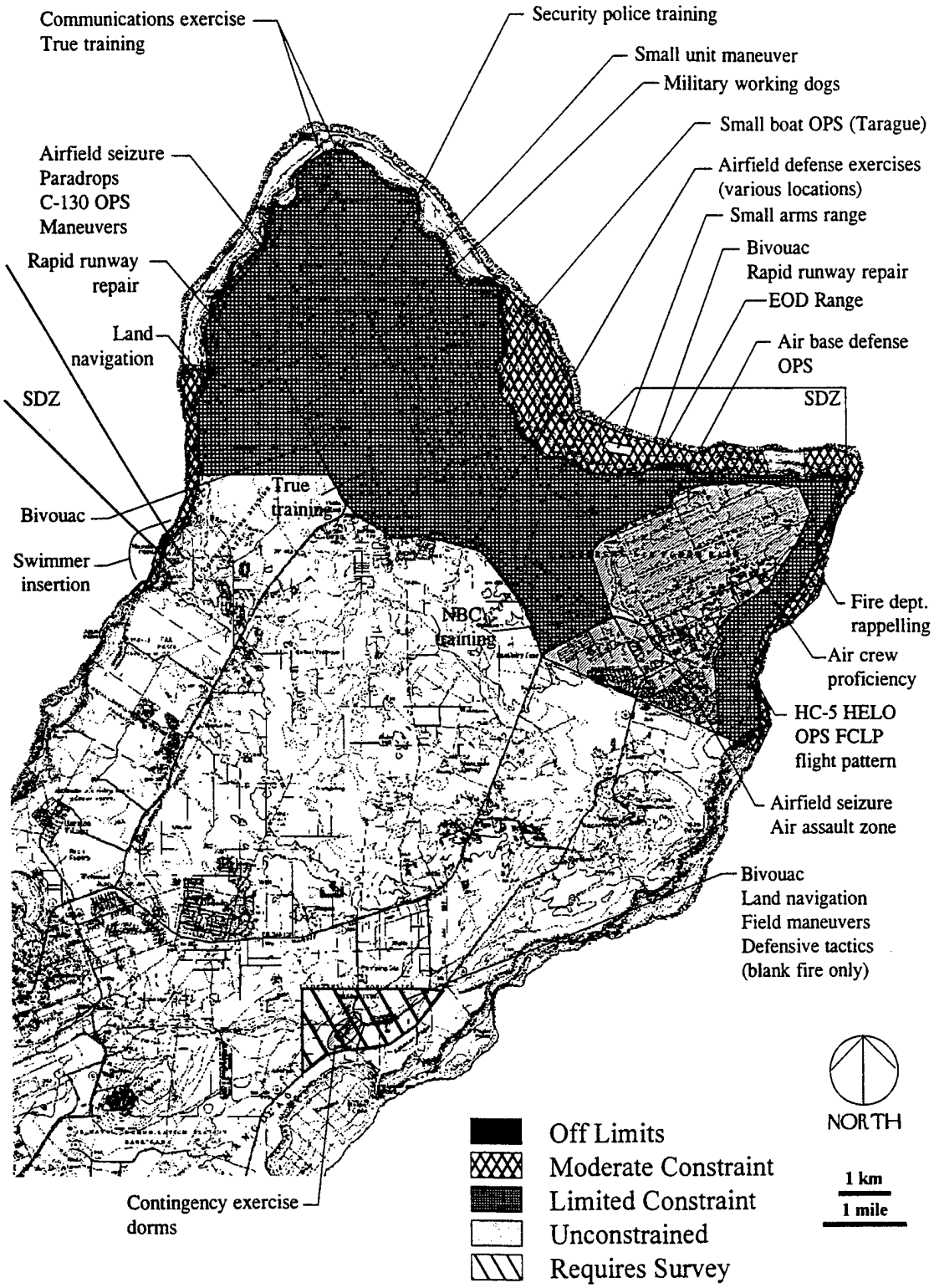


Figure 11. Site Protection Areas for Andersen AFB and NCTAMS Training.

Category 2. Moderate Constraint.

Restrictions: These areas would be limited to pedestrian activity off-road, with vehicles restricted to established roads. No digging would be allowed. Where appropriate, these areas would have permanent on-the-ground markers for identification. Highly sensitive sites in this areas might also be marked as off-limits.

The major training activities which would be constrained would be exercises involving off-road vehicles and bivouacking (where these would involve any subsurface activities such as digging latrines), explosives detonation, and weapons firing. Constrained areas would not be closed to exercises with no likely impact such as pedestrian unit patrolling, land navigation, swimmer insertions.

Areas: The Ordnance Annex southern training area, including the sniper and firing range, except for the off-limits areas; Dadi Beach, Gab Gab Beach, and the Orote Historic Complex at the Waterfront Annex; Apra Harbor areas with submerged ships; coastal areas at Andersen AFB and NCTAMS Finegayan. The areas recommended for inclusion in this category are shown in Figures 9-11.

All of the proposed training area in the south section of the Ordnance Annex is listed as a constrained area, except for those site areas placed off-limits. The area contains numerous potentially significant prehistoric sites which are highly sensitive to impacts from training except for those types of training which only involve pedestrian movement through the area.

At the Waterfront Annex, Dadi Beach is a Category 2 constrained area. Swimmer insertion would be permitted, but not amphibious vehicle landings followed by off-road maneuvers. LCAC landings should be restricted to the current beach area only. Caves and rockshelters behind the beach are significant sites and should be avoided during training activities. Orote Historic Complex and Gab Gab Beach contain sites that could be adversely impacted by ground disturbing activities and are therefore listed as Category 2 areas.

Outer Apra Harbor contains numerous significant and potentially significant shipwrecks. The areas where these are concentrated have been marked as Category 2 constrained areas. The main concern is the potential impact that detonation of explosives might have on these remains. All underwater demolition should take place outside these constrained areas.

The Tarague embayment, except for the already existing small arms range and EOD disposal area, is considered a Category 2 moderate constraint area because of the large number of significant sites the area contains. Consistent with current plans, training should be limited to activities, such as swimmer insertions, that would not have an adverse impact on these resources.

In addition areas which have not been surveyed and for which archaeological survey is recommended should be treated as constrained areas (see Recommendation III below).

Category 3. Limited constraint.

Restrictions: Restrictions in these area would include general prohibition against collection of historic artifacts; prohibition against vandalism; and restrictions on digging within three feet of any structure with concrete walls (concrete pads are not included in this category) or digging within any caves.

Areas: Seabee Deployment area and one IED site at the Waterfront Annex, Orote Peninsula except for Gab Gab Beach and the Orote Historic Complex, and Northwest Field and surrounding areas at Andersen AFB.

At Andersen AFB, Northwest Field and the surrounding area which may be used for training falls into this category. Digging should not take place within three feet of any structures or of the paved runways and taxiways. At the Waterfront Annex, the same restrictions would apply to the use of Orote Airfield and to training elsewhere on Orote Peninsula outside the areas of the Orote Historical Complex and Gab Gab Beach. In the case of some activities the training areas are not well defined and previous archaeological survey of the areas limited, so that the potential for adverse impacts cannot be fully evaluated. Based on the sample areas surveyed, In areas that have been surveyed, only foundations of historic structures and pottery scatters have been found, so the potential impact should be limited. Avoidance of structures should insure adequate protection of cultural resources.

Category 4. Unconstrained.

Restrictions: In these areas, no restrictions (concerning historic resources) would be placed on military actions as currently planned.

In addition, if actions of Recommendation II and III are followed, additional areas might be placed in this category with appropriate data recovery.

Areas: Apra Harbor except for Category 2 areas shown on the maps; small training areas slated for helicopter insertions and extractions, riverine training, IED training, and Apra Harbor LCAC landings at the Waterfront Annex; small training areas slated for helicopter landing, rappelling, field exercises, and a paradrop zone in the north portion of the Ordnance Annex; the developed portion of Andersen AFB around North Field, the developed portion of Andersen South, and the Andersen AFB small arms range.

II. Identification Of Specific Military Project Areas.

The historic preservation actions and site protection planning place their emphasis on avoiding damage to historic sites. To accomplish this, it is recommended that, where

possible, specifics of military exercises, specialized training areas, and any required facilities be identified regarding types of terrain, necessary total area, and recommended location. This information should be evaluated in terms of the distribution of historic resources to attempt to define the most appropriate areas for these actions with the least possible damage to any historic resources. Additionally, if specific military actions/projects as indicated above might be most effectively placed in areas of historic resources of lesser value, then appropriate data recovery might be considered to allow the action/project to take place. It is recommended that consultation take place with the NAVACTS cultural resource manager preceding any new training activities at NAVACTS Ordnance Annex or Waterfront Annex and with the Andersen AFB cultural and natural resource manager preceding new activities at that base.

III. Further Archaeological Survey.

Archaeological inventory survey is recommended for several areas which have not been previously surveyed or only cursorily surveyed. Four areas in which bivouac activities are proposed should have the highest priority in terms of future surveys. These are the northwest area of the Ordnance Annex, the northeast section of the Ordnance Annex, the undeveloped southern portion of Andersen South, and the undeveloped portions of NCTAMS Barrigada. Until such survey is conducted and the sensitivity of sites in these areas to impacts from training evaluated, these unsurveyed areas should be considered Category 2 areas, with moderate constraints on training activities.

Small portions of other areas in which general training exercises are proposed, namely Orote Peninsula and Northwest Field, have been surveyed, providing a sample of the types of sites to be found in these area. Further, more complete survey would allow a better definition of the potential impacts to sites and might permit placement of portions of the training areas into Category 4, unconstrained.

IV. Information and Instructions.

Information on the historic importance of Guam and on the site protection areas, with identified restrictions, will be placed in all relevant instruction manuals and on operational maps, where possible. Written and oral instructions which will alert the troops participating in exercises to the need to be careful to protect the cultural resources of the island. These instructions would involve the caution not to move, pick up, or in any way disturb artifacts or other historic properties on the island. Those participating in the exercises should be briefed on the significance of archaeological and historical resources on the island. Protective measures should be written into the instructions for the specific exercises. Prohibited and constrained areas should be clearly marked on all maps to be used during specific exercises. The military should provide sufficient oversight of the exercises to insure compliance with these mitigation measures.

V. Program of assessment.

The US Navy and the Historic Preservation Office of Guam should develop a monitoring plan for the evaluation of site protection actions after they have been implemented. This would involve, at a minimum, determining the extent to which the measures have been effectively implemented (for example, whether protection areas are marked effectively) and the extent to which the required actions and regulations are followed (for example, whether vehicles have respected the boundaries of prohibited areas).

VI. Interpretation.

A program of site interpretation has been instituted by the US Navy at NAVACTS Waterfront Annex and by the Air Force at Andersen AFB. These programs are being implemented by the cultural and natural resource managers for these bases and should be expanded. The existing program at the Waterfront Annex involves an interpretive brochure that is available to the public, a driving trail, walking trails, and a number of on-site interpretive signs. The Air Force has placed an interpretive trial with on-site signs at Tarague Beach. The current Legacy of Tarague Embayment project will provide the basis for establishing a number of additional interpretive trails and preparing a brochure for the Tarague area (Tomonari-Tuggle 1996). These programs should be brought to the attention of all military users as a part of the briefing in appreciation of the history of the island and protection of its resources.

Management of Site Protection Areas

As noted above in the description of the Site Protection Areas, in general it is recommended that long-term protection be afforded areas by a variety of measures, possibly including permanent fencing for those areas that are eventually agreed to be designated as off-limits, and appropriate signage for selected portions of the Category 2 and Category 4 areas. Signage, rather than fencing, may be sufficient for the larger off-limits *latte* sites in the Ordnance Annex, where base security already severely restricts access. Base cultural resource managers should be consulted before any new, specific training activities are undertaken.

It is recommended that a Site Protection Plan, similar to the one prepared for military training areas in northern Tinian (Tuggle and Welch 1996), be prepared for Guam military training areas. The plan should include the assignment of GHPO site numbers to all significant sites on Guam military bases that have not previously been assigned these numbers. The plan should review the protection procedures suggested in this document, propose appropriate mitigation for sites that might be impacted and cannot be avoided, and define in more detail the site protection measures that should be taken.

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APPENDIX A:

LISTING OF PREVIOUSLY IDENTIFIED SITES

Listing of previously identified sites.

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
1.	AAFB	Abandoned Reservoir - Bldg. 09120		concrete structure	1949	Schilz 1996
2.	AAFB	Abandoned Water Treatment Plant - Bldg. 09601		concrete structure	1949	Schilz 1996
3.	AAFB	Andersen Airfield	66-07-1064	airfield	1945-1949	Schilz 1996
4.	AAFB	Arc Light Memorial	66-07-1022	surface structures commemorating events of Vietnam conflict	1974	Schilz 1996
5.	AAFB	Falcona Beach Complex	66-08-0009	*latte* remains, rockshelters, surface materials	prehistoric	Schilz 1996
6.	AAFB	Guerrero Water Catchment		above ground concrete water catchment	1920s	Schilz 1996
7.	AAFB	Housing Support Storage and Warehouse (former laundry) - Bldg. 01125		intact surface structure	1949	Schilz 1996
8.	AAFB	Jinapsan Complex	66-08-0014	extensive *latte* site with surface materials, rockshelters	prehistoric	Schilz 1996
9.	AAFB	Lafac	66-07-0017	surface pottery scatter; 0.5 acres, relatively level shelf below cliffs	prehistoric	Schilz 1996
10.	AAFB	Northwest Field	66-08-1065	airfield only	1945	Schilz 1996
11.	AAFB	Pagat Point	66-08-0021	"extremely disturbed", *latte* remains, surface materials	prehistoric	Schilz 1996
12.	AAFB	Pajon Point Complex	66-08-0013	*latte* site with surface materials	prehistoric	Schilz 1996
13.	AAFB	Pati Point Complex	66-07-0016	displaced *latte*, buried deposits, rockshelters, burials	prehistoric	Schilz 1996
14.	AAFB	Ritidian Complex	66-08-0012	surface materials, buried deposits, burials, *latte* features, rockshelters; 15 acres	prehistoric	Schilz 1996
15.	AAFB	Stone Pier		rock pier remnant	1920s	Schilz 1996
16.	AAFB	Tarague Beach	66-07-0015	stratified deposits and surface materials, rockshelters, burials	prehistoric	Schilz 1996
17.	AAFB	Torres Farmhouse		walls and foundation	1920s	Schilz 1996
18.	AAFB	Uruno Beach Complex	66-08-0011	*latte* structures and surface materials	prehistoric	Schilz 1996
19.	AAFB	Uruno Complex	66-08-0010	4 *latte* structures and surface materials, rockshelters	prehistoric	Schilz 1996
20.	AAFB	World War II Bunker		damaged concrete bunker; Japanese	1944	Schilz 1996
382.	AAFB	Central Exchange Warehouse, Bldg. 00910		metal surface feature, modern modifications	1949	Schilz 1996
383.	AAFB	Communications Facility, Bldg. 25008		surface feature with modern modifications	1949	Schilz 1996
384.	AAFB	Dormitories - Officers and Airmen, Bldgs. 27000, 270001 [sic]		surface features, modern modifications, currently in use	1948	Schilz 1996
385.	AAFB	Dormitories, Bldgs. 00001-00006		surface features, modern modifications, currently in use	1948	Schilz 1996
386.	AAFB	Fleming Heights Houses, Bldgs. 28000-28113, 28116-28124, 28129-28139		surface features, modern modifications, currently in use	1948	Schilz 1996

Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
:hilz 1996	1	yes	assoc. with development of permanent base			
:hilz 1996	2	yes	assoc. with development of permanent base			
:hilz 1996	3	undeter.	critical role during Vietnam conflict			
:hilz 1996	4	undeter.				
:hilz 1996	10	yes	only one of its type			
:hilz 1996	12	yes				
:hilz 1996	14	undeter.				
:hilz 1996	15	yes		Dec 74	Dec 74	Cited as "Jinapsan Site, 66-08-1192" on Guam HPO Registered Historic Places list
:hilz 1996	16	undeter.				
:hilz 1996	21	yes	valued for construction history and role in WWII; considered eligible under criteria C and A by Guam HPO			
:hilz 1996	23	yes				Not on AAFB property, but listed in CRMP document.
:hilz 1996	24	yes			July 74	
:hilz 1996	25	yes			July 74	no systematic survey or mapping
:hilz 1996	30	yes			Aug 74	no systematic survey or mapping
:hilz 1996	32	yes	"only extant copra plantation constructions"			
:hilz 1996	34	yes			Aug 85	
:hilz 1996	36	yes	"rare example" of pre-WWII housing			
:hilz 1996	39	yes		Dec 74	June 74	
:hilz 1996	40	yes		Dec 74	July 74	
:hilz 1996	47	yes	thematic or historic district eligibility			
:hilz 1996	6	no				
:hilz 1996	7	no				
:hilz 1996	9	no	first permanent bachelor officers quarters			
:hilz 1996	8	no				
:hilz 1996	11	no				

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
387.	AAFB	Last Tank Action/Salisbury – Tarague Trail	66-08-1044	no surface remains extant	1944	Schilz 1996
388.	AAFB	PME Lab, Bldg. 00286		surface feature with modern modifications	1949	Schilz 1996
389.	AAFB	Post Office (former mess hall), Bldg. 21001		metal and concrete surface structure, modern modifications, currently in use	1948	Schilz 1996
390.	AAFB	Sanitary Sewage Pump Station, Bldg. 01120		surface and subsurface feature, modern modifications	1949	Schilz 1996
391.	AAFB	Support Structure, Bldg. 00911		surface feature, minor modifications, but lacks significance	1949	Schilz 1996
392.	AAFB	Water Supply Buildings and Water wells, Bldgs. 01498, 01499, 01600, 01601, 01622, and 01623		surface and subsurface features, modern modifications	1948	Schilz 1996
393.	AAFB	Water Well, Bldg. 00608		metal surface materials	1947	Schilz 1996
394.	AAFB	Water Well, Bldg. 02771		surface and subsurface feature, modern modifications	1945	Schilz 1996
395.	AAFB	Wilson Homes, Bldgs. 00200, 00202, 00204, 00206, 00208, 00210, 00212, 00214, 00216, 00218, 00220, 00222-00239, 00241-00244, 00246, 00248, 00250, 00252, 00254, 00256, 00258, 00260, 00262, 00264, 00266, 00268, 00270, 00272-00280, 00290, 00292, 00294, 00296, and 00298		surface features, modern modifications, currently in use	1948	Schilz 1996
396.	AAFB	Wing Headquarters (former dormitory), Bldg. 21000		metal and concrete surface structure, modern modifications, currently in use	1948	Schilz 1996
397.	AAFB	WWII Remnant Equipment		airplanes and half-tracks, out of original context	1944-1945	Schilz 1996
398.	AAFB			surface sherd scatter, 2 x 2.3 m, in remnant limestone forest; no subsurface remains encountered	prehistoric	Kurashina, McGrath, a Manner 1987
399.	AAFB			surface sherd scatter, 22 x 6 m, in remnant limestone forest; no subsurface remains encountered	prehistoric	Kurashina, McGrath, a Manner 1987
400.	AAFB			surface sherd scatter, 5 x 5 m; no subsurface remains encountered	prehistoric	Kurashina, McGrath, a Manner 1987
401.	AAFB			isolated surface sherd; no subsurface remains encountered	prehistoric	Kurashina, McGrath, a Manner 1987
402.	AAFB			surface sherd scatter, maximum dimension of 33 m, no subsurface remains encountered	prehistoric	Kurashina, McGrath, a Manner 1987
403.	AAFB			surface sherd scatter, 40 x 30 m, no subsurface remains encountered	prehistoric	Kurashina, McGrath, a Manner 1987
404.	AAFB			surface sherd scatter, 4 x 6 m, no subsurface remains encountered	prehistoric	Kurashina, McGrath, a Manner 1987
405.	AAFB			surface sherd scatter, 2 x 8 m, no subsurface remains encountered	prehistoric	Kurashina, McGrath, a Manner 1987
406.	AAFB			single surface sherd, no subsurface remains encountered	prehistoric	Kurashina, McGrath, a Manner 1987
407.	AAFB			surface sherd scatter, 7 x 7 m	prehistoric	Kurashina, McGrath, a Manner 1987

ation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
lz 1996	17	no				
lz 1996	27	no				
lz 1996	28	no	first permanent mess hall for enlisted men			
lz 1996	31	no				
lz 1996	33	no				
lz 1996	44	no				
lz 1996	43	no				
lz 1996	42	no				
lz 1996	45	no	first permanent housing for Air Force personnel			
lz 1996	46	no	first permanent dormitory for enlisted men			
lz 1996	48	no				
McGrath, and ner 1987	T1					Not included in CRMP document
McGrath, and ner 1987	T2					Not included in CRMP document
McGrath, and ner 1987	T3					Not included in CRMP document
McGrath, and ner 1987	T4					Not included in CRMP document
McGrath, and ner 1987	T5					Not included in CRMP document
McGrath, and ner 1987	T7					Not included in CRMP document
McGrath, and ner 1987	T9					Not included in CRMP document
McGrath, and ner 1987	T10					Not included in CRMP document
McGrath, and ner 1987	T11					Not included in CRMP document
McGrath, and ner 1987	T12					Not included in CRMP document

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
408.	AAFB			surface sherd scatter, 10 x 10 m	prehistoric	Kurashina, McGrath, Manner 1987
409.	AAFB			surface sherd scatter, 3 x 3 m; no subsurface remains reported	prehistoric	Kurashina, McGrath, Manner 1987
410.	AAFB			surface sherd scatter, 17.5 x 8 m	prehistoric	Kurashina, McGrath, Manner 1987
411.	AAFB			surface sherd scatter, maximum dimension of 30 m	prehistoric	Kurashina, McGrath, Manner 1987
412.	AAFB			pottery scatter, ca 225 m^2, subsurface sherds recovered	prehistoric	Haun 1988
413.	AAFB			pottery scatter, ca 150 m^2, no subsurface remains reported	prehistoric	Haun 1988
414.	AAFB			pottery scatter, ca 150 m^2, no subsurface remains reported	prehistoric	Haun 1988
415.	AAFB			ca. 920 m surface and subsurface pottery scatter and *Tridacna* adze fragment	prehistoric	Haun 1988
416.	AAFB			isolated surface sherd find	prehistoric	Haun 1988
417.	AAFB			pottery scatter, ca 25m^2, no subsurface remains reported	prehistoric	Haun 1988
418.	AAFB			pottery scatter, ca 10-15.0 m in diameter	prehistoric	Haun 1988
419.	AAFB			pottery scatter, ca 10-15.0 m in diameter	prehistoric	Haun 1988
21.	ORDANX	Abandoned magazines; scattered locations		earth and metal surface structures, some damaged	1944, 1945	Craib and Yoklavich Lauter-Reinman 19
22.	ORDANX	Airplane Crash Site		unable to relocate; surface remnants; possible WWII site		Craib and Yoklavich Lauter-Reinman 19
23.	ORDANX	Alifan Ridge Complex		cave complex with WWII surface materials; "needs survey"	prehistoric/ historic	Craib and Yoklavich Lauter-Reinman 19
24.	ORDANX	Almagosa Springs Complex	66-02-0150	no information; unable to relocate		Craib and Yoklavich
25.	ORDANX	Baseball Field - Bldg. 707		extant surface structure	1944	Craib and Yoklavich Lauter-Reinman 19
26.	ORDANX	Bona Spring		latte remains	prehistoric	Craib and Nees 19
27.	ORDANX	Bona Spring Complex	66-02-0152	no visible surface remains; *latte* structure(s)	prehistoric	Craib and Yoklavich
28.	ORDANX	Bonya Complex		multiple latte features; 19 acres	prehistoric	Craib and Nees 19
29.	ORDANX	East Bonya Complex	66-02-0145	surface features reported "destroyed in 1977"; single *latte* structure	prehistoric	Craib and Yoklavich
30.	ORDANX	West Bonya Complex	66-02-0145	surface features reported "destroyed in 1977"; single *latte* structure	prehistoric	Craib and Yoklavich
31.	ORDANX	Displayed Objects; scattered locations		mines, torpedo, anchor, and mobile artillery launcher	unknown	Craib and Yoklavich Lauter-Reinman 1
32.	ORDANX	Dobo Complex	66-02-0151	no information; unable to relocate		Craib and Yoklavich
33.	ORDANX	Dobo Spring Complex		multiple latte features; 30 acres	prehistoric	Craib and Nees 1

Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
ıa, McGrath, and ınner 1987	T13					Not included in CRMP document
ıa, McGrath, and ınner 1987	T15					Not included in CRMP document
ıa, McGrath, and ınner 1987	T16					Not included in CRMP document
ıa, McGrath, and ınner 1987	T17					Not included in CRMP document
aun 1988	T-3					Not included in CRMP document
laun 1988	T-4					Not included in CRMP document
laun 1988	T-5					Not included in CRMP document
laun 1988	T-7					Not included in CRMP document
laun 1988	T-8					Not included in CRMP document
laun 1988	T-9					Not included in CRMP document
laun 1988	—					Not included in CRMP document
laun 1988	—					Not included in CRMP document
Yoklavich 1992b ·Reinman 1994	1	II nce	assoc. with the broad patterns of Navy WWII base construction; distinctive construction type; examples of type			
Yoklavich 1992b ·Reinman 1994	5	II no				
Yoklavich 1992b ·Reinman 1994	6	II unev				
Yoklavich 1992b						no systematic survey or mapping
Yoklavich 1992b ·Reinman 1994	8	II yes	assoc. with the broad patterns of Navy WWII base construction; eligible as part of thematic grouping			
and Nees 1995		D				
Yoklavich 1992b		II				} may be the same site
and Nees 1995	WB1-7 EB1-6 SI1-3	D				may be equivalent to sites 29 and 30: East Bonya Complex and West Bonya Complex
Yoklavich 1992b		II			Oct 77	Cited as "66-02-0145B" in report; cited as "Bona Site" on Guam HPO Registered Historic Places list
Yoklavich 1992b	3	I		Mar 79	Mar 79	Incorrectly cited as "66-02-1145A" in report; cited as "West Bona Site" on Guam HPO Registered Historic Places list
Yoklavich 1992b ·Reinman 1994	29	II no	possibly associated with the broad patterns of Navy WWII equipment design; removed from original locations			
Yoklavich 1992b and Nees 1995	DS1-10	D				} may be the same site

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
34.	ORDANX	Explosive Truck Holding Yard (total of 11) - Bldgs. 629-639		earthen revetments, open excavated storage areas; currently in use	1944	Craib and Yoklavi Lauter-Reinmar
35.	ORDANX	Fena Massacre Site-God's Cave	66-02-1313	two rockshelters	1944	Lauter-Reinmar
36.	ORDANX	Flagpole - Bldg. 706		metal surface feature; destroyed by typhoon	1944	Craib and Yoklavi Lauter-Reinmar
37.	ORDANX	Inert Storehouse Sheds 3 and 11 - Bldgs. 309, 310		metal surface structures	1949	Craib and Yoklavi
38.	ORDANX	Laquet Complex	66-02-0149	no visible surface remains; "two presumably destroyed house site components" - probably *latte* structures; 15 acres	prehistoric	Craib and Yoklavi Craib and Nee
39.	ORDANX	Maanot Reservoir		concrete surface materials	?	Lauter-Reinma
40.	ORDANX	Maemong		3 rockshelters, 1 latte site and 1 pottery scatter	prehistoric	Craib and Nee
41.	ORDANX	Maemong River Complex		rockshelters with prehistoric and historic surface materials; "needs survey"	?	Craib and Yoklav Lauter-Reinma
42.	ORDANX	Old Bridge at NAVMAG		metal and concrete surface structure; poor condition	?	Lauter-Reinma
43.	ORDANX	Open Storage Area, Revetments (total of 11) - Bldgs. 600, 602, 604, 605, 606, 616, 614-623, 625, 627, 628		earthen revetments, open excavated storage areas; mostly disused	1944	Craib and Yoklav Lauter-Reinma
44.	ORDANX	Vehicular Bridge - Bldg. 702		wood and concrete surface structure	1944	Craib and Yoklav Lauter-Reinma
45.	ORDANX	Vehicular Bridge - Bldg. 705		wood and concrete structure; rebuilt	1944	Craib and Yoklav Lauter-Reinma
46.	ORDANX	Concrete Bridge - Bldg. 777		concrete surface structure	1945	Lauter-Reinma
47.	ORDANX	*Latte* set		110.4 sq m; 6 column *latte*	prehistoric/ historic	Henry et al.
48.	ORDANX	*Latte* set		71.5 sq m; 8 column *latte*	prehistoric	Henry et al.
49.	ORDANX	Complex (2 *Latte* sets, 2 *Latte* clusters, 2 Overhangs)		1153.3 sq m; 8 and 10 column *latte*, 2 *latte* remnants	prehistoric	Henry et al.
50.	ORDANX	Historic artifact scatter		4.5 sq m	post-WWII	Henry et al.
51.	ORDANX	Complex (12 *Latte* sets)		4669.6 sq m; 6, 8, and 10 column *latte*	prehistoric	Henry et al.
52.	ORDANX	Historic artifact scatter		168.0 sq m; also basalt mortar	prehistoric/ historic	Henry et al.
53.	ORDANX	Complex (2 Overhangs)		144.3 sq m; modified shelters	prehistoric/ historic	Henry et al.
54.	ORDANX	Complex (3 *Latte* sets)		293.2 sq m; 6, 8, and 10 column *latte*	prehistoric	Henry et al.
55.	ORDANX	*Latte* set		44.1 sq m; 8 column *latte*	prehistoric	Henry et al.
56.	ORDANX	Overhang		6.5 sq m; ceramics	prehistoric	Henry et al.
57.	ORDANX	*Latte* set		33.3 sq m; 8 column *latte*	prehistoric	Henry et al.
58.	ORDANX	Overhang		21.3 sq m; ceramics	prehistoric	Henry et al.
59.	ORDANX	Cave		21.0 sq m; ceramics	prehistoric	Henry et al.
60.	ORDANX	Cave		679.4 sq m; artifacts	prehistoric	Henry et al.

ation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
klavich 1992b		II	assoc. with the broad patterns of Navy			
inman 1994	31	nce	WWII base construction; distinctive construction type not unique			
inman 1994	33	yes	Criterion A and as "a traditional cultural property"			
klavich 1992b		II	assoc. with the broad patterns of Navy			
inman 1994	37	no	WWII base construction; eligible as part of thematic grouping			
klavich 1992b		II	assoc. with the broad patterns of Navy permanent base construction; earliest extant semi-permanent buildings at installation			
klavich 1992b		II				
l Nees 1995	LQA-B	D				
inman 1994	68	unev				
l Nees 1995		D				
oklavich 1992b		II				} may be the same site
inman 1994	69	unev				
inman 1994	74	unev				
oklavich 1992b		II	assoc. with the broad patterns of Navy			
einman 1994	75	no	WWII base construction; distinctive construction type			
oklavich 1992b	13	II	assoc. with the broad patterns of Navy			
einman 1994	133	yes	WWII base construction; very good condition, excellent example of type			
oklavich 1992b	13	II	assoc. with the broad patterns of Navy			
einman 1994	134	no	WWII base construction			
einman 1994	21	yes	only one of its type			
et al. 1996	3	D,TC	contains or may contain human remains			
et al. 1996	5	D,TC	contains or may contain human remains			
et al. 1996	6	D,TC	contains or may contain human remains			
et al. 1996	7	D				
et al. 1996	8	D,TC	contains or may contain human remains			
et al. 1996	9	D				
et al. 1996	10	D				
et al. 1996	11	D,TC	contains or may contain human remains			
et al. 1996	12	D,TC	contains or may contain human remains			
et al. 1996	13	D				
et al. 1996	14	D,TC	contains or may contain human remains			
et al. 1996	15	D				
et al. 1996	16	D				
et al. 1996	17	D				

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
61.	ORDANX	*Latte* set		43.8 sq m; 8 column *latte*	prehistoric	Henry et al. 1996
62.	ORDANX	Overhang		7.4 sq m; ceramics	prehistoric	Henry et al. 1996
63.	ORDANX	Overhang		78.7 sq m; ceramics	prehistoric	Henry et al. 1996
64.	ORDANX	*Latte* set		41.8 sq m; 8 column *latte*	prehistoric	Henry et al. 1996
65.	ORDANX	*Latte* set		31.1 sq m; 8 column *latte*	prehistoric	Henry et al. 1996
66.	ORDANX	Prehistoric artifact scatter		120.0 sq m	prehistoric	Henry et al. 1996
67.	ORDANX	Historic artifact scatter		21.0 sq m	WWII	Henry et al. 1996
68.	ORDANX	Overhang		7.1 sq m; ceramics	prehistoric/ historic	Henry et al. 1996
69.	ORDANX	Overhang		286.0 sq m; artifacts	prehistoric	Henry et al. 1996
70.	ORDANX	Complex (Cave, Overhang)		373.4 sq m; artifacts	prehistoric/ WWII	Henry et al. 1996
71.	ORDANX	*Latte* set		46.4 sq m; 8 column *latte*	prehistoric	Henry et al. 1996
72.	ORDANX	Historic artifact scatter		50.0 sq m	WWII	Henry et al. 1996
73.	ORDANX	*Latte* set		42.1 sq m; 8 column *latte* with historic artifacts	prehistoric/ historic	Henry et al. 1996
74.	ORDANX	Historic artifact scatter		9.0 sq m	WWII	Henry et al. 1996
75.	ORDANX	Overhang		39.0 sq m; ceramics	prehistoric	Henry et al. 1996
76.	ORDANX	Complex (*Latte* set, *Latte* cluster)		75.6 sq m; 8 column *latte*, possible *latte*, historic artifacts	prehistoric/ historic	Henry et al. 1996
77.	ORDANX	Complex (6 *Latte* sets)		1060.3 sq m; 6, 8, 10 column *latte*	prehistoric	Henry et al. 1996
78.	ORDANX	Complex (2 *Latte* sets)		808.5 sq m; 6 column *latte*	prehistoric	Henry et al. 1996
79.	ORDANX	Complex (*Latte* set, *Latte* cluster, Shell midden)		482.3 sq m; 8 column *latte*; remnant *latte*; shell midden; historic artifacts	prehistoric/ historic	Henry et al. 1996
80.	ORDANX	Complex (2 *Latte* sets)		355.4 sq m; 6 and 8 column *latte* with historic artifacts	prehistoric/ historic	Henry et al. 1996
81.	ORDANX	Complex (2 *Latte* sets)		117.9 sq m; 6 column *latte*	prehistoric	Henry et al. 1996
82.	ORDANX	Cave		1098.0 sq m; ceramics	prehistoric	Henry et al. 1996
83.	ORDANX	Complex (4 *Latte* sets, 4 *Latte* clusters)		2745.3 sq m; 6 and 8 column *latte*; 4 remnant *latte*	prehistoric	Henry et al. 1996
84.	ORDANX	Complex (Prehistoric artifact scatter, 33 *Latte* sets, 12 *Latte* clusters)		36301.4 sq m; 6, 8, 10 and 12 column *latte*; remnants of at least 12 *latte*	prehistoric	Henry et al. 1996
85.	ORDANX	Complex (Overhang, 3 Caves)		1519.6 sq m; ceramics	prehistoric	Henry et al. 1996
86.	ORDANX	Complex (Cave, 2 Overhangs)		158.7 sq m; ceramics	prehistoric	Henry et al. 1996
87.	ORDANX	Cave		9.3 sq m; ceramics	prehistoric	Henry et al. 1996
88.	ORDANX	Complex (2 Overhangs)		114.9 sq m; ceramics	prehistoric	Henry et al. 1996
89.	ORDANX	Cave		26.0 sq m; ceramics	prehistoric	Henry et al. 1996
90.	ORDANX	Overhang		15.5 sq m; ceramics	prehistoric	Henry et al. 1996
91.	ORDANX	Complex (2 *Latte* clusters)		337.6 sq m; remnant *latte*	prehistoric	Henry et al. 1996
92.	ORDANX	Complex (5 *Latte* sets, 3 *Latte* clusters)		1559.2 sq m; 6, 8, 10 column *latte* and 3 remnant *latte*	prehistoric	Henry et al. 1996
93.	ORDANX	Overhang		4.9 sq m; ceramics	prehistoric	Henry et al. 1996
94.	ORDANX	Prehistoric artifact scatter		90.0 sq m	prehistoric	Henry et al. 1996
95.	ORDANX	Prehistoric artifact scatter		12.0 sq m	prehistoric	Henry et al. 1996
96.	ORDANX	Prehistoric artifact scatter		520.0 sq m	prehistoric	Henry et al. 1996
97.	ORDANX	*Latte* set		43.7 sq m; 8 column *latte*	prehistoric	Henry et al. 1996
98.	ORDANX	Complex (*Latte* cluster, 2 *Latte* sets)		791.3 sq m; 6 column *latte* and 1 remnant *latte*	prehistoric	Henry et al. 1996

Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
ıry et al. 1996	18	D,TC	contains or may contain human remains			
ıry et al. 1996	19	D				
ıry et al. 1996	20	D				
ıry et al. 1996	21	D,TC	contains or may contain human remains			
ıry et al. 1996	22	D,TC	contains or may contain human remains			
ıry et al. 1996	23	D				
ıry et al. 1996	24	D				
ıry et al. 1996	25	D				
ıry et al. 1996	26	D				
ıry et al. 1996	27	D				
ıry et al. 1996	28	D,TC	contains or may contain human remains			
ıry et al. 1996	29	D				
ıry et al. 1996	31	D,TC	contains or may contain human remains			
ıry et al. 1996	32	D				
ıry et al. 1996	33	D				
ıry et al. 1996	37	D,TC	contains or may contain human remains			
ıry et al. 1996	38	D,TC	contains or may contain human remains			
ıry et al. 1996	39	D,TC	contains or may contain human remains			
ıry et al. 1996	42	D,TC	contains or may contain human remains			
ıry et al. 1996	43	D,TC	contains or may contain human remains			
ıry et al. 1996	44	D,TC	contains or may contain human remains			
ıry et al. 1996	48	D				
ıry et al. 1996	49	D,TC	contains or may contain human remains			
ıry et al. 1996	50	D,TC	contains or may contain human remains			
ıry et al. 1996	51	D,TC	contains or may contain human remains			
ıry et al. 1996	52	D				
ıry et al. 1996	55	D				
ıry et al. 1996	56	D				
ıry et al. 1996	58	D				
ıry et al. 1996	60	D				
ıry et al. 1996	61	D,TC	contains or may contain human remains			
ıry et al. 1996	62	D,TC	contains or may contain human remains			
ıry et al. 1996	63	D				
ıry et al. 1996	64	D				
ıry et al. 1996	65	D				
ıry et al. 1996	66	D				
ıry et al. 1996	67	D,TC	contains or may contain human remains			
ıry et al. 1996	68	D,TC	contains or may contain human remains			

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
99.	ORDANX	Complex (6 *Latte* sets, 2 *Latte* clusters)		2192.6 sq m; 8 and 12 column *latte* and 2 remnant *latte*	prehistoric	Henry et al. 1996
100.	ORDANX	Prehistoric artifact scatter		14256.0 sq m	prehistoric	Henry et al. 1996
101.	ORDANX	Prehistoric artifact scatter		4950.0 sq m	prehistoric	Henry et al. 1996
102.	ORDANX	Prehistoric artifact scatter		736.0 sq m	prehistoric	Henry et al. 1996
103.	ORDANX	Complex (*Latte* set, *Latte* cluster)		168.7 sq m; 6 col. *latte* and 1 remnant *latte*	prehistoric	Henry et al. 1996
104.	ORDANX	*Latte* cluster		112.0 sq m; remnant *latte*	prehistoric	Henry et al. 1996
105.	ORDANX	Prehistoric artifact scatter		1000.0 sq m	prehistoric	Henry et al. 1996
106.	ORDANX	Complex (*Latte* cluster, 2 *Latte* sets)		257.0 sq m; 8 and 10 column *latte* and 1 remnant *latte*	prehistoric	Henry et al. 1996
107.	ORDANX	Prehistoric artifact scatter		250.0 sq m	prehistoric	Henry et al. 1996
108.	ORDANX	*Latte* cluster		374.0 sq m; remnant *latte*	prehistoric	Henry et al. 1996
109.	ORDANX	Chiseled steps		2.9 sq m; depressions excavated into basalt outcrop	prehistoric	Henry et al. 1996
110.	ORDANX	Prehistoric artifact scatter		140.0 sq m	prehistoric	Henry et al. 1996
111.	ORDANX	Complex (*Latte* set, *Latte* cluster)		451.8 sq m; 10 col. *latte* and 1 remnant *latte*	prehistoric	Henry et al. 1996
112.	ORDANX	Prehistoric artifact scatter		6300.0 sq m	prehistoric	Henry et al. 1996
113.	ORDANX	Prehistoric artifact scatter		50.0 sq m	prehistoric	Henry et al. 1996
114.	ORDANX	Complex (2 *Latte* sets)		318.4 sq m; 8 column *latte*	prehistoric	Henry et al. 1996
115.	ORDANX	Prehistoric artifact scatter		5200.0 sq m	prehistoric	Henry et al. 1996
116.	ORDANX	Prehistoric artifact scatter		432.0 sq m	prehistoric	Henry et al. 1996
117.	ORDANX	Prehistoric artifact scatter		110.0 sq m	prehistoric	Henry et al. 1996
118.	ORDANX	Prehistoric artifact scatter		375.0 sq m	prehistoric	Henry et al. 1996
119.	ORDANX	Prehistoric artifact scatter		75.0 sq m	prehistoric	Henry et al. 1996
120.	ORDANX	Prehistoric artifact scatter		400.0 sq m	prehistoric	Henry et al. 1996
121.	ORDANX	Prehistoric artifact scatter		500.0 sq m	prehistoric	Henry et al. 1996
122.	ORDANX	Overhang		60.6 sq m; artifacts and pictographs	prehistoric	Henry et al. 1996
123.	ORDANX	Prehistoric artifact scatter		5600.0 sq m	prehistoric	Henry et al. 1996
124.	ORDANX	Prehistoric artifact scatter		525.0 sq m	prehistoric	Henry et al. 1996
125.	ORDANX	Overhang		1000.0 sq m; artifacts	prehistoric	Henry et al. 1996
126.	ORDANX	Concrete block		2.9 sq m; concrete survey marker	historic	Henry et al. 1996
127.	ORDANX	*Latte* set		62.5 sq m; 10 column *latte*	prehistoric	Henry et al. 1996
128.	ORDANX	Complex (2 *Latte* sets)		195.0 sq m; 8 column *latte*	prehistoric	Henry et al. 1996
129.	ORDANX	Overhang		6.75 sq m; ceramics	prehistoric	Henry et al. 1996
130.	ORDANX	*Latte* set		26.6 sq m; 8 column *latte*	prehistoric	Henry et al. 1996
131.	ORDANX	*Latte* set		90.33 sq m; 8 column *latte*	prehistoric	Henry et al. 1996
132.	ORDANX	Complex (3 Caves)		509.0 sq m; ceramics	prehistoric?	Henry et al. 1996
133.	ORDANX	Overhang		10.8 sq m; ceramics	prehistoric	Henry et al. 1996
134.	ORDANX	Crevice		125.3 sq m; ceramics	prehistoric	Henry et al. 1996
135.	ORDANX	Overhang		17.2 sq m; artifacts	prehistoric	Henry et al. 1996
136.	ORDANX	Overhang		2.76 sq m; artifacts	prehistoric	Henry et al. 1996
137.	ORDANX	Overhang		15.4 sq m; ceramics	prehistoric	Henry et al. 1996
138.	ORDANX	Overhang		5.7 sq m; ceramics	prehistoric	Henry et al. 1996
139.	ORDANX	Overhang		12.6 sq m; artifacts	prehistoric	Henry et al. 1996
140.	ORDANX	Overhang		24.7 sq m; ceramics	prehistoric	Henry et al. 1996
141.	ORDANX	Cave		110.0 sq m; ceramics	prehistoric	Henry et al. 1996
142.	ORDANX	Complex (Cave, 2 Overhangs)		185.4 sq m; artifacts	prehistoric	Henry et al. 1996

ation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
t al. 1996	69	D,TC	contains or may contain human remains			
t al. 1996	70	D				
t al. 1996	71	D				
t al. 1996	72	D				
t al. 1996	73	D,TC	contains or may contain human remains			
t al. 1996	74	D,TC	contains or may contain human remains			
t al. 1996	75	D				
t al. 1996	76	D,TC	contains or may contain human remains			
t al. 1996	77	D				
t al. 1996	78	D,TC	contains or may contain human remains			
t al. 1996	79	C,D	unique site type			
t al. 1996	80	D				
t al. 1996	81	D,TC	contains or may contain human remains			
t al. 1996	82	D				
t al. 1996	83	D				
t al. 1996	85	D,TC	contains or may contain human remains			
t al. 1996	86	D				
t al. 1996	87	D				
t al. 1996	88	D				
t al. 1996	89	D				
t al. 1996	90	D				
t al. 1996	91	D				
t al. 1996	92	D				
t al. 1996	93	C,D,TC	human remains and pictographs present			restricted location information
t al. 1996	94	D				
t al. 1996	95	D				
t al. 1996	96	D				
t al. 1996	97	D				location not mapped in report
t al. 1996	98	D,TC	contains or may contain human remains			
t al. 1996	99	D,TC	contains or may contain human remains			
t al. 1996	100	D				
t al. 1996	101	D,TC	contains or may contain human remains			
t al. 1996	102	D,TC	contains or may contain human remains			
t al. 1996	103	D				
t al. 1996	104	D				
t al. 1996	105	D				
t al. 1996	106	D				
t al. 1996	107	D				
t al. 1996	108	D				
t al. 1996	109	D				
t al. 1996	110	D				
t al. 1996	111	D				
t al. 1996	112	D				
t al. 1996	113	D,TC	contains or may contain human remains			

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
143.	ORDANX	Overhang		22.8 sq m; artifacts	historic	Henry et al. 1996
144.	ORDANX	Complex (*Latte* set, 2 *Latte* clusters)		217.6 sq m; 8 col. *latte* and 2 remnant *latte*	prehistoric	Henry et al. 1996
145.	ORDANX	*Latte* set		56.4 sq m; 8 column *latte*	prehistoric	Henry et al. 1996
146.	ORDANX	*Latte* set		133.6 sq m; 6 column *latte*	prehistoric	Henry et al. 1996
147.	ORDANX	Overhang		423.0 sq m; artifacts	prehistoric/ historic	Henry et al. 1996
148.	ORDANX	Complex (2 Overhangs)		239.3 sq m; artifacts	prehistoric	Henry et al. 1996
149.	ORDANX	Complex (Cave, Overhang)		224.7 sq m; artifacts	prehistoric/ historic	Henry et al. 1996
150.	ORDANX	Overhang		15.8 sq m; stacked wall and ceramics	prehistoric/ historic	Henry et al. 1996
151.	ORDANX	Complex (Cave, 3 Overhangs)		340.3 sq m; artifacts	prehistoric	Henry et al. 1996
152.	ORDANX	Cave		67.8 sq m; ceramics and pictographs	prehistoric	Henry et al. 1996
153.	ORDANX	Complex (*Latte* set, 2 *Latte* clusters)		561.5 sq m; 10 col. *latte* and 2 remnant *latte*	prehistoric	Henry et al. 1996
154.	ORDANX	Complex (*Latte* set, Overhang, 2 Caves)		1028.5 sq m; 8 col. *latte*; other features have historic artifacts and/or prehistoric ceramics	prehistoric/ historic	Henry et al. 1996
155.	ORDANX	Overhang		10.4 sq m; ceramics	prehistoric	Henry et al. 1996
156.	ORDANX	Complex (*Latte* set, 6 Overhangs)		1177.9 sq m; 8 column *latte*; ceramics	prehistoric	Henry et al. 1996
157.	ORDANX	Overhang		9.4 sq m; ceramics	prehistoric	Henry et al. 1996
158.	ORDANX	Overhang		27.4 sq m; ceramics	prehistoric	Henry et al. 1996
159.	ORDANX	Overhang		12.6 sq m; ceramics	prehistoric/ historic	Henry et al. 1996
160.	ORDANX	Complex (*Latte* set, Overhang)		182.7 sq m; 8 column *latte*; ceramics	prehistoric	Henry et al. 199
161.	ORDANX	Complex (Historic artifact scatter, *Latte* set, 2 *Latte* clusters)		580.2 sq m; 8 column *latte* and 2 remnant *latte*; WWII artifact scatter	prehistoric/ WWII	Henry et al. 199
162.	ORDANX	Complex (2 *Latte* sets)		380.8 sq m; 8 column *latte* with prehistoric and historic artifacts	prehistoric/ historic	Henry et al. 199
163.	ORDANX	Complex (Historic artifact scatter, 2 *Latte* sets, 2 *Latte* clusters)		743.5 sq m; 6 and 8 column *latte* and 2 remnant *latte*; WWII artifact scatter	prehistoric/ historic	Henry et al. 199
164.	ORDANX	Historic artifact scatter		1040.0 sq m; artifacts	historic	Henry et al. 199
165.	ORDANX	Overhang		3.71 sq m; artifacts	prehistoric/ historic	Henry et al. 199
166.	ORDANX	Complex (2 Quarries, 2 *Latte* sets)		676.9 sq m; 8 and 10 column *latte*; 2 *latte* stone quarries	prehistoric	Henry et al. 199
167.	ORDANX	*Latte* set		165.8 sq m; 10 column *latte* with historic artifacts	prehistoric/ historiac	Henry et al. 199
168.	ORDANX	Complex (Prehistoric artifact scatter, 2 *Latte* sets, 4 *Latte* clusters)		2757.6 sq m; 6 and 12 column *latte* and 4 remnant *latte*	prehistoric	Henry et al. 199
169.	WFANX	Administration Bldg. 101A		metal surface structure	?	Yoklavich and Crait Lauter-Reinman 1

Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
ıry et al. 1996	114	D				
ıry et al. 1996	115	D,TC	contains or may contain human remains			
ıry et al. 1996	116	D,TC	contains or may contain human remains			
ıry et al. 1996	117	D,TC	contains or may contain human remains			
ıry et al. 1996	118	D,TC	contains human remains			
ıry et al. 1996	119	D				
ıry et al. 1996	120	D				
ıry et al. 1996	121	D				
ıry et al. 1996	122	D				
ıry et al. 1996	123	C,D,TC	human remains and pictographs present			restricted location information
ıry et al. 1996	124	D,TC	contains or may contain human remains			
ıry et al. 1996	125	D,TC	contains or may contain human remains			
ıry et al. 1996	126	D				
ıry et al. 1996	127	D,TC	contains or may contain human remains			
ıry et al. 1996	128	D				
ıry et al. 1996	129	D				
ıry et al. 1996	130	D				
ıry et al. 1996	131	D,TC	contains or may contain human remains			includes Dobo Spring Complex *Latte* set 9 (DS 9) Craib and Nees 1995
ıry et al. 1996	132	D,TC	contains or may contain human remains			
ıry et al. 1996	133	D,TC	contains or may contain human remains			
ıry et al. 1996	134	D,TC	contains or may contain human remains			
ıry et al. 1996	135	D				
ıry et al. 1996	136	D				
ıry et al. 1996	137	D,TC	contains or may contain human remains			includes Dobo Spring Complex *Latte* sets 7 and 8 (DS 7, DS 8) and Laquet Complex features (LQA and LQB) Craib and Nees 1995
ıry et al. 1996	138	D,TC	contains or may contain human remains			
ıry et al. 1996	139	D,TC	contains or may contain human remains			includes Dobo Spring Complex *Latte* sets 1, 2, 3, 4, 5, and 6 (DS 1 – DS 6) Craib and Nees 1995
:h and Craib 1992 -Reinman 1995	2	II unev	assoc. with broad patterns of pre-WWII Navy permanent base construction; "The architectural significance and integrity of these buildings is not high..."			

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
170.	WFANX	Administration Bldgs. B100, B103, B104, B105		metal surface structures	1946	Yoklavich and Cr Lauter-Reinma
171.	WFANX	AFDL-23 (floating drydock)		floating metal structure	1944	Lauter-Reinma
172.	WFANX	AFDM-5 (floating drydock)		floating metal structure	1943	Lauter-Reinma Lauter-Reinma
173.	WFANX	AFDM-8		floating metal structure	1943	Lauter-Reinma Lauter-Reinma
174.	WFANX	Apra Sports Diving Club - 2104		no longer extant; surface structure	1946	Craib and Yoklavi Lauter-Reinma
175.	WFANX	Apra Village		no remains reported; location uncertain	?	Craib and Yoklavi Carucci 19 Lauter-Reinma
176.	WFANX	Apuntua Point Remains		submerged discarded historic materials	WWII?	Lauter-Reinma
177.	WFANX	Baseball Field - 95		surface feature	1946	Lauter-Reinma
178.	WFANX	Baseball Field -1962		surface feature	1946	Lauter-Reinma
179.	WFANX	Basketball Court - 1978		surface feature	1949	Craib and Yoklav Lauter-Reinma
180.	WFANX	Battery Recharge Shop - Bldg. 779		surface structure	1947	Craib and Yoklav Lauter-Reinma
181.	WFANX	Bldg. 5506 - A4-1		surface structure	?	Lauter-Reinma
182.	WFANX	Building 93-1		metal surface structure	1945	Lauter-Reinma
183.	WFANX	Bulldozed Debris & Pad TN-5		disturbed surface materials	?	Carucci 19 Lauter-Reinma Lauter-Reinma
184.	WFANX	Bulldozed Debris TN-3		disturbed surface materials	?	Carucci 19 Lauter-Reinma Lauter-Reinma
185.	WFANX	Bulldozed Debris TN-4		disturbed surface materials	?	Carucci 19 Lauter-Reinma Lauter-Reinma
186.	WFANX	Bunker and Gun Emplacement A4-8 & 9			?	Lauter-Reinma
187.	WFANX	Butler 2016		metal surface structure	?	Lauter-Reinma Lauter-Reinma
188.	WFANX	Butler 2028		metal surface structure	?	Lauter-Reinma Lauter-Reinma
189.	WFANX	Butler 2055		metal surface structure	?	Lauter-Reinma Lauter-Reinma
190.	WFANX	Butler 2060		metal and concrete surface structure	?	Lauter-Reinma Lauter-Reinma
191.	WFANX	Butler 2060A		metal and concrete surface structure	?	Lauter-Reinma Lauter-Reinma
192.	WFANX	Butler 2068		metal surface structure	?	Lauter-Reinma Lauter-Reinma
193.	WFANX	Butler 2070		metal surface structure	?	Lauter-Reinma Lauter-Reinma

ation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
ınd Craib 1992		II	assoc. with broad patterns of pre-WWII			
einman 1995	1	unev	Navy permanent base construction; "The architectural significance and integrity of these buildings is not high..."			
einman 1994	2	unev				
einman 1994	3	unev				
einman 1995	3					
einman 1994	4	mq	representative of a type *not* used at Guam			
einman 1995	4					
oklavich 1992d		II	assoc. with the broad patterns of Navy			
einman 1995	5	no	permanent base construction			
oklavich 1992d		II	potential cultural deposits			
cci 1993						
einman 1995	6	unev				
einman 1994						
einman 1995	7	no				
einman 1995	8	no				
oklavich 1992d		II	assoc. with the broad patterns of Navy			
einman 1995	9	no	WWII and permanent base construction			
oklavich 1992c		II	assoc. with the broad patterns of Navy			
einman 1995	10	unev	permanent base construction			
einman 1995	11	no				
einman 1994	84	no	modified			
cci 1993	TN-5	NE				
einman 1994	9	no				
einman 1995	12	no				
cci 1993	TN-3	NE				
einman 1994	10	no				
einman 1995	13	no				
cci 1993	TN-4	NE				
einman 1994	11	no				
einman 1995	14	no				
einman 1995	15	no				
		no				
einman 1994	12	mq	unusual construction type			
einman 1995	16	no				
einman 1994	13	mq	unusual construction type			
einman 1995	17	no				
einman 1994	14	no	modified			
einman 1995	18	unev				
einman 1994	15	no	modified			
einman 1995	19	unev				
einman 1994	16	no	modified			
einman 1995	20	unev				
einman 1994	17	no	modified			
einman 1995	21	unev				
einman 1994	18	no	common			
einman 1995	22	unev				

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
194.	WFANX	Cable Station Remains	66-03-1043	masonry surface structures; 6.1 acres	1905-1944	Craib and Yoklavich 19 Lauter-Reinman 1994 Lauter-Reinman 1995
195.	WFANX	Captain Glass Monument			1971	Craib and Yoklavich 19 Lauter-Reinman 1995
196.	WFANX	Circular Concrete Pad A4-2		surface concrete feature	?	Lauter-Reinman 1994 Lauter-Reinman 1995
197.	WFANX	Concrete Foundation TN-19		concrete surface feature	?	Carucci 1993 Lauter-Reinman 1994 Lauter-Reinman 1995
198.	WFANX	Concrete Foundations A5-9 & 10			1950?	Lauter-Reinman 1995
199.	WFANX	Concrete Pad A4-3			?	Lauter-Reinman 1995
200.	WFANX	Concrete Pads A8-1			?	Lauter-Reinman 1995
201.	WFANX	Concrete Pads A5-2			?	Lauter-Reinman 1995
202.	WFANX	Concrete Pads and Debris TN-16		disturbed surface materials	?	Carucci 1993 Lauter-Reinman 1994 Lauter-Reinman 1995
203.	WFANX	Concrete Pads TN-6		concrete surface features	?	Carucci 1993 Lauter-Reinman 1994 Lauter-Reinman 1995
204.	WFANX	Concrete Pads TN-8		concrete surface features	?	Carucci 1993 Lauter-Reinman 1994 Lauter-Reinman 1995
205.	WFANX	Concrete Remains A5-1			?	Lauter-Reinman 1995
206.	WFANX	Concrete Stair Segment A4-10			?	Lauter-Reinman 1995
207.	WFANX	Concrete Structural Remains A5-8			?	Lauter-Reinman 1995
208.	WFANX	Concrete Wall TN-10		concrete surface feature	?	Carucci 1993 Lauter-Reinman 1994 Lauter-Reinman 1995
209.	WFANX	Concrete Waste Dump TN-7		concrete surface features	?	Carucci 1993 Lauter-Reinman 1994 Lauter-Reinman 1995
210.	WFANX	Coral Facing TN-2		masonry surface feature	?	Carucci 1993 Lauter-Reinman 1994 Lauter-Reinman 1995
211.	WFANX	Dadi Beach	66-02-0143	possible remnant shell midden; HPO reported site "destroyed by post WWII grading and construction"	prehistoric	Craib and Yoklavich 19 Craib and Yoklavich 19 Carucci 1993
212.	WFANX	Features Off Dadi Beach TN-9		concrete, metal and other historic objects below high water mark	?	Carucci 1993 Lauter-Reinman 1995 Lauter-Reinman 1995
213.	WFANX	Displayed Objects; scattered locations		anchors, guns, and sinkers of both Japanese and U.S. origin	?	Lauter-Reinman 1995
214.	WFANX	War Dog Cemetery	66-04-1098	surface and subsurface feature	1994	Lauter-Reinman 1995
215.	WFANX	Equipment Shed - Bldg. 1463		concrete and metal surface features	1945	Craib and Yoklavich 19 Lauter-Reinman 1995 Lauter-Reinman 1995
216.	WFANX	Fallout Shelter - Bldg. 5507			1946	Craib and Yoklavich 19 Lauter-Reinman 1995

Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
d Yoklavich 1992d		I	probably Criterion A, possibly D	Sept 79	Oct 74	
r-Reinman 1994	19	yes				
r-Reinman 1995	23	yes				
d Yoklavich 1992d		I	marker with design significance			
r-Reinman 1995	24	no-st				
r-Reinman 1994	20	unev				
r-Reinman 1995	25	no				
arucci 1993	TN-19	NE				
r-Reinman 1994	22	no				
r-Reinman 1995	26	no				
r-Reinman 1995	27	no				
r-Reinman 1995	28	no				
r-Reinman 1995	33	no				
r-Reinman 1995	32	no				
arucci 1993	TN-16	NE				
r-Reinman 1994	23	no				
r-Reinman 1995	29	no				
arucci 1993	TN-6	NE				
r-Reinman 1994	24	no				
r-Reinman 1995	30	no				
arucci 1993	TN-8	NE				
r-Reinman 1994	25	no				
r-Reinman 1995	31	no				
r-Reinman 1995	34	no				
r-Reinman 1995	36	no				
r-Reinman 1995	35	no				
arucci 1993	TN-10	NE				
r-Reinman 1994	26	no				
r-Reinman 1995	37	no				
arucci 1993	TN-7	NE				
r-Reinman 1994	27	no				
r-Reinman 1995	38	no				
arucci 1993	TN-2	NE				
r-Reinman 1994	28	no				
r-Reinman 1995	39	no				
l Yoklavich 1992c Yoklavich 1992d arucci 1993		II	potential cultural deposits			
arucci 1993	TN-9	uncertain				
r-Reinman 1994	32	unev				
r-Reinman 1995	44	unev				
r-Reinman 1995	40	no-st	removed from original locations; lack integrity of location, setting or association			
r-Reinman 1995	158	no-st				
Yoklavich 1992d		II	assoc. with the broad patterns of Navy WWII base construction			
r-Reinman 1994	30	no				
r-Reinman 1995	41	no				
Yoklavich 1992d		II	assoc. with the broad patterns of Navy permanent base construction			
r-Reinman 1995	43	unev				

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
217.	WFANX	Finger Pier R-96		concrete structure	1945	Lauter-Reinman 19 Lauter-Reinman 19
218.	WFANX	Fire Debris TN-18		disturbed surface materials	?	Carucci 1993 Lauter-Reinman 19 Lauter-Reinman 19
219.	WFANX	Floating Dry Dock	66-01-1026		?	Craib and Yoklavich Lauter-Reinman 19 Lauter-Reinman 19
220.	WFANX	Football Field 1973			1949	Craib and Yoklavich Lauter-Reinman 19
221.	WFANX	Fort San Luis	66-03-1126		Spanish	Craib and Yoklavich Lauter-Reinman 19
222.	WFANX	Fort Santa Cruz	66-03-1010		Spanish	Craib and Yoklavich Lauter-Reinman 19
223.	WFANX	Foxholes - Leepers Loop A6-1			WWII	Lauter-Reinman 19
224.	WFANX	Fuel Tanks - A5-14			1945+	Lauter-Reinman 19
225.	WFANX	Fuel/Water Tank and RD A8-4&5			?	Lauter-Reinman 19
226.	WFANX	FY4 Corsair Wreckage			WWII	Craib and Yoklavich Lauter-Reinman 19
227.	WFANX	Gab Gab Beach Fortifications	66-03-1346 66-03-1347	concrete surface structures	1944	Craib and Yoklavich Lauter-Reinman 1 Lauter-Reinman 1
228.	WFANX	Gab Gab Beach Recreation Area		original structures destroyed	1944	Lauter-Reinman 1 Lauter-Reinman 1
229.	WFANX	Gab Gab Beach Site			prehistoric	Craib and Yoklavich Lauter-Reinman 1
230.	WFANX	Garbage Stand - 5829			1946	Craib and Yoklavich
231.	WFANX	Glass Breakwater		limestone rubble structure	1941-1944	Craib and Yoklavich Lauter-Reinman 1 Lauter-Reinman 1
232.	WFANX	Guns at Polaris Point			?	Lauter-Reinman 1
233.	WFANX	Guns near USMC Jungle School		metal objects; present location unknown	?	Craib and Yoklavich Lauter-Reinman 1 Lauter-Reinman 1
234.	WFANX	Historical Monument and Spanish Shrine	66-03-1012	no description	?	Craib and Yoklavich
235.	WFANX	Housing Area 8 Remains A7-1&2			1950s	Lauter-Reinman 1
236.	WFANX	Japanese Anchors - Objects		metal objects; removed from original locations	?	Craib and Yoklavich Lauter-Reinman 1 Lauter-Reinman 1
237.	WFANX	Japanese Bunker - Atypical	66-02-1303	concrete surface structure; unusual	WWII	Carucci 1993 Lauter-Reinman 1 Lauter-Reinman 1
238.	WFANX	Japanese Bunker and Cave-Cmp B	66-02-1301	modified rockshelter; disturbed deposits	WWII	Carucci 1993 Lauter-Reinman 1 Lauter-Reinman 1

ation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
inman 1994	34	nce	significantly altered			
inman 1995	45	nce				
ci 1993	TN-18	NE				incorrectly located at NAVMAG in
inman 1994	35	no				Appendix B, L-R 1994
inman 1995	62	no				
klavich 1992d		II				
inman 1994	38	no				
inman 1995	47	no				
klavich 1992d		II	assoc. with the broad patterns of Navy			
inman 1995	49	no	WWII and permanent base construction			
klavich 1992d		III				
inman 1995	50	no				
klavich 1992d						on map, but not listed among
inman 1995	51	no				resources
inman 1995	52	no-st				
inman 1995	54	no				
inman 1995	53	no				
oklavich 1992d		II	distinctive object type			
inman 1995	42	no				
oklavich 1992d		II	assoc. with WWII battles			Former site number of 66-03-1128
inman 1994	40	yes				retired by Guam HPO and replaced
einman 1995	55	yes				with two new numbers
einman 1994	41	nce				
einman 1995	56	nce				
oklavich 1992d		II	potential cultural deposits			
einman 1995	57	unev				
oklavich 1992d		II	assoc. with the broad patterns of Navy permanent base construction			
oklavich 1992d		II	Criteria A and B			
einman 1994	43	yes				
einman 1995	59	yes				
einman 1995	61	no				
oklavich 1992d		II	distinct object type; assoc. with WWII			
einman 1994	44	unev	battles			
einman 1995	60	no				
oklavich 1992d						on map, but not discussed in text
einman 1995	63	no				
oklavich 1992d		II	distinctive object type			
einman 1994	47	no				
einman 1995	64	no				
icci 1993	TN-14	A,C,D,MP				
einman 1994	50	yes				
einman 1995	67	yes				
icci 1993	TN-12	A,D,MP				
einman 1994	49	yes				
einman 1995	66	yes				

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
239.	WFANX	Japanese Bunkers and Cave	66-02-1129	modified rockshelters; no cultural materials	1944	Carucci 1993 Lauter-Reinman 19 Lauter-Reinman 19
240.	WFANX	Japanese Defense Position T-4		semi-subterranean stone and concrete feature	WWII	Craib and Yoklavich Lauter-Reinman 19 Lauter-Reinman 19
241.	WFANX	Japanese Defense Position T-5		stone and metal subsurface feature	WWII	Craib and Yoklavich Lauter-Reinman 19 Lauter-Reinman 19
242.	WFANX	Japanese Defensive Cave I	66-02-1305	modified rockshelter	WWII	Carucci 1993 Lauter-Reinman 19 Lauter-Reinman 19
243.	WFANX	Japanese Defensive Cave II	66-02-1306	modified rockshelter	WWII	Carucci 1993 Lauter-Reinman 19 Lauter-Reinman 19
244.	WFANX	Japanese Defensive Cave III	66-02-1307	modified rockshelter	WWII	Carucci 1993 Lauter-Reinman 19 Lauter-Reinman 19
245.	WFANX	Japanese Defensive Cave IV	66-02-1308	modified rockshelter	WWII	Carucci 1993 Lauter-Reinman 19 Lauter-Reinman 19
246.	WFANX	Japanese Defensive Cave V	66-02-1309	modified rockshelter	WWII	Carucci 1993 Lauter-Reinman 19 Lauter-Reinman 19
247.	WFANX	Japanese Defensive Cave VI	66-02-1310	modified rockshelter; elaborate modifications	WWII	Carucci 1993 Lauter-Reinman 19 Lauter-Reinman 19
248.	WFANX	Japanese Gun Position T-1		metal and concrete surface features	WWII	Craib and Yoklavich Lauter-Reinman 19 Lauter-Reinman 19
249.	WFANX	Japanese Gun Position T-2		concrete platform	WWII	Craib and Yoklavich Lauter-Reinman 19 Lauter-Reinman 19
250.	WFANX	Japanese Mass Grave Site	66-03-1092	subsurface feature	1944	Craib and Yoklavich Lauter-Reinman 19 Lauter-Reinman 19
251.	WFANX	Japanese Midget Submarine	66-03-1088	metal object	WWII	Craib and Yoklavich Lauter-Reinman 19 Lauter-Reinman 19
252.	WFANX	Japanese sinker and anchor		metal objects	WWII	Lauter-Reinman 19 Lauter-Reinman 19
253.	WFANX	Japanese Steps and Wall		masonry surface structure; POW built	1945	Craib and Yoklavich Lauter-Reinman 19 Lauter-Reinman 19
254.	WFANX	Lathe from NY Shipyard			1936	Lauter-Reinman 19
255.	WFANX	Maanot Water Reservoir - Site 380		roofed, concrete surface structure	1931	Yoklavich and Craib

Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
ırucci 1993		A,D,MP				
-Reinman 1994	48	yes				
-Reinman 1995	65	yes				
l Yoklavich 1992d		I	assoc. with WWII battles			
-Reinman 1994	58	no				
-Reinman 1995	75	no				
l Yoklavich 1992d		III	assoc. with WWII battles			
-Reinman 1994	59	no				
-Reinman 1995	76	no				
ırucci 1993	TN-22	A,D,MP				
-Reinman 1994	51	yes				
-Reinman 1995	69	yes				
ırucci 1993	TN-26	A,D,MP				
-Reinman 1994	52	yes				
-Reinman 1995	70	yes				
ırucci 1993	TN-27	A,D,MP				
-Reinman 1994	53	yes				
-Reinman 1995	71	yes				
ırucci 1993	TN-28	A,D,MP				
-Reinman 1994	54	yes				
-Reinman 1995	72	yes				
ırucci 1993	TN-29	A,D,MP				
-Reinman 1994	55	yes				
-Reinman 1995	73	yes				
ırucci 1993	TN-30	A,D,MP				
-Reinman 1994	56	yes				
-Reinman 1995	74	yes				
Yoklavich 1992d		III	assoc. with WWII battles; "too disturbed to be significant"			
-Reinman 1994	60	no				
-Reinman 1995	77	no				
Yoklavich 1992d		I	assoc. with WWII battles			
-Reinman 1994	61	no				
-Reinman 1995	78	no				
Yoklavich 1992d		I	assoc. with WWII battles			
-Reinman 1994	62	no				
-Reinman 1995	79	no				
Yoklavich 1992d		II	Criteria A and C; assoc. with WWII battles		Sep 77	
-Reinman 1994	63	yes				
-Reinman 1995	80	yes				
-Reinman 1994	64	no	removed from original locations			
-Reinman 1995	81	no				
Yoklavich 1992d		II	distinctive method of construction			
-Reinman 1994	65	yes				
-Reinman 1995	82	yes				
-Reinman 1995	83	unev				
h and Craib 1992		I	assoc. with broad patterns of pre-WWII Navy construction			

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
256.	WFANX	Marine Barracks Plaque			1921-on	Craib and Yoklavich Lauter-Reinman Lauter-Reinman
257.	WFANX	Marine Barracks Site	66-03-1036	no surface features remaining	1921-1941	Craib and Yoklavich Lauter-Reinman
258.	WFANX	Military Dump A5-5			?	Lauter-Reinman
259.	WFANX	Miramar Road Remains - A8-2			?	Lauter-Reinman
260.	WFANX	Modified Karst Pits A5-6 & 7			?	Lauter-Reinman
261.	WFANX	NOB Hill Bowl Theater		masonry surface structure, remnant	1945	Yoklavich and Crai Lauter-Reinman Lauter-Reinman
262.	WFANX	Office Bldg. for Shop Area - 1770		wooden surface structure	1947	Yoklavich and Crai Lauter-Reinman
263.	WFANX	Operational Storage Building (former Armco hut) - Bldg. 501A		surface structure	1950?	Craib and Yoklavic
264.	WFANX	Orote Airfield	66-03-1066	limestone surface structure; modified	1942-1944	Craib and Yoklavic Lauter-Reinman Lauter-Reinman
265.	WFANX	Orote Historical Complex	66-03-1009	masonry surface features including Fort Santiago, Spanish Steps, Spanish Well, Orote Archaeological Site; pre-Latte pottery, rockshelter with surface materials; no *latte* remains reported	prehistoric/ historic	Craib and Yoklavic Lauter-Reinman
266.	WFANX	Orote Mangrove Battle Site	66-03-1058	"destroyed site"; no location	1944	Craib and Yoklavic Lauter-Reinman Lauter-Reinman
267.	WFANX	Orote Village			1676	Craib and Yoklavic Craib and Yoklavic Carucci 199 Lauter-Reinman
268.	WFANX	Pad Complex A4-6			?	Lauter-Reinman
269.	WFANX	Pan American Airways Hotel Remains	66-03-0142	concrete foundation only, location in question; destroyed during recapture of Guam	1936-1944	Craib and Yoklavic Lauter-Reinman Lauter-Reinman
270.	WFANX	Pan American Airways Seaplane Ramp		concrete quay	1935-1944	Lauter-Reinman Lauter-Reinman
271.	WFANX	Picnic Structure Pads TN-24		concrete surface features	?	Carucci 199 Lauter-Reinman Lauter-Reinman
272.	WFANX	Piti *Latte* Site	66-03-0137	single 10 pillar *latte*; probably destroyed	prehistoric	Craib and Yoklavic
273.	WFANX	Potable Water Tank - 532			1945	Lauter-Reinman
274.	WFANX	Potable Water Well - C534			1945	Lauter-Reinman
275.	WFANX	Pottery and Lithic Scatter			prehistoric	Lauter-Reinman
276.	WFANX	Pottery Scatters A8-3			prehistoric	Lauter-Reinman
277.	WFANX	Pottery Sherds TN-17			prehistoric	Carucci 199 Lauter-Reinman
278.	WFANX	Prehistoric Rockshelter TN-13	66-02-1302		prehistoric	Carucci 199 Lauter-Reinman

tation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
oklavich 1992d		I	distinct object type			
einman 1994	70	no				
einman 1995	87	no-st				
oklavich 1992d		III	assoc. with broad patterns of Navy WWII			not mapped
einman 1995	88	no	base construction			
einman 1995	89	no				
einman 1995	90	no				
einman 1995	91	no				
and Craib 1992		I	Criterion C; assoc. with broad patterns of			
einman 1994	72	yes	pre-WWII Navy construction; only extant			
einman 1995	92	yes	example			
and Craib 1992		I	assoc. with broad patterns of pre-WWII			
einman 1995	93	unev	Navy permanent base construction; "unique structure due to its materials"			
oklavich 1992c		II	assoc. with the broad patterns of Navy permanent base construction (WWII?)			
oklavich 1992d		II	assoc. with WWII battles	June 75	Feb 75	
einman 1994	76	yes				
einman 1995	94	yes				
oklavich 1992d		I	research potential; assoc. with important	Oct 79	Oct 79	
einman 1995	95	yes	events in history			
oklavich 1992d		II	possible cultural deposits			
einman 1994	77	no				
einman 1995	96	no				
oklavich 1992c		II	potential cultural deposits			
oklavich 1992d		II				
ucci 1993						
einman 1995	97	unev				
einman 1995	100	no				
oklavich 1992d		III	presence of existing remains questionable		Oct 74	
einman 1994	78	mq				
einman 1995	98	no				
einman 1994	79	mq				
einman 1995	99	unev				
ucci 1993	TN-24	NE				
einman 1994	80	no				
einman 1995	101	no				
oklavich 1992d		II				
einman 1994	81	no				
einman 1994	82	no				
einman 1995	104	unev				
einman 1995	105	unev				
ucci 1993	TN-17	NE				
einman 1995	103	no				
ucci 1993	TN-13	D				
einman 1995	106	yes				

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
279.	WFANX	Public Toilet - Bldg. 3170		metal surface structure	1945	Craib and Yoklavich 19 Lauter-Reinman 199 Lauter-Reinman 199
280.	WFANX	Quonset 151		metal surface structure; uncertain date	1944-1945?	Craib and Yoklavich 19 Lauter-Reinman 199 Lauter-Reinman 199
281.	WFANX	Quonset 1627		metal surface structure; in disrepair	?	Craib and Yoklavich 19 Lauter-Reinman 199 Lauter-Reinman 199
282.	WFANX	Quonset 2001A		metal surface structure	1945	Lauter-Reinman 199 Lauter-Reinman 199
283.	WFANX	Quonset 2004		metal surface structure	1944	Lauter-Reinman 199 Lauter-Reinman 199
284.	WFANX	Quonset 2006		metal surface structure	1944	Lauter-Reinman 199 Lauter-Reinman 199
285.	WFANX	Quonset 2008		metal surface structure	1944	Lauter-Reinman 199 Lauter-Reinman 199
286.	WFANX	Quonset 2013		metal surface structure	1944	Lauter-Reinman 199 Lauter-Reinman 199
287.	WFANX	Quonset 2039		metal surface structure	1944	Lauter-Reinman 199 Lauter-Reinman 199
288.	WFANX	Quonset 2049		metal surface structure	1944	Lauter-Reinman 199 Lauter-Reinman 199
289.	WFANX	Quonset 2053		metal surface structure	1944	Lauter-Reinman 199 Lauter-Reinman 199
290.	WFANX	Quonset 2054		metal surface structure	1944	Lauter-Reinman 199 Lauter-Reinman 199
291.	WFANX	Quonset 5407		metal surface structure	1944-1945	Craib and Yoklavich 19 Lauter-Reinman 199 Lauter-Reinman 199
292.	WFANX	Quonset 5408		metal surface structure	1944-1945	Craib and Yoklavich 19 Lauter-Reinman 199 Lauter-Reinman 199
293.	WFANX	Quonset 5409		metal surface structure; destroyed by typhoon	1944-1945	Craib and Yoklavich 19 Lauter-Reinman 199
294.	WFANX	Quonset 609		metal surface structure	1945	Craib and Yoklavich 19 Lauter-Reinman 199 Lauter-Reinman 199
295.	WFANX	Quonset 611		metal surface structure	1945	Craib and Yoklavich 19 Lauter-Reinman 199 Lauter-Reinman 199
296.	WFANX	Quonset 6118		metal surface structure	1945	Lauter-Reinman 199 Lauter-Reinman 199
297.	WFANX	Quonset 630		metal surface structure; in disrepair	1945	Craib and Yoklavich 1 Lauter-Reinman 199
298.	WFANX	Quonset 634A		metal surface structure	1944-1945?	Craib and Yoklavich 1 Lauter-Reinman 199 Lauter-Reinman 199

Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
l Yoklavich 1992c		II	assoc. with the broad patterns of Navy			
-Reinman 1994	83	nce	WWII base construction; modified			
-Reinman 1995	107	no				
Yoklavich 1992d		unev	assoc. with broad patterns of Navy WWII			
-Reinman 1994	85	mq	base construction; unique design			
-Reinman 1995	108					
Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
-Reinman 1994	96	no	base construction			
-Reinman 1995	118	no				
-Reinman 1994	98	no	common			
-Reinman 1995	120	no				
-Reinman 1994	99	nce	early date			
-Reinman 1995	121	nce				
-Reinman 1994	100	no	modified			
-Reinman 1995	122	no				
-Reinman 1994	101	no	modified			
-Reinman 1995	123	no				
-Reinman 1994	102	no	modified			
-Reinman 1995	124	no				
-Reinman 1994	103	no	modified			
-Reinman 1995	125	no				
-Reinman 1994	104	no	modified			
-Reinman 1995	126	no				
-Reinman 1994	105	no	common			
-Reinman 1995	127	no				
-Reinman 1994	106	no	common			
-Reinman 1995	128	no				
l Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
-Reinman 1994	107	yes	base construction; good example of type			
-Reinman 1995	129	yes				
l Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
-Reinman 1994	108	yes	base construction; good example of type			
-Reinman 1995	130	yes				
l Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
-Reinman 1994	109	no	base construction			
l Yoklavich 1992c		II	common; assoc. with the broad patterns of			
-Reinman 1994	87	no	Navy WWII base construction; distinctive			
-Reinman 1995	110	no	construction type			
l Yoklavich 1992c		II	common; assoc. with the broad patterns of			
-Reinman 1994	88	no	Navy WWII base construction; distinctive			
-Reinman 1995	111	no	construction type			
-Reinman 1994	110	no	common			
-Reinman 1995	131	no				
l Yoklavich 1992c		II	assoc. with the broad patterns of Navy			
-Reinman 1994	89	no	WWII base construction; distinctive construction type			
l Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
-Reinman 1994	90	mq	base construction; unremarkable example			
-Reinman 1995	112	mq				

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
299.	WFANX	Quonset 634B		metal surface structure	1944-1945?	Craib and Yoklav Lauter-Reinma Lauter-Reinma
300.	WFANX	Quonset 634C		metal surface structure	1944-1945?	Craib and Yoklav Lauter-Reinma Lauter-Reinma
301.	WFANX	Quonset 730			1944-1945	Craib and Yoklav Lauter-Reinm Lauter-Reinm
302.	WFANX	Quonset 731			1944-1945	Craib and Yoklav Lauter-Reinm Lauter-Reinm
303.	WFANX	Quonset 732			1944-1945	Craib and Yoklav Lauter-Reinm Lauter-Reinm
304.	WFANX	Quonset Hut in Shop Area - Site 1686		metal surface structure	1945	Yoklavich and C Lauter-Reinm Lauter-Reinm
305.	WFANX	Refueling Structure T-3		concrete surface features; unknown function	WWII	Craib and Yokla Lauter-Reinm Lauter-Reinm
306.	WFANX	Remains at Camp Bright TN-11	66-02-1300	concrete features and foundations	WWII	Carucci 1 Lauter-Reinm Lauter-Reinm
307.	WFANX	Remains of Aircraft Eng. A4-12			?	Lauter-Reinm
308.	WFANX	Remains of Comm. Cond.			?	Lauter-Reinm
309.	WFANX	Sewer Features TN-23		concrete and metal surface features	?	Carucci 1 Lauter-Reinm Lauter-Reinm
310.	WFANX	Sewer Features TN-25		metal surface features	?	Carucci 1 Lauter-Reinm Lauter-Reinm
311.	WFANX	Shipboard Guns - Objects		metal objects	?	Craib and Yokla Lauter-Reinm
312.	WFANX	Shop Bldgs. 1714, 1771-1774, 3000-3004, 1767, 1768		metal surface structures	1947 & 1949	Yoklavich and Lauter-Reinm
313.	WFANX	Sinkhole Caverns - PS-1 & 2	66-03-1304	subsurface features	prehistoric	Carucci Lauter-Reinm
314.	WFANX	Stone Wall and Steps TN-21		concrete surface features	?	Carucci Lauter-Reinm Lauter-Reinm
315.	WFANX	Storm Drain & Bridge TN-15		surface features	?	Carucci Lauter-Reinm Lauter-Reinm
316.	WFANX	Structure Foundations A4-4&5			?	Lauter-Reinm
317.	WFANX	Sumay Caves Fortifications		modified rockshelters; surface artifacts	WWII	Lauter-Reinm Lauter-Reinm

itation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
Reinman 1994	91	mq	base construction; unremarkable example			
Reinman 1995	113	mq				
Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
Reinman 1994	92	mq	base construction; unremarkable example			
Reinman 1995	114	mq				
Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
Reinman 1994	93	no	base construction			
Reinman 1995	115	no				
Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
Reinman 1994	94	no	base construction			
Reinman 1995	116	no				
Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
Reinman 1994	95	no	base construction			
Reinman 1995	117	no				
and Craib 1992		II	assoc. with broad patterns of pre-WWII			
Reinman 1994	97	nce	Navy permanent base construction; common			
Reinman 1995	119	nce				
Yoklavich 1992d		II	assoc. with WWII battles			
Reinman 1994	112	no				
Reinman 1995	132	unev				
ucci 1993	TN-11	A				
Reinman 1994	113	no-st				
Reinman 1995	133	no-st				
Reinman 1995	134	no				
Reinman 1995	135	no				
ucci 1993	TN-23	NE				
Reinman 1994	115	no				
Reinman 1995	136	no				
ucci 1993	TN-25	NE				
Reinman 1994	116	no				
Reinman 1995	137	no				
Yoklavich 1992d		II	distinctive object type; removed from			
Reinman 1994	117	no	original locations			
and Craib 1992		II	assoc. with broad patterns of pre-WWII			
Reinman 1995	138	unev	Navy permanent base construction			
ucci 1993	PS-1 PS-2	D				
Reinman 1995	139	no				
ucci 1993	TN-21	A,C,D				
Reinman 1994	118	no				
Reinman 1995	140	no				
ucci 1993	TN-15	NE				
Reinman 1994	119	no				
Reinman 1995	141	no				
Reinman 1995	142	no				
Reinman 1994	120	mq				
Reinman 1995	143	mq				

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
318.	WFANX	Sumay Cemetery	66-03-1041	cemetery with surface features	1910-1943	Craib and Yoklavich 19 Lauter-Reinman 1994 Lauter-Reinman 1995
319.	WFANX	Sumay Village	66-03-1038	no surface structures remain	WWII	Craib and Yoklavich 19 Lauter-Reinman 1994 Lauter-Reinman 1995
320.	WFANX	Tennis Court - 1794		surface feature	?	Lauter-Reinman 1994 Lauter-Reinman 1995
321.	WFANX	Tennis Court -1792			1947	Lauter-Reinman 1995
322.	WFANX	Tipalao Bay South End Caves	66-02-1312	rockshelters; modified or used??	WWII	Carucci 1993 Lauter-Reinman 1994 Lauter-Reinman 1995
323.	WFANX	Tipalao Marsh	66-03-1327	swamp or wetland	?	Carucci 1993
324.	WFANX	Toilet Remains - PS 17		concrete and metal surface feature	?	Carucci 1993 Lauter-Reinman 199
325.	WFANX	Transit Shed No. 1 - Bldg. 3169		metal surface structure	1947	Craib and Yoklavich 19 Lauter-Reinman 199
326.	WFANX	Transit Shed No. 2 - Bldg. 3171		metal surface structure	1945	Craib and Yoklavich 19 Lauter-Reinman 199 Lauter-Reinman 199
327.	WFANX	Tuparao Village	66-02-1311		1672	Craib and Yoklavich 19 Carucci 1993 Lauter-Reinman 199
328.	WFANX	Type 96 Anti-aircraft gun		metal object	1936?	Craib and Yoklavich 19 Lauter-Reinman 199 Lauter-Reinman 199
329.	WFANX	Vehicular Bridge - 1632 - Cmp. C.			1946	Lauter-Reinman 199
330.	WFANX	Walled Structure A5-11		concrete surface feature	?	Lauter-Reinman 199
331.	WFANX	Water Distribution Building - 4181		surface structure	1945	Yoklavich and Craib 1 Lauter-Reinman 199
332.	WFANX	Water Reservoir - 4180		subsurface concrete structure	1949	Yoklavich and Craib 1 Lauter-Reinman 199
333.	WFANX	Water System TN-20		concrete surface features	?	Carucci 1993 Lauter-Reinman 199 Lauter-Reinman 199
334.	WFANX	Water Tank and Wall - A7-3&4			?	Lauter-Reinman 199
335.	WFANX	Water/Drainage Tanks A5-3			?	Lauter-Reinman 199
336.	WFANX	West Orote Bunker A4-7			WWII	Lauter-Reinman 199
337.	WFANX	Wharves L thru Q		concrete structures	1945	Lauter-Reinman 199 Lauter-Reinman 199
338.	WFANX	Alpha, Bravo, Uniform, and Victor Wharves			1946	Craib and Yoklavich 1
339.	WFANX	Sierra, Tango and X-Ray Wharves		metal and wood surface structures	1946	Craib and Yoklavich 1
340.	WFANX	Aichi D3A2 "Val"		submerged Japanese Navy dive bomber	WWII	Lauter-Reinman 199 Lauter-Reinman 199
341.	WFANX	Barge - ABJ Lagoon breakwater		submerged remains		Lauter-Reinman 199 Lauter-Reinman 199

Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
l Yoklavich 1992d		II	Criterion A		Sep 74	
-Reinman 1994	121	yes				
-Reinman 1995	144	yes				
l Yoklavich 1992d		II	potential cultural deposits			
-Reinman 1994	122	mq				
-Reinman 1995	145	mq				
-Reinman 1994	123	no				
-Reinman 1995	147	no				
-Reinman 1995	146	no				
arucci 1993	PS-13	A,D,MP				
-Reinman 1994	125	mq				
-Reinman 1995	149	mq				
arucci 1993	PS-6	D				
arucci 1993	PS-17	NE	lack integrity			
-Reinman 1995	150	no				
l Yoklavich 1992c		II	assoc. with the broad patterns of Navy			
-Reinman 1995	151	unev	permanent base construction; distinctive construction type			
l Yoklavich 1992c		II	assoc. with the broad patterns of Navy			
-Reinman 1994	126	yes	WWII base construction; distinctive			
-Reinman 1995	152	yes	construction type			
l Yoklavich 1992d		II	potential cultural deposits			
arucci 1993	PS-12	C,D				
-Reinman 1995	153	unev				
l Yoklavich 1992d		II	distinctive object type; moved from original			
-Reinman 1994	128	unev	location			
-Reinman 1995	154	unev				
-Reinman 1995	155	unev				
-Reinman 1995	156	mq				
ch and Craib 1992		I	assoc. with broad patterns of pre-WWII			
-Reinman 1994		no	Navy construction; only extant example			
ch and Craib 1992		II	assoc. with broad patterns of pre-WWII			
-Reinman 1995	161	unev	Navy permanent base construction			
arucci 1993	TN-20	NE				
-Reinman 1994	131	no				
-Reinman 1995	162	no				
-Reinman 1995	164	no				
-Reinman 1995	160	no				
-Reinman 1995	165	yes				
-Reinman 1994	132	nce	significantly altered			
-Reinman 1995	166	no				
l Yoklavich 1992d		II	assoc. with the broad patterns of Navy permanent base construction			
l Yoklavich 1992c		II	assoc. with the broad patterns of Navy WWII base construction			
-Reinman 1994						
-Reinman 1995	SR-30					
-Reinman 1994	SR-20					
-Reinman 1995	SR-20					

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
342.	WFANX	Barge - Dry Dock Island		submerged remains		Lauter-Reinman 19 Lauter-Reinman 19
343.	WFANX	Barge - east of Dry Dock Island		submerged remains		Lauter-Reinman 19 Lauter-Reinman 19
344.	WFANX	Barge - Glass Breakwater		submerged remains		Lauter-Reinman 19 Lauter-Reinman 19
345.	WFANX	Barge - Glass Breakwater		submerged remains		Lauter-Reinman 19 Lauter-Reinman 19
346.	WFANX	Barge - Glass Breakwater		submerged remains		Lauter-Reinman 19 Lauter-Reinman 19
347.	WFANX	Barge - northeast 26, 27		submerged remains		Lauter-Reinman 19 Lauter-Reinman 19
348.	WFANX	Barge - northeast of Adotgan Point		submerged remains		Lauter-Reinman 19 Lauter-Reinman 19
349.	WFANX	Barge - Piti channel		submerged remains		Lauter-Reinman 1 Lauter-Reinman 1
350.	WFANX	Caribia - Harbor mouth		submerged remains		Lauter-Reinman 1
351.	WFANX	Fishing Boat - Marianas Yacht Club		submerged remains		Lauter-Reinman 1
352.	WFANX	LCU - Glass Breakwater		submerged remains		Lauter-Reinman 1 Lauter-Reinman 1
353.	WFANX	LCU - north of Orote		submerged remains		Lauter-Reinman 1 Lauter-Reinman 1
354.	WFANX	LCU - Piti back bay		submerged remains		Lauter-Reinman 1 Lauter-Reinman 1
355.	WFANX	Kitsugawa Maru	66-03-1154	submerged Japanese Navy transport ship	1941	Craib and Yoklavich Lauter-Reinman 1 Lauter-Reinman 1
356.	WFANX	Nichiyu Maru	66-03-1155	submerged Japanese Navy freighter	1933	Craib and Yoklavich Lauter-Reinman 1 Lauter-Reinman 1
357.	WFANX	RMS Scotia		submerged ship	1904	Lauter-Reinman 1
358.	WFANX	SMS Cormoran	66-03-1037	submerged ship	1917	Lauter-Reinman 1 Lauter-Reinman 1
359.	WFANX	Tokai Maru	66-03-1089	submerged Japanese Navy transport ship	1930	Lauter-Reinman 1 Lauter-Reinman 1
360.	WFANX	Japanese Naval Tug		submerged remains		Lauter-Reinman 1
361.	WFANX	Tug - Seaplane Ramp		submerged remains		Lauter-Reinman 1
362.	WFANX	Tug - Dry Dock Island		submerged remains		Lauter-Reinman 1
363.	WFANX	Yacht - Marianas Yacht Club		submerged remains		Lauter-Reinman 1
364.	WFANX	Yacht - Marianas Yacht Club		submerged remains		Lauter-Reinman 1
365.	WFANX	Yacht - Marianas Yacht Club		submerged remains		Lauter-Reinman 1
366.	WFANX	Yacht - Marianas Yacht Club		submerged remains		Lauter-Reinman 1
367.	NCTAMS	Barrigada Battlefield	66-04-1059	no surface remains	1944	Craib and Yoklavich Lauter-Reinman 1 Craib and Yoklavic
368.	NCTAMS	Barrigada Golf Course - Facility No. 95		surface feature	1948	Craib and Yoklavich Craib and Yoklavic

ation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
inman 1994	SR-13					
inman 1995	SR-13					
inman 1994	SR-14					
inman 1995	SR-14					
inman 1994	SR-25					
inman 1995	SR-25					
inman 1994	SR-26					
inman 1995	SR-26					
inman 1994	SR-27					
inman 1995	SR-27					
inman 1994	SR-28					
inman 1995	SR-28					
inman 1994	SR-23					
inman 1995	SR-23					
inman 1994	SR-30					
inman 1995	SR-29					
inman 1995	SR-21					
inman 1995	SR-9					
inman 1994	SR-19					
inman 1995	SR-19					
inman 1994	SR-24					
inman 1995	SR-24					
inman 1994	SR-4					
inman 1995	SR-4					
oklavich 1992d			nomination form completed			
inman 1994						
inman 1995	SR-18					
cklavich 1992d						
inman 1994						
inman 1995	SR-5					
inman 1995	SR-22					
inman 1994					July 74	no discussion in report
inman 1995	SR-15					
inman 1994				July 88	July 88	
inman 1995	SR-16					
inman 1995	SR-17					
inman 1995	SR-11					
inman 1995	SR-12					
inman 1995	SR-6					
inman 1995	SR-7					
inman 1995	SR-8					
inman 1995	SR-10					
oklavich 1992a		II	associated with significant event in Guam			
inman 1994	7	no-st	history			
Yoklavich 1996		II	warrants plaque only			
oklavich 1992a		II	associated with broad patterns of Navy			
Yoklavich 1996		III	permanent base construction; earliest extant golf course on Guam			

Map No.	Location	Site Name Used in CRM Reference	Guam HPO Site Number	Description	Dating	Citation
369.	NCTAMS	Bone Discovery	66-08-1193	surface find of isolated human remains with WWII artifacts; likely to yield information important in history; along top of cliff line above the beach	1941-1945	Craib and Yoklavich 1 Craib and Yoklavich Lauter-Reinman 19
370.	NCTAMS	Haputo	66-08-0007	extensive *latte* village - 20 sets identified on coastal flat	prehistoric	Craib and Yoklavich 1 Craib and Yoklavich
371.	NCTAMS	Officers Country entry gates and area - Facility No. 46		two masonry entry pillars	1944-1945	Craib and Yoklavich 1 Craib and Yoklavich
372.	NCTAMS	Officers' Country Pillars		masonry surface features	1945	Lauter-Reinman 19
373.	NCTAMS	Pugua Point Complex	66-08-0008	rockshelter, midden deposits and surface artifacts on coastal flat; 12.35 acres	prehistoric	Craib and Yoklavich Craib and Yoklavich
374.	NCTAMS	Tweed's Cave	66-08-1051	rockshelter with surface materials	1942-1944	Craib and Yoklavich Lauter-Reinman 19 Craib and Yoklavich
375.	NCTAMS			surface sherd scatter, 2.2 m in diameter, no subsurface remains encountered	prehistoric	Kurashina, McGrath Manner 1987
376.	NCTAMS			surface sherd scatter, 12 m in diameter	prehistoric	Kurashina, McGrath Manner 1987
377.	NCTAMS			surface sherd scatter, 11 x 9 m	prehistoric	Kurashina, McGrath Manner 1987
378.	NCTAMS			pottery scatter, ca 7 m in diam, subsurface sherds recovered	prehistoric	Haun 1988
379.	NCTAMS			pottery scatter, ca 100 m^2, no subsurface remains encountered	prehistoric	Haun 1988
380.	NCTAMS			isolated *Tridacna* adze fragment, no subsurface remains encountered	prehistoric	Haun 1988
381.	NCTAMS			pottery scatter, , ca 35 m^2, no subsurface remains encountered	prehistoric	Haun 1989b

Citation	Orig. No.	Nat. Reg. Eligibility Assess.	Eligibility Comments	Nat. Reg. Listing	Guam Reg. Listing	Comments
l Yoklavich 1992a		II				Incorrectly cited as "66-03-1193" in reports.
d Yoklavich 1996		II				
-Reinman 1994	71	no				
l Yoklavich 1992a		I		Nov 74	Nov 74	
d Yoklavich 1996		I				
l Yoklavich 1992a		II	likely to yield information important in history; distinctive masonry construction			
d Yoklavich 1996		II				
-Reinman 1994	73	no-st				
l Yoklavich 1992a		II				
d Yoklavich 1996		II				
l Yoklavich 1992a		II	Criterion A; assoc. with significant persons and events in Guam history			
-Reinman 1994	127	yes				
d Yoklavich 1996		II				
na, McGrath, and anner 1987	T6					Not included in CRMP document
na, McGrath, and anner 1987	T8					Not included in CRMP document
na, McGrath, and anner 1987	T14					Not included in CRMP document
laun 1988	T-1					Not included in CRMP document
laun 1988	T-2					Not included in CRMP document
laun 1988	T-6					Not included in CRMP document
laun 1989b	T-1					Not included in CRMP document

Significance/National Register Eligibility Keys:

Title 36 CFR 60.4 (used by Carucci 1993, Craib and Nees 1995, Henry et al. 1996)		Lauter-Reinman 1994, 1995	
A	The site is associated with events that have made a significant contribution to the broad patterns of our history.	yes	Eligible for listing in the National Reg listed) – retain integrity
B	The site is associated with the lives of persons significant in our past.	nce	Non-contributing element in a National I Grouping – lacking integrity
C	The site embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.	mq	May qualify as an element of a National Grouping, but needs more research
D	The site yielded, or may be likely to yield, information important in prehistory or history.	no-st	Not eligible but is deserving of special tre
		unev	Unevaluated; needs more research before
		no	Not eligible

In addition to the National Register criteria, Carucci 1993 also used:

MP Sites are significant and should be added to the already existing "Japanese Defensive Fortifications on Guam" Multiple Property nomination to the National Register.

NE Not eligible

In addition to the National Register criteria, Henry et al. 1996 also used:

TC Based upon guidelines in National Register Bulletin 38 (1990) sites are significant if they include those properties related to cultural or ethnic identity and values. Evaluated upon their value to contemporary populations, sites defined as significant under this category include those exhibiting rock art, *latte* stones, and human burials.

	Navy HARP (used by Craib and Yoklavich 1992a-d, Yoklavich and Craib 1992)	
nal Register (date given if already	I	...of outstanding historical, architectural, engineering or cultural significance. Further, these resources have been evaluated as having retained their 'integrity' i.e., original and/or authentic Period materials, design and context.
itional Register District or Thematic		
ational Register District or Thematic h	II	Resources of lesser historical, architectural, archaeological, engineering or cultural significance than resources included in Category I. They may not be able to match Category I properties in terms of integrity.
ecial treatment	III	Resources that qualified professionals have concluded do not met national Register eligibility criteria, as well as all World War II temporary buildings, and buildings in historic districts that have been professionally evaluated as non-contributing elements of the district.
before it can be properly evaluated		

Appendix O

Revised Prefinal Military Exercises and Historic Sites in Military Training Areas on the Island of Tinian: An Archaeological Assessment

— REVISED PREFINAL —

MILITARY EXERCISES AND HISTORIC SITES IN THE MILITARY LEASE AREA OF THE ISLAND OF TINIAN, CNMI: AN ARCHAEOLOGICAL ASSESSMENT

by

David J. Welch and H. David Tuggle

Note: This Report Should Be Used In Conjunction With

THE TINIAN HISTORIC SITE PROTECTION PLAN FOR THE MILITARY LEASE AREA, 1996

Prepared for:

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December 1996

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ACKNOWLEDGMENTS

During the background research for the present report, consultation was held with Mr. Scott Russell, Deputy Historic Preservation Officer of the CNMI, Ms. Carmen Sanchez, Tinian Historic Preservation Coordinator, and Mr. Mike Fitzgerald, military liaison of the Office of the Mayor of the Municipality of Tinian. On previous trips to the CNMI relating to site protection planning, consultation was also held with Mr. Michael Fleming, then Historic Preservation Officer (HPO) for the CNMI and with Mr. Joseph Guerrero, who would become the HPO, and with various officials of the Municipality of Tinian. We appreciate very much the information and suggestions they provided regarding historic preservation on Tinian, and these consultations are summarized in the text of the report.

We would like to thank Ms. Amy Sheridan and Mr. David Stefansson, Mr. John Goody, and Ms. Vanessa Kawamura of Belt Collins Hawaii for discussions of the planned military use of the island and keeping us up-to-date on the planning proposals.

Much of this report depends on the data from a recent extensive archaeological survey by Paul H. Rosendahl, Ph.D. Inc. (PHRI). We are very grateful to Mr. David DeFant and Mr. David Henry of PHRI for details they provided to us in discussions regarding the sites of their survey. In addition, we need to thank Dr. Alan Haun for the rapid transmission of the AutoCAD data on site locations from the PHRI survey, information which was used as background for the preparation of many of the maps in this report.

A Cultural Resource Management Plan is being prepared by Ogden Environmental and Energy Services Co., which has also conducted a number of archaeological surveys on the island. We wish to thank Mr. Alan Schilz of Ogden Environmental, who has been extremely helpful to us in providing information regarding sites, surveys, reports, and CRMP planning.

We would like to acknowledge a special debt of gratitude to Ms. Carmen Sanchez, who has provided us with information and support in innumerable ways as part of her continuing efforts to protect the historic resources of Tinian.

Connie Bodner conducted the initial reports review and organized the assessment report for the Tinian Tandem Thrust 93 exercises, the basic foundation for the present report. Roger Blankfein undertook the difficult task of drafting the maps, with the numerous revisions that this entailed. Joan Clarke completed the formatting and final editing of the report.

INTRODUCTION

Approximately 16,100 acres on the Island of Tinian in the Commonwealth of the Northern Mariana Islands (Fig. 1) are under lease to the United States Department of Defense, and are managed by the Commander, Naval Forces, Marianas (COMNAVMAR). This area is known as the Military Lease Area (MLA) and is divided into two sections, the northern half is the Exclusive Military Use Area (EMUA) and the southern half is referred to as the Leaseback Area (LBA). The EMUA is used for periodic military training exercises and is not sub-leased to the public. However, there is no permanent military installation or staffed facility in the EMUA, and it is open to the public for recreational purposes when it is not in use for military training. The LBA is a joint use area, where both military and non-military activities may take place.

A draft Environmental Impact Statement (DEIS) has been developed for military training in the MLA. The present document is an assessment of the historic resources (generally defined as archaeological sites and historic buildings) in the MLA, prepared as a background document for the DEIS. It provides recommendations for site eligibility to the National Register of Historic Places (NRHP), an evaluation of the potential impacts of military training, and a summary of actions related to the protection of sites from military actions. A companion document that should be consulted is *The Tinian Historic Site Protection Plan for the Military Lease Area* (Tuggle and Welch 1996), which includes detailed recommendations for site protection related to the potential impacts of military training, as well as recommendations for protection of sites from other threats. Some of the text in the present report is duplicated in the *Site Protection Plan.*

Background

Preparation of this assessment is based on (1) information derived from existing archaeological survey reports, (2) consultation with archaeological contractors who have conducted surveys in conjunction with specific military exercises, (3) previous archaeological assessments and interim site protection plans (Welch and Bodner 1993; Welch 1994a and 1994b), (4) consultation with representatives of the Historic Preservation Officer of the CNMI and of the Office of the Mayor of the Municipality of Tinian (see Acknowledgments), (5) information of military training plans provided by Belt Collins Hawaii, with background information obtained from military training personnel for Tandem Thrust 95, and (6) field assessments. Portions of the present report have been taken from Welch and Bodner (1993) and Welch (1994a).

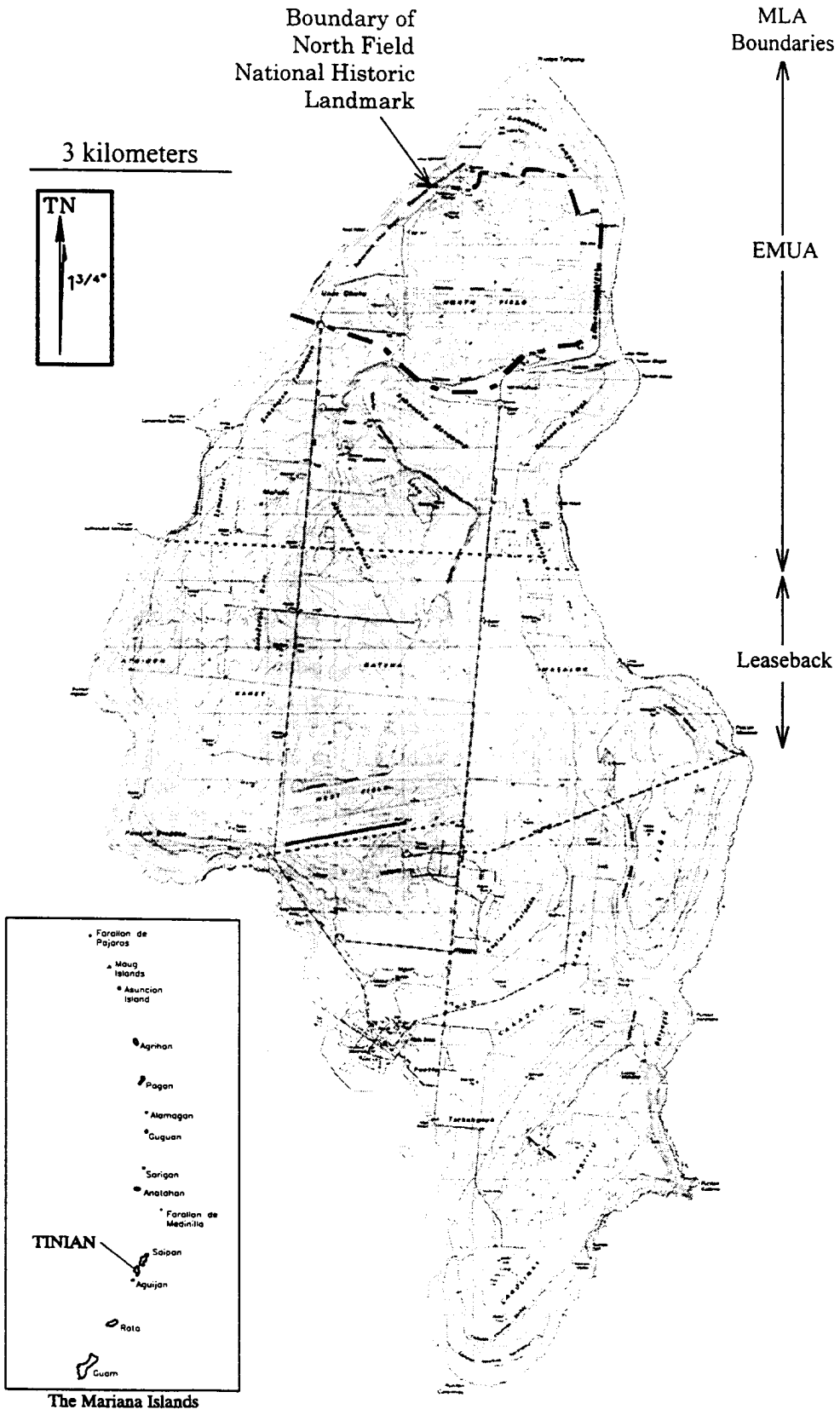


Figure 1. The Mariana Islands, showing Tinian and the project area.

Consultation and review have been effected through attendance at the Navy Tinian Cultural Resource Management Workshop in July 1994, several follow-up phone calls to the principal investigators for the archaeological surveys, review of reports provided by the Navy and/or the contractors, and by several meetings on Tinian and Saipan with staff of the CNMI Division of Historic Preservation.

Following the 1994 workshop, Welch and Tuggle undertook a one week in-field assessment of selected sites in the EMUA, focused on determining applicable and effective measures to protect sites in these areas from potential adverse impacts related to a military exercise planned for late 1994 (Welch 1994b). Subsequently, some site protective procedures were implemented by Tuggle and Jolie Liston in November 1994 and additional in-field site review and assessment were conducted at this time. Planning for public interpretation of selected sites as a part of site protection actions was also carried out during the two 1994 field trips.

For the present report, field assessment of historic resources was conducted by Welch and Tuggle from July 25 to August 2, 1996, with particular emphasis on evaluation of sites recorded by recent survey (Henry et al. 1996).

Two previous versions of the *Archaeological Assessment* have been prepared (Welch and Tuggle 1996a, 1996b). The present version includes a major change in site numbering, discussed below.

The Island of Tinian

The present document is limited in its purpose and does not include a description of the history and environment of the Island of Tinian. This information is summarized in the accompanying DEIS and may also be found in numerous recent publications (e.g., Farrell 1991; Henry et al. 1996; Bodner and Welch 1992).

The Undertaking and the Area of Potential Effect

Military training on Tinian may involve Guam-based elements of the U.S. Navy, U.S. Air Force, U.S. Army Reserve-Marianas, Guam Army National Guard, and Guam Air National Guard as well as U.S. Marine Corps elements from Okinawa and California, U.S. Army units from Okinawa, Hawai'i, and Alaska, U.S. Navy and USAF squadrons from Japan, and some allied forces (Belt Collins Hawaii 1995, 1996a). These exercises proposed for the EMUA (Fig. 2) include airfield operations by fixed-wing and helicopter-borne forces; ground maneuvers through much of the terrain, blank firing and pyrotechnic signals in certain areas; rapid runway repairs in one location at North Field; use of wheeled and tracked vehicles on paved taxiways, roads (and runways?); amphibious assault landings (and beach insertion/extraction) on beach sites; a permanent base camp; live fire weapons range;

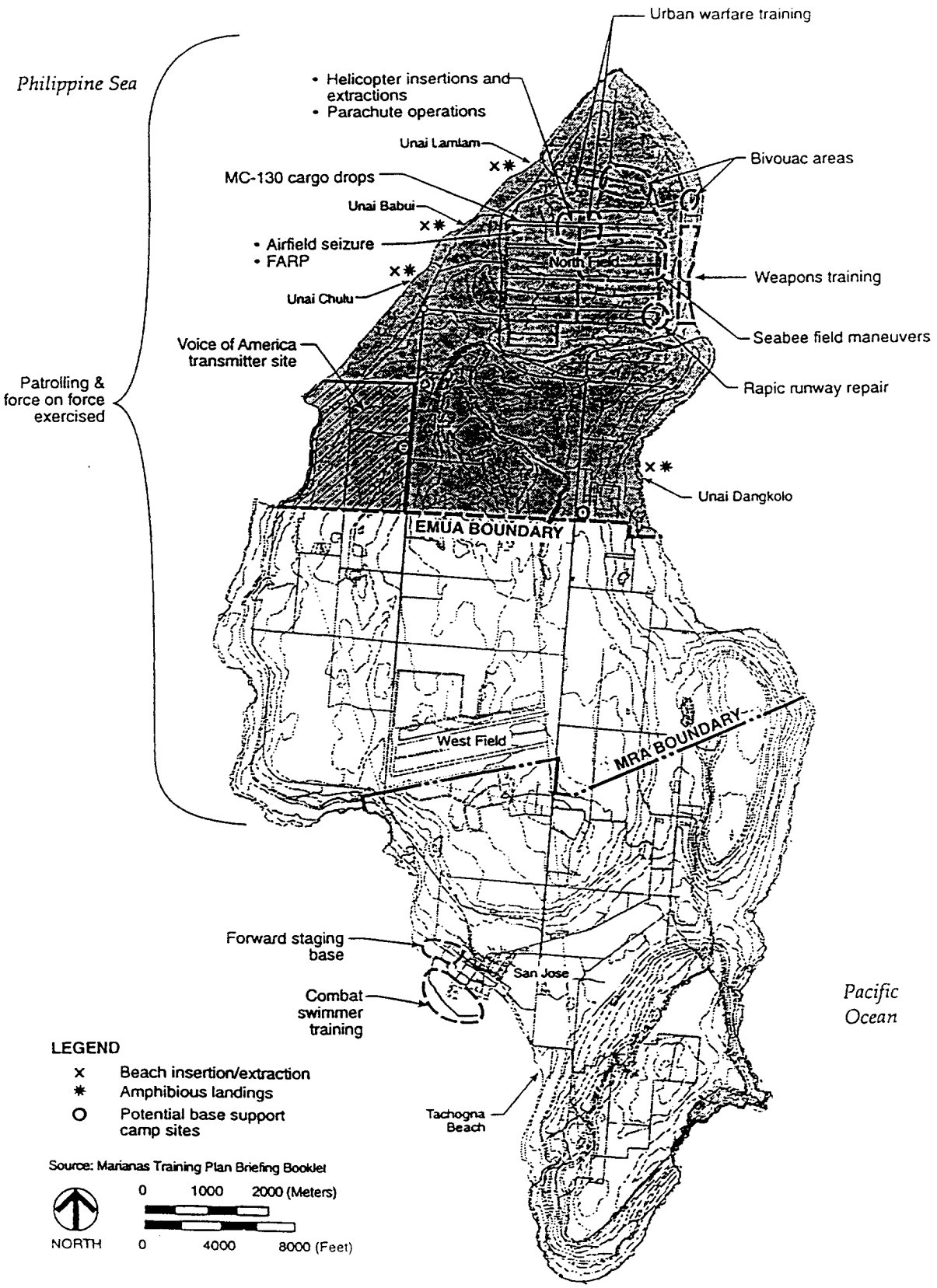


Figure 2. Proposed training areas, Tinian. (From Belt Collins Hawaii 1996a)

transmission of electromagnetic signals; use of demolitions and hand grenades; various logistic operations; bivouac areas; urban warfare training; cargo drops; and Seabee field maneuvers (Belt Collins Hawaii 1995: 13, Figure 7; 1996a: Figure 8; 1996b). In addition, in the LBA, West Field is a possible landing area for airmobile and airborne forces, with ground maneuvers from this area north into the EMUA.

Outside the MLA, it has also been proposed that San Jose Harbor be used for other force introductions, with adjacent forward staging bases, and for combat swimmer training (Belt Collins Hawaii 1995: 13 and Figure 7; 1996a). Kammer Beach has recently been proposed as an alternative landing beach for assault amphibious vehicles.

Based on this preliminary information, it can be concluded that the primary area of potential effect (defined as the area most heavily used) will be the EMUA (see Fig. 1), where most of the MLA archaeological surveys have been conducted. Because of these two factors, historic resources of the EMUA are emphasized in the following sections on inventory and significance. The LBA is discussed to some extent in these sections, but San Jose Harbor and Kammer Beach (outside the MLA) are considered only briefly because of the uncertainty of the proposed military activities in these areas.

HISTORIC RESOURCES INVENTORY

The historic resource inventory includes a listing of all of the historic sites recorded in the MLA, with recommendations regarding significance and eligibility to the National Register of Historic Places (Appendices A and B).

All of the historic resources in the MLA are archaeological sites. Some of these sites are the remains of buildings that have been afforded some inventory treatment as historic structures (e.g., Jones 1991, Bouthillier 1996). However, none of these structures have sufficient integrity as buildings to allow adequate evaluation and appropriate treatment according the guidelines of the U.S. Navy (Greenhorne & O'Mara, Inc. 1990) and thus in the present report are treated exclusively as archaeological sites, not as historic buildings.

Inventory Survey of the Military Lease Area

Prior to the early 1980s, only limited archaeological forays into north Tinian had been made (Thompson 1932; Spoehr 1957) and very few sites recorded. However, under federal historic preservation law and action, numerous archaeological surveys have now been carried out in the MLA (Fig. 3; Table 1), with the most recent survey conducted to complete coverage of most of the area planned for military use in the EMUA (Henry et al. 1996) (Fig. 4).

Inventory survey and selected test excavations have been conducted in most of the EMUA (Figs. 3 and 4), with the only incomplete coverage being in the area surveyed for Voice of America (VOA) (Fig. 3), although not all EMUA areas have been covered with the same intensity (Table 1 and Fig. 5) It is probable that the area west of 8th Avenue will be used by VOA and will not be used for military training. Thus, relevant to military training in the EMUA, only the VOA survey section east of 8th Avenue should be considered insufficiently inventoried for historic resources, if the variation in survey intensity of the EMUA is acceptable.

The Leaseback Area, in contrast, has had only selected survey and site specific search (Fig. 3). Only the 8th avenue corridor has been intensively survey, and as a result the historic resource inventory coverage of the region is incomplete.

The coastal strip behind San Jose Harbor and Kammer Beach was surveyed by Spoehr (1957) and later by Thomas (1980).

The sites identified in these surveys are listed in Appendices A and B.

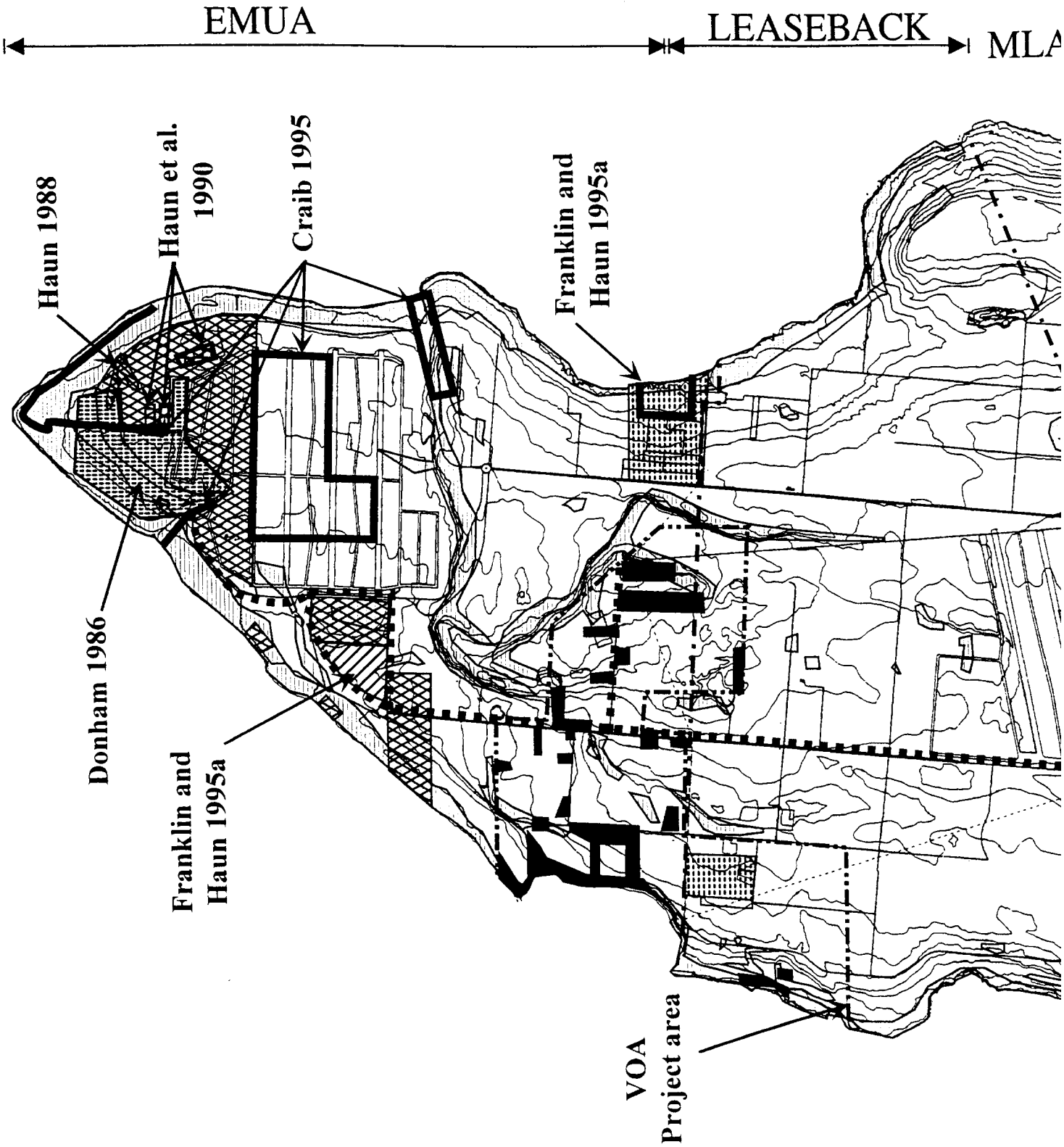
Table 1. Archaeological Projects in the Military Lease Area.

Survey Report	Location	Intensity	Area
Bouthillier (1996)	sites in the EMUA	selected sites	NA
Craib (1993)	six parcels in North Field area	medium	800 acres
Craib (1994; in prep)	Unai Dangkulo, Banderon Nunu, portion of Mt. Lasu, (area north of House of Taga, outside present MLA)	low; limited test excavations	600 acres
Craib (1995)	(1) portion of North Field (2) northern roadways (3) Unai Chiget	medium low low	500 acres linear 28 acres
Denfeld (1983)	North Field	site specific search	NA
Donham (1986)	northern end of North Field	medium	312 acres
Eble et al. (1995)	proposed VOA areas, western area of MLA	low (sample reconnaissance)	small sample of 2,400 acre area
Franklin and Haun (1995a)	Hagoi area, Unai Dangkulo area	high	200 acres
Franklin and Haun (1995b)	8th Ave. road corridor	high, with emergency data recovery	ca. 18 km
Haun (1988)	north end of North Field	medium	40% sample of 80 acres
Haun et al. (1990)	north end of North Field	medium	37 acres
Henry and Haun (1995)	8th Ave. road corridor	testing Franklin and Haun (1995b) locales	ca 18 km
Henry et al. (1996)	major portion of EMUA	intensive	4,162 acres
Jimenez et al. (1996)	Unai Chulu (Site TN-073)	testing	NA
Jones (1991)	historic structures	site specific search	NA
Moore et al. (1986)	coastal zone and selected mountain areas	intensive	1,779 acres

Archaeological Research in the EMUA

Several cultural resource surveys have been conducted within the Exclusive Military Use Area (Figs. 3 and 4). These were designed with different objectives in mind, but together they provide survey at various levels of intensity for most of the EMUA. In addition to field surveys, extensive archival research, primarily of World War II documents, has been carried out. Test excavations have been conducted at several prehistoric sites.

Modern archaeological research in the area was initiated in the early 1980s (1980, 1983, and 1984) by D. Colt Denfeld (1983, 1992) for the CNMI Historic Preservation Office. This resulted in the identification of large, prominent features from the Japanese use of Ushi Airfield and the American use of North Field. Denfeld recorded 11 Japanese sites and 20 American sites (Appendix A). In addition, Denfeld noted the significance of Unai Chulu and nearby Unai Babui as the beaches on which the American invasion forces landed in 1944. He recorded several features in the vicinity of these beaches, including Japanese pillboxes, gun positions, and exits and service roads.


EMUA
LEASEBACK
MLA
Haun 1988
Haun et al. 1990
Craib 1995
Franklin and Haun 1995a
Donham 1986
Franklin and Haun 1995a
VOA Project area

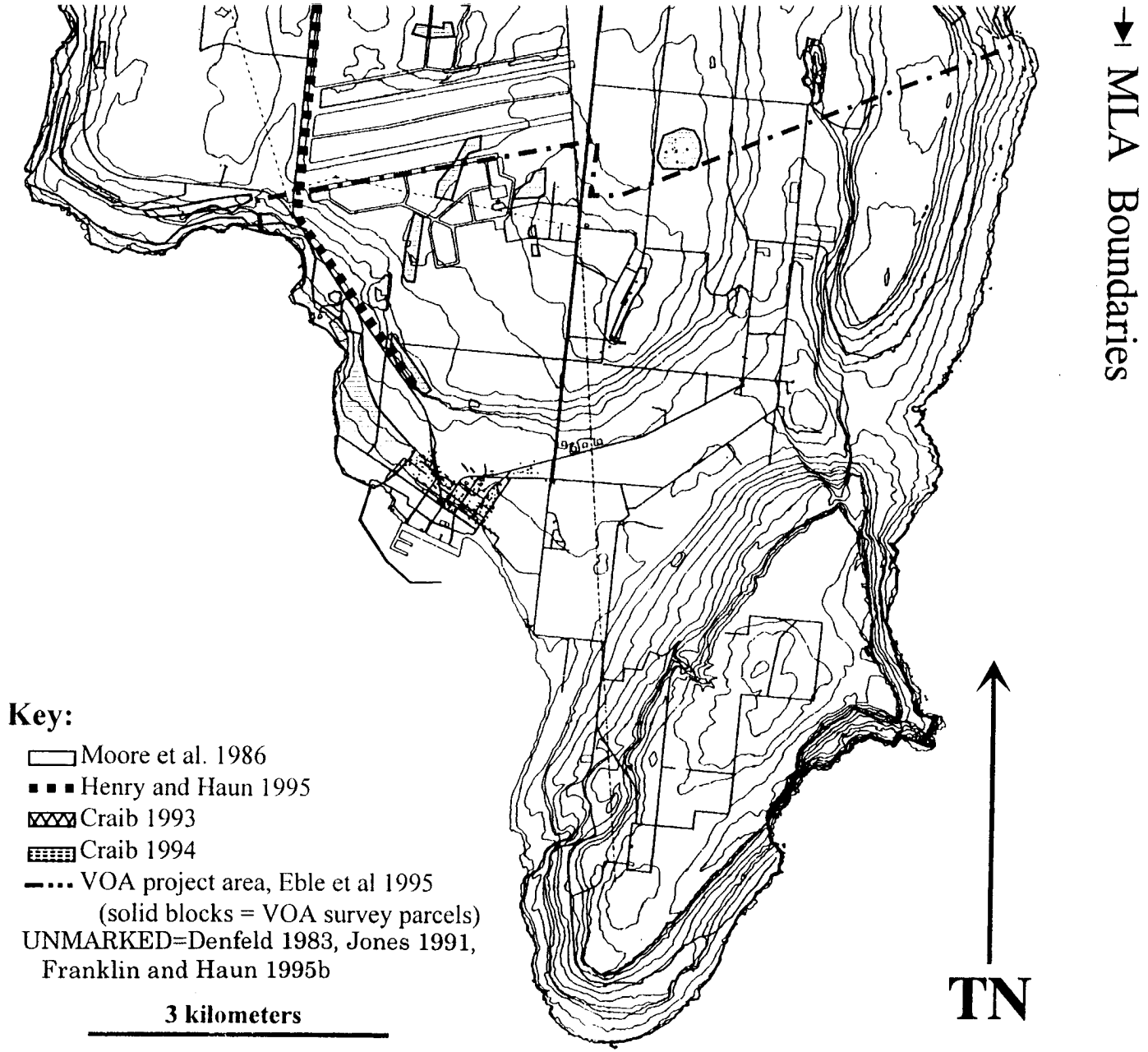


Figure 3. Map of Tinian showing the Military Lease Area and locales of archaeological surveys (pre-Henry et al. 1996).



Figure 4. Survey area of Henry et al. (1996), shown in unscreened area (from Henry et al. 1996). Screened areas are other surveys, as shown in Figure 3.

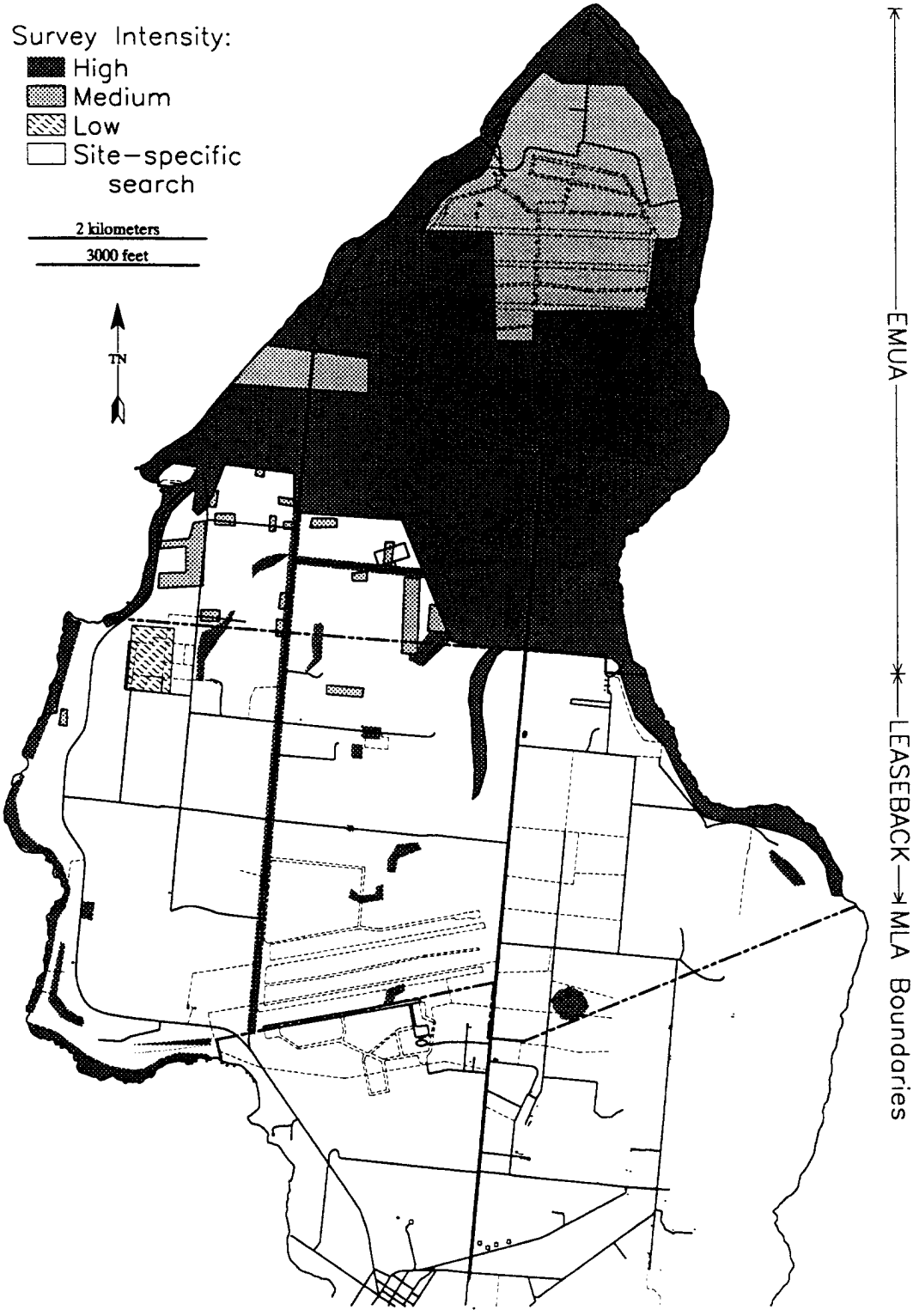


Figure 5. Survey intensity in the MLA.

Following Denfeld's work a National Register nomination form for North Field (Thompson 1984) was prepared, submitted, and revised, and in 1987 North Field was listed as a National Historic Landmark (see Fig. 1). Lying within the 1987 Landmark boundaries and included on the nomination form are five Japanese structures, a Japanese service apron, two American invasion landing beaches, and the North Field runways, taxiways, and service aprons. In 1985 Jack Jones (1991) conducted an investigation of non-indigenous resources on Tinian not included on the National Register form. In his inventory, Jones included Unai Chulu and Unai Babui. He documented 17 other significant Japanese pre-World War II, Japanese World War II, and American World War II sites in the general area of the EMUA, and a number of others in what is now the LBA.

In 1984 and 1985 American Resources Group (ARG) undertook the first major archaeological survey for indigenous sites on northern Tinian (Moore et al. 1986). Several relatively undisturbed parcels in the northern section of the island were selected for investigation (Fig. 3; Appendix A). ARG surveyed numerous parcels along both the west and east coasts, as well as several scattered inland parcels. Along the west shore, they recorded seven prehistoric sites, consisting of scatters of pottery and other indigenous artifacts and remnants of *latte* sets, including one site at Unai Chulu and one at Unai Babui. On the east coast they identified two *latte* set complexes, one made up of three sites at Unai Masalog and one of 10 sites at Unai Dangkulo. ARG prepared National Register nomination forms (1985) for the sites at Unai Dangkulo, nominating them as a complex, the Unai Dangkulo Archaeological District.

In the late 1980s, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted field surveys of three areas north of North Field in connection with the planned Relocatable-Over-the-Horizon Radar Project (ROTHR). A survey by Donham (1986) located 50 sites within a 312-acre parcel, a survey of approximately 40 percent of an 80-acre area by Haun (1988) identified features in the 358th and 359th US Service Group facilities area, and a survey of 3 separate parcels totaling 37 acres by Haun et al. (1990) located 41 American World War II features, which were grouped by Haun into one site. In connection with ROTHR, PHRI also conducted extensive background documentary research concerning North Field, assembling numerous documents, photographs, and other data, mostly related to the American invasion and use of the area during World War II (Dilli and Haun 1991). The report recommended expansion of the boundaries of the North Field Historic District to include the US North Service Group facility areas, the 18th Naval CB/509th Composite Group camp, and the Japanese Asahi Shrine.

Three recent surveys have been conducted by Ogden Environmental and Energy Services Co. The first, conducted in 1992 (Craib 1995), included the area between Runways 1 and 4 within North Field, a road running north from North Field, and Unai Chiget (Fig. 3), with the result that 48 prehistoric and historic period sites were identified (Appendix A).

A second Ogden survey, conducted in March 1993, included four survey areas (Craib 1993). Area 1 lay to the southwest of North Field, Area 2 at the northwest corner of

North Field, Area 3 at the northeast corner of North Field, and Area 4 near the north end of the island (Fig. 3). The survey team recorded 349 locations with evidence of former cultural activity (Appendices A and B). Subsurface testing of previously identified sites along the west coast was also conducted (Craib 1993).

The third Ogden survey was carried out by Craib in early 1994 (Fig. 3) and involved a low intensity coverage of about 540 acres in what is now the MLA (Craib 1994; in prep.; with additional work in the area of the House of Taga). At Unai Dangkulo, the area behind the coast within the ARG survey area was resurveyed and a sketch map of site locations prepared. Preliminary results suggested that five additional *latte* sets may have been found in addition to the 16 *latte* features previously recorded by ARG. Shovel tests were conducted within the *latte* complex. West of the *latte* site complex, extending to Broadway, the survey team recorded the remains of the 12lst Naval Construction Battalion camp site. These remains included concrete pads and pavings, coral paved roads and walkways, and historic debris. South of the Unai Dangkulo *latte* sites at a cave site (Z-563), pictographs were observed on a rock face near the large cave's entrance. The survey area extended west from Broadway to the Lasu cliff face. Caves were concentrated along the lower face of the cliff, most exhibiting some form of modification, primarily rock walls constructed at the entrance. Historical material found inside the caves includes bottles, porcelain pottery, and metal fragments. Major use of these caves and construction of the modifications appear to date to the latter years of World War II. Two small areas were surveyed on the plateau above the Laderan Lasu cliff lines at the base of the Mount Lasu summit. The survey areas consist of cultivated fields. These contained a continuous scatter of pottery sherds. Evidence in the form of broken up limestone and high densities of pottery and pounder fragments are indicative of a prehistoric *latte* settlement. West of Mount Lasu on a plateau overlooking the west coast at Puntan Lamanibot Sanpapa a 150 acre survey area consisted of several cultivated fields contained continuous scatters of pottery sherds. A few basalt pestle fragments and marine shells were noted. The evidence suggested that this was an agricultural rather than a settlement area.

In the last three years, six surveys and related test excavations have been conducted in the MLA, five of these by PHRI and one by BioSystems Analysis, Inc. Four of the PHRI projects were conducted in relation to a military exercise that was planned for late 1994, and to site damage caused by unauthorized bulldozing along roads in the MLA (Fig. 3, Appendix A). The fifth PHRI project was intensive survey of a large portion of the EMUA, intended to largely complete the inventory of the area relevant to the EIS evaluation for military training (Henry et al. 1996). The BioSystems survey was a preliminary assessment of areas for possible location of Voice of America (VOA) Relay Stations.

As part of the PHRI work, intensive survey was carried out near Lake Hagoi and at Unai Dangkulo (Franklin and Haun 1995a). In the Hagoi area 18 sites were defined, primarily consisting of features relating to WWII Japanese military installations and to the edge of a Japanese village, the main portion of which was identified by Craib (1993) on the west side of Lake Hagoi. A sherd scatter related to the major prehistoric site complex at Unai Chulu was also located. At Unai Dangkulo, the numerous sets of *latte* in the area that had

been individually numbered as sites during previous surveys were combined into a single site (DS-21, or TN-078 in the CNMI numbering system; see Tuggle and Welch 1996, Table C-2), and a number of other sites were identified, including sherd scatters, a few remains indicating previous Japanese period occupation in the area, and American military features, primarily associated with the 121st Naval Seabee camp. Two caves may have been utilized prehistorically and by the Japanese, one as a World War II refuge cave. One basalt mortar and two artifact scatters were identified.

Related to the site damage assessment and data recovery project, survey and test excavation were conducted along the roadside of the western roadway stretching 14 km from San Jose to the northern end of the island (Franklin and Haun 1995b; Henry and Haun 1995), extending through the EMUA as well as the LBA. These two projects identified some 63 sites, the majority of which are sherd scatters, but which also included a WWII LVT and several pre-war Japanese habitation features or complexes.

A detailed survey and intensive test excavations were also conducted at Unai Chulu by PHRI as an effort to identify the boundaries of this important prehistoric site (Jimenez et al. 1996). This site (CNMI Site TN-073) is discussed below under Site Protection Area Q.

The VOA project area covered a large area of the EMUA and also extended into the LBA (Fig. 3), but the survey itself consisted of only a small sample of each of these three locales (Eble et al. 1995). Thirty-two sites were recorded (Appendices A and B), including prehistoric pottery scatters, Japanese civilian features, and several sites related to WWII.

The most recent archaeological project in the MLA is an intensive survey of over 4,000 acres (Fig. 4), with intensive testing of a number of prehistoric sites (Henry et al. 1996). The survey covered areas which had not been previously surveyed as well as areas that had previously been covered only by low intensity surveys. This survey completed the inventory coverage of the EMUA, except for a portion of the VOA survey area, and resulted in the identification of 520 sites, representing all periods of Tinian history (Appendices A and B).

Archaeological Research in the Leaseback Area

Very little archaeological work has been carried out in the Leaseback Area (Fig. 3). The ARG survey in the 1980s (Moore et al. 1986) was the first modern archaeological survey in this area. In the early part of the century, limited survey had been conducted by Hornbostel (Thompson 1932), followed by Spoehr's (1957) more intensive work along the coasts, resulting in the identification of archaeological areas defined by sherd scatters and several major *latte* sets. ARG surveyed nearly the entire east and west coastlines of the LBA, recording six sites along the west coast and three sites along the east coast. The east coast sites consist of three groups of *latte* sets that together form a cluster called the Unai Masalog Archaeological Complex. The west coast sites include a disturbed *latte* set, a complex of *latte* sets and a quarry, rock shelters, and three artifact scatters.

At the time of the ARG inventory, Jones' survey of non-indigenous resources on Tinian was carried out, resulting in the location of numerous sites in what is now the LBA (Jones 1991: Figure 19). Jones recorded significant pre-World War II Japanese structures, including a civilian camp police center, an administration building, the communications center, and a Shinto shrine. Japanese World War II features are less common in this area than in the EMUA with a large gun, antenna tower supports, and a small airfield recorded. Remains of the intensive American military occupation are more common and include foundations and remnant structures of the Quonset huts and revetments at the Masalog storage area, a bomb group camp, a bomb wing headquarters, a Seabee camp, and West Field.

Of the recent intensive surveys of the MLA, only the roadside damage assessment survey extended into the LBA (Franklin and Haun 1995b; Henry and Haun 1995), resulting in the identification of a number of sherd scatters, Japanese civilian structures, and features associated with West Field.

Approximately one-third of the VOA reconnaissance project (Eble et al. 1995) was located in the LBA, but the actual sample survey area in the LBA consisted of three small transects (Fig. 3), with the recording of three sites (Appendix A).

In order to take into account the numerous remnants of the WWII US sites in the areas, which have not been recorded due to the limited survey of the area (Jones 1991), aerial photographs have been used to define general site complex boundaries in the LBA (as described below)

Archaeological Site Numbering

Appendices A and B list the sites recorded within the boundaries of the EMUA and LBA. The problems with Tinian site numbers and the manner in which the problems have been temporarily resolved are discussed in the following.

Site Numbering Problems

Because of variation in the way researchers have identified and grouped sites, it is difficult to precisely enumerate the total number of sites in the area. It is common for each new survey to assign new (temporary) numbers to sites that have already been assigned (temporary) numbers by previous researchers. In some cases single sites have three or four temporary numbers. Thus combining the reported sites into a single list using the temporary site numbers assigned by the various researchers can result in a great deal of confusion in site labeling.

Because most researchers begin their temporary series with "1" and number sites in order, there is a great deal of repetition of these temporary numbers. In at least one case, one

phase of a project assigned numbers with a "T" for temporary, then in the second phase assigned the same series of numbers without the T to another set of sites. Further, what is counted as one site with several features in one report may be broken down into two or three sites in another report, then recombined and added to another site in yet a subsequent report. In several cases differences in the description or the indicated location between one report and another make it impossible to be certain if two descriptions refer to a single site or to two separate sites. In other instances, some previously recorded sites are given new numbers, others are referred to by old numbers, and yet others (in the survey area) are ignored altogether. These problems are compounded when maps of site locations are not provided, as is the case with some reports. There have been no limits to the ingenuity employed in creating site number chaos.

A complicating factor is that, to the best of our knowledge, none of the draft or final reports for northern Tinian have used the permanent CNMI site numbers that have been assigned by the HPO or have acquired permanent CNMI numbers for the sites recorded in new survey areas.

Site Re-numbering and Reorganization

In order to move toward clarity in site numbering and site identification, three actions have been taken in the *Archaeological Assessment*.

First, in cases where a permanent CNMI number can be identified with a specific survey site (see below), the CNMI number is used.

Second, an attempt has been made to identify all duplicate sites given various temporary numbers. When duplication has been found, the two are listed under a single number. The various numbers assigned sites are listed in Appendices A and B.

The third action has been to assign a new number to all sites that do not have a CNMI number.

CNMI Permanent Numbers (TN-sites)

A list of the previously assigned CNMI permanent numbers was obtained from the Tinian Historic Preservation Coordinator. Unfortunately, not all of the sites with permanent numbers on this list could be identified because of the loss of the original sites forms in a DHP building fire, and because of the limited information on the site number list. The permanent site numbers are shown in Appendix A (and tables and figures below), with the suffix "TN-" (for Tinian). However, the numerical prefix used by the CNMI HPO to indicate chronological placement of the site has not been included. This system has been changed recently and the chronological designation should be given by the CNMI DHP when the final

set of CNMI numbers is established for all of the sites in the MLA. This does not affect the primary site numbers, which are unique in the Tinian sequence.

It should be pointed out that the exact definition of the CNMI sites and their boundaries is unknown, given the loss of the site forms. Consequently, site boundary identification will have to be established when CNMI site forms are completed for all sites. However, some modification of the original site definition (and thus site form) would have been necessary in many cases because of the substantial amount of new information collected by the recent surveys.

Site Renumbering (Z-sites)

In previous reports, the multiplicity of site numbers was dealt with in various ways (Welch and Bodner 1993; Welch and Tuggle 1996b), all involving designations keyed to an original site survey and survey numbering. This has proved too cumbersome to use readily, and it was decided to apply a single sequence of site numbering to all of the sites without permanent CNMI numbers. However, in order to make this as efficient as possible, an unduplicated Tinian number sequence was obtained from the CNMI Division of Historic Preservation (letter of September 17, 1996). These numbers (from 353 to 614) are indicated with a "Z-" in the tables, figures, and appendices). The various temporary site numbers are indicated in Appendices A and B, and a table of concordance showing the conversion from old to new numbers is in the *Site Protection Plan* (Tuggle and Welch 1996:Appendix C)

One component of the permanent numbering of CNMI sits has not been used here. Ordinarily added to each site number is a prefix that indicates the cultural/chronological association of the site (e.g., 1- for the Prehistoric Period; 4- for Japanese Prewar Period). These prefixes are not assigned in the present report because of the problems offered by multi-component sites or sites of uncertain identification. The decision for this designation is left for the process of completing the CNMI site forms, when detailed consultation with the DHP can be carried out.

It has to be emphasized that the Z-numbers are not permanent CNMI numbers. The CNMI DHP requires that site forms be completed before permanent CNMI site numbers are assigned. However, when such forms are eventually completed, the working sequence can be easily converted to permanent numbers because they do not duplicate existing CNMI Tinian numbers.

In the process of assigning a consistent set of numbers to the Tinian sites, it was decided to organize the recorded sites and features, where possible, into spatial clusters of similar features under a single site designation. This was done for three reasons. First, there is a great deal of variation in how sites have been defined and in how features have been grouped; the present organization into feature clusters introduces some level of consistency (although this needs additional refinement). Second, features clustered under single site numbers provide more manageable units for planning than the much larger numbers of

individual site-feature designations. Third, when the final permanent CNMI site numbers are assigned (with some expected site reorganization), it will prove much easier to segregate features into separate sites and assign additional numbers, if necessary, than to combine existing sites and remove numbers.

In reorganizing site and feature numbers, the attempt was made to include all clustered features that appear to be part of a single "activity area" or occupation under individual site numbers. For example, clusters of defensive features are grouped as single sites, and individual US military camps are given singe site designations.

Every cluster of *latte* sets (with the associated sherd scatter and subsurface deposit) has been given a single site number. This follows the *de facto* CNMI practice as indicated by the fact that many of these clusters had been assigned CNMI permanent numbers. This eliminates the confusion created by giving a site number to each set in a cluster. The multiple numbering of clustered sets led to problems with site boundaries and uncertainty as to whether *latte* sets had or had not been recorded. For example, the *latte* complex at Unai Dangkulo has been formally surveyed at least four times in the last ten years (See Tuggle and Welch 1996:Table C-2), with the sets grouped, ungrouped, numbered and renumbered in a variety of ways in these surveys (with one of the last surveys recommending that the site be surveyed yet again), with some surveys finding "new" *latte* stones that were recorded in previous surveys.

Archaeological Site Locations

The large number of sites in the EMUA makes compilation of all of the sites on a single map unworkable. Locations of sites recommended as eligible to the National Register are shown in the present report on maps of individual protection areas, as defined below. These maps, however, have to be used with some caution. They are compiled from many different sources and the accuracy of site locations may vary considerably. These maps are for general planning purposes and should not be used to define exact locations.

The Archaeological Site Inventory

The total number of sites recorded for the MLA (as complied and edited for the present report) is 525, ranging from prehistoric sites to World War II buildings. Of these, 309 are recommended as eligible to the National Register of Historic Places (Appendix A), and 216 are recommended as not eligible to the National Register (Appendix B). Eligibility recommendations are discussed below.

SIGNIFICANCE EVALUATION AND POTENTIAL EFFECTS

Archaeological sites are evaluated for significance in terms of their ability to meet the criteria of eligibility for nomination to the National Register of Historic Places (NRHP). To be considered eligible, sites must possess integrity and meet at least one of the following four criteria of historic value:

A: The site is associated with events that have made a significant contribution to the broad patterns of our history.

B: The site is associated with the lives of persons significant in our past.

C: The site embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.

D: The site has yielded, or may be likely to yield, information important in prehistory or history.

Sites may be placed on the NRHP according to these criteria or they may be determined eligible for the NRHP according to these criteria, and in both instances are afforded the attention of appropriate historic preservation law.

The National Historic Landmark and Sites Listed on the National Register of Historic Places

One site complex that is listed on the NRHP and is also a National Historic Landmark is North Field, but there is considerable confusion regarding (1) the boundaries of the area (partly because several NR eligibility and nomination forms have been submitted) and (2) which properties are recognized as contributing elements (cf. Dilli and Haun 1991: 15; Spencer Mason Architects 1994). In Figure 1 the boundary of the North Field National Historic Landmark is derived from the landmark map in Dilli and Haun (1991: Figure 4), based on the 1986 nomination form. It is probable that at least included as contributing elements are the runways/taxiways, White Beaches 1 and 2, and the major Japanese buildings at Ushi Field.

However, a reconsideration of the boundaries of North Field has been undertaken by the U.S. Navy and the National Park Service, and it is assumed that a final determination on this will be made in the near future. It is recommended here that this boundary should at least include all of the features closely associated with the atomic bomb missions: these would

include not only North Field and the bomb loading pits, but also the service area for the 509th composite group (Site Z-362), the camp for the 509th composite group (Site TN-039) and the site identified as the location of the atomic bomb assembly (Site TN-041; see Appendix C).

Other sites on Tinian that are reported to be listed on the NR are "the NKK Administration Building, the NKK Ice Storage Plant, the NKK Laboratory, and a Japanese Structure near Red 2 Beach" (Spencer Mason Architects 1994:np). This listing has not been verified, but none are in the MLA.

Preliminary Significance Assessments

The recommendations concerning site significance and eligibility to the NRHP for all of the sites recorded in the MLA are presented in Appendix A. This is a summary with some modifications of previous eligibility recommendations, as indicated in the following.

In the majority of archaeological survey reports for the MLA, no recommendations for site significance or NRHP eligibility have been made. Welch and Bodner (1993) prepared a summary of sites recorded up to 1993 and provided such recommendations, later supplemented by Welch (1994). The Welch and Bodner (1993) recommendations were made for sites that had been recorded, but for which the original investigator had made no assessment or made an incomplete assessment. The evaluations of Welch and Bodner (1993) are based on a full assessment of all previous work conducted within the boundaries of the EMUA prior to 1993. None of the researchers who had conducted archaeological or historical investigations in the EMUA provided explicit evaluations of sites in terms of specific National Register criteria. Evaluations have consisted of general appraisals of site importance (e.g., Craib 1992, 1993), statements that particular sites are eligible for the National Register (e.g., Jones 1991: 345; Moore et al. 1986: 205), or evaluations of whether sties are significant for their information content or as excellent examples of a site type (e.g., Donham 1986: 102-103). The justification for these recommendations is in Welch and Bodner (1993) and Welch (1994). Subsequently one revision of an original survey report (Craib 1995) has adopted the Welch and Bodner (1993) recommendations for sites in its survey area.

With minor revisions, the present report maintains the recommendations for site significance for those sites included in Welch and Bodner (1993). The most recent survey report for the MLA (Henry et al. 1996) includes recommendations for site significance, largely covering sites not on the Welch and Bodner list. For the sites recorded by Henry et al. (1996), most of the significance recommendations are accepted in the present report (Appendix A), although there is some variation in the specific criteria on the basis of which sites are recommended for eligibility, and some variation due to the grouping of sites from Henry et al. (1996) in the present report.

Appendices A and B present sites in two categories, those recommended as not significant or not eligible for the NRHP and those recommended as eligible for the NRHP. In

the first category are sites that do not appear to meet eligibility criteria, primarily bulldozed debris piles, trash dumps, and isolated military features of no identifiable importance, such as pipelines. In addition, Appendix B includes sites considered eligible under Criterion D, but for which adequate information has been recovered, with no consideration for preservation, listed in Henry et al. (1996: Table 35) as NFW (No Further Work) with no preservation. However, some of the sites in this category in Henry et al. (1996) have been moved into the category of recommended eligible (Appendix A) because they have artifacts of historic importance (primarily WWII or Japanese era materials) that should be collected and preserved, constituting additional value based on need for data collection. Site evaluation is discussed in more detail in Tuggle and Welch (1996).

General Potential Adverse Effects

The military exercises proposed for Tinian could adversely impact sites in the area in a number of ways. The most serious threat would result from activities associated with any new construction; with area clearance (such as bulldozing for landing zones); with the use of vehicles off established roads (all-terrain vehicles, bulldozers, landing vehicles); with maneuvers that involve the digging of foxholes, latrines, and other subsurface excavations; and with the use of live fire. Other damage to the historic resources could come from the presence of large numbers of individuals and involve removal of historic artifacts and vandalism.

In Appendix A, one column is dedicated to the sensitivity to threats from the various potential actions. Military impact is also evaluated in Tuggle and Welch (1996).

SITE PROTECTION PLANNING

The following section provides the general plan recommended for the avoidance or mitigation of any potential adverse effects of the undertaking on the historic resources of the MLA. The framework for this is provided by reference to CNMI HPO priorities.

CNMI HPO Priorities

The staff of the CNMI Office of Historic Preservation provided the following information related to their priorities and concerns. This is, however, a summary prepared by the authors of the present report, based on consultation (see Acknowledgments), but has not been reviewed or approved as their position, and thus should be taken as general guidelines. The official position of the HPO in these matters will probably be addressed in a formal review of the EIS, the present *Assessment*, and the *Site Protection Plan*.

The highest priority of the HPO for site protection and preservation is intact prehistoric sites. The second priority for site protection and preservation is relatively unique and significant historic sites. There is particular concern with protection of sites at Unai Babui, Unai Chulu, Unai Dangkulo, and with the sites on the clifflines (which contain prehistoric deposits in shelters and caves, as well as numerous WWII features).

Regarding site management, concern was expressed regarding whether or not ground disturbing activities could be monitored during exercises, what sanctions might be available for violation of site protection measures during exercises, and what measures will be in place to clean up debris left on sites and in the vicinity of sites as a result of military exercises and encampments. The last item relates to experience following TT95 in which large quantities of trash were reported to have been left in the exercise areas, and had to be removed by Historic Preservation staff and others.

Concerning site recording, the staff of the HPO would like to see individual site significance statements presented in survey reports, and would like to see a consistent application of the CNMI site numbering system to sites within the MLA.

Recommended Protection Measures for the EMUA

The following measures are recommended for the mitigation of potential adverse impacts on the historic resources of Tinian as a result of military exercises.

This is a summary of the actions that are presented in the companion document *The Tinian Historic Site Protection Plan for the Military Lease Area* (Tuggle and Welch 1996), which should be consulted for more detail.

It should be emphasized that the recommendations below are specific to the military undertaking, and should be implemented within the more general site management framework recommended in Tuggle and Welch (1996), noting in particular, as described in the inventory section above, that the identification of resources at the level of inventory survey has not been completed for some areas of the EMUA or for most of the LBA.

The basic approach to site assessment and protection planning is the division of military lands into categories of constraint related to the significance and sensitivity of sites within those areas. This approach met with the general approval of the staff of the CNMI HPD and is also incorporated into the *Site Protection Plan* (Tuggle and Welch 1996).

Recommended protective measures are as follows:

I. Identification and marking of Site Protection Areas.

It is recommended that the EMUA be divided into Site Protection Areas (SPA), based on site sensitivity and importance. Proposed boundaries of Site Protection Areas are presented in Figure 6.

Following a final and accepted definition of these areas, they should be clearly marked on the ground and identified on appropriate operational military maps.

The categories of the protection areas are:

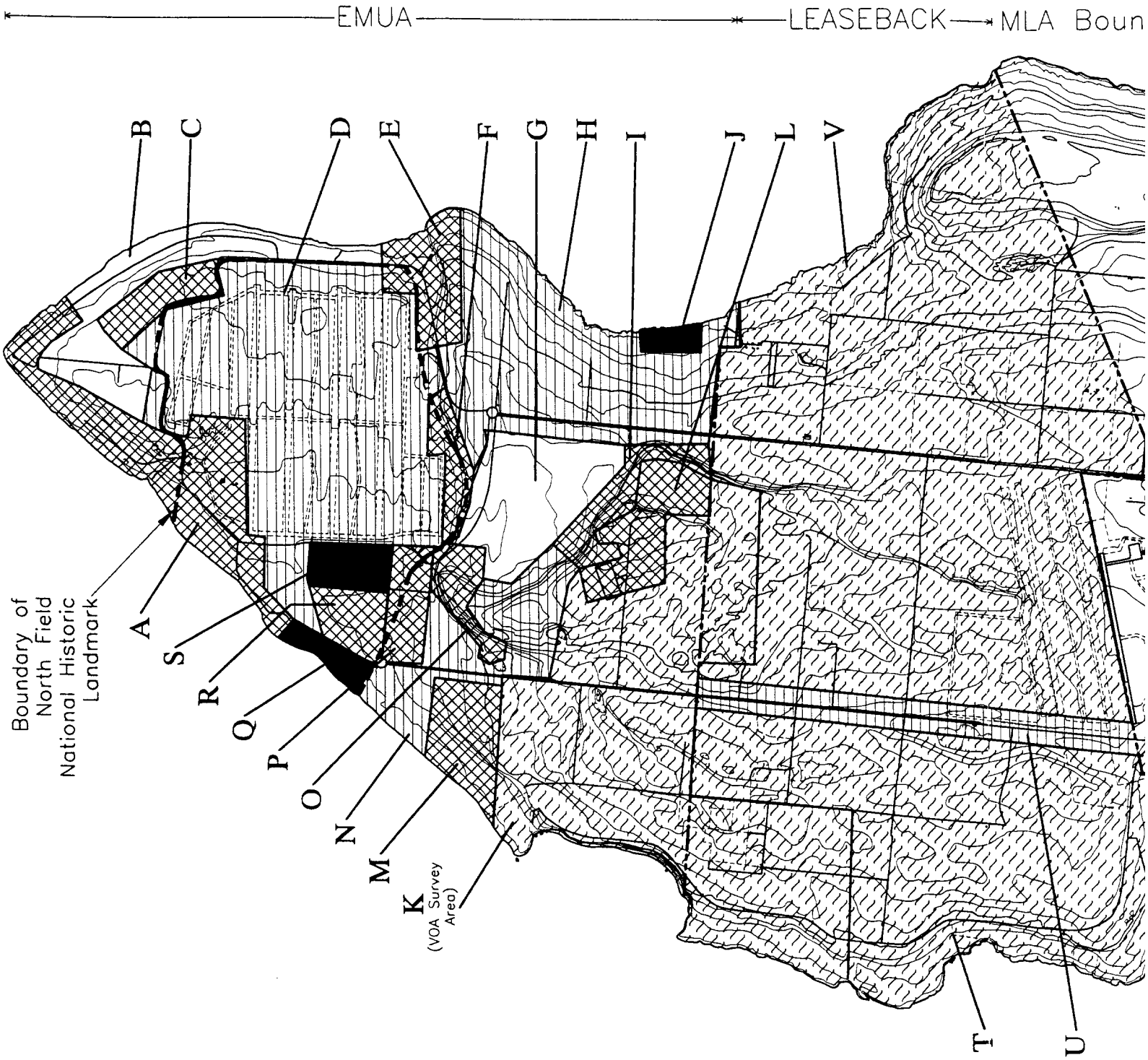
Category 1. Off-limits.

Restrictions: No military use of these areas would take place except for troop and vehicular movement on established roads. These roads would be marked on maps and identified on the ground with appropriate right-of-way signs.

Areas: Three areas are recommended for off-limits designation (Fig. 6): Unai Chulu complex, (SPA Q), the Lake Hagoi area (SPA S) and the Unai Dangkulo complex (SPA J).

Category 2. Moderate constraint.

Restrictions: These areas would be limited to pedestrian use; vehicles would be prohibited except for the use of established roads. No digging or other ground disturbance would be allowed. These areas would have permanent on-the-ground markers for identification. Individual sensitive sites in these areas should be marked as off-limits.


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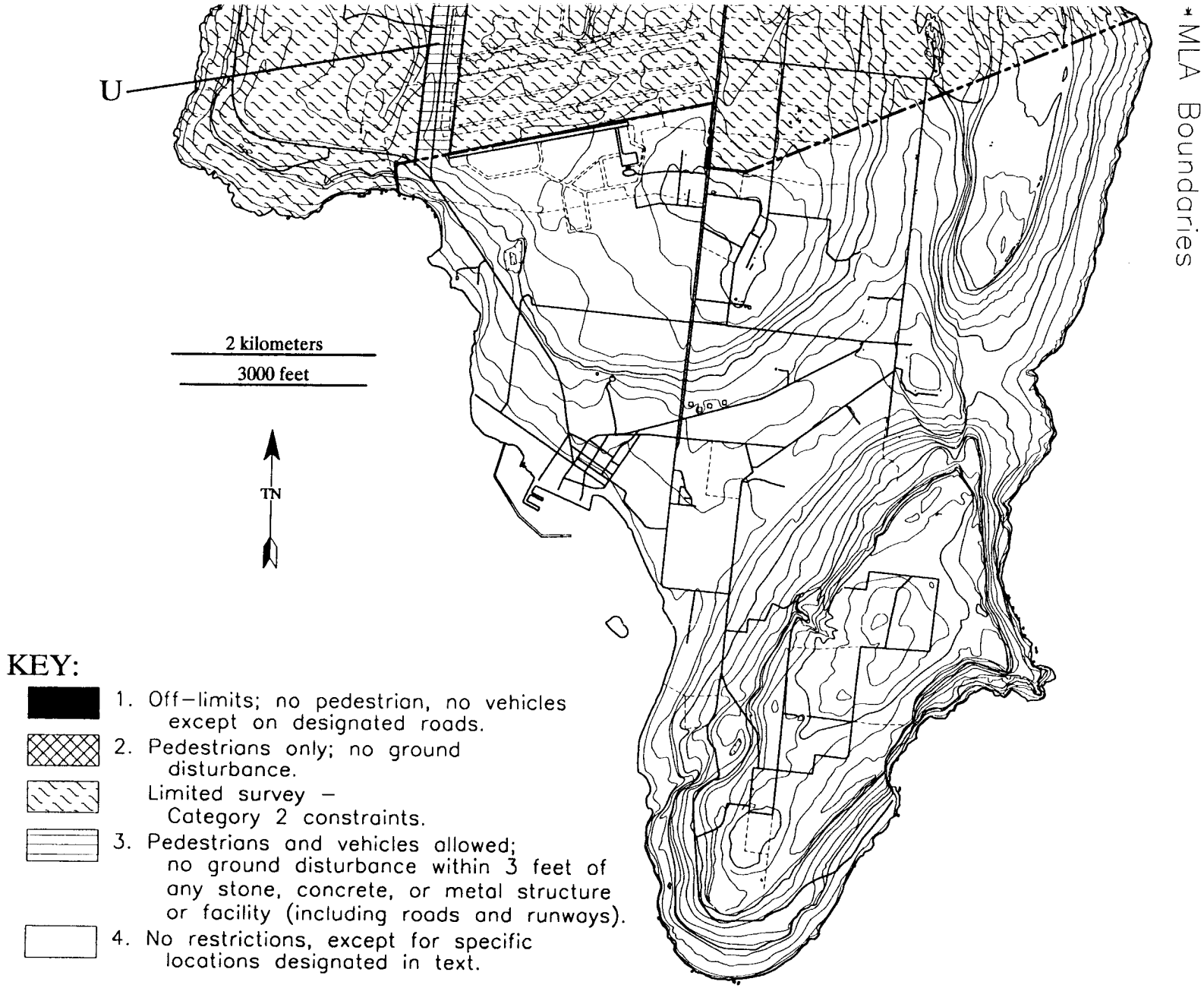


Figure 6. Site Protection Areas with National Landmark boundary.

Areas: The areas recommended for inclusion in this category are shown in Figure 6: Site Protection Areas A, C, E, F, L, I, M, O, and P. The VOA survey area (SPA K) has not had a complete inventory so it is also recommended for Category 2.

Category 3. Limited constraint.

Restrictions: Pedestrian and vehicular use of these areas would be permitted, but no ground disturbance would be allowed within three feet of any stone, concrete, or metal structures (including roads and runways). Restrictions would include general prohibition against collection of historic artifacts; prohibition against vandalism; and specific restrictions on digging within three feet of any structure or digging within any caves. Individual sensitive sites in these areas should be marked as off-limits.

Areas: Category 3 areas are shown in Figure 6: Site Protection Areas D, H, and N.

Category 4. Unconstrained.

Restrictions: Concerning cultural resources, there would be no restrictions on military activities in these areas. Individual sensitive sites in these areas should be marked as off-limits, or if appropriate, have data recovery conducted.

Areas: Category 4 areas (Fig. 6) include: Site Protection Areas C and G.

II. Identification of specific military project areas and development of special training locales.

The historic preservation actions and site protection planning place their emphasis on avoiding damage to historic sites. To accomplish this, it is recommended that, where possible, specifics of military exercises, specialized training areas, and any required facilities be identified regarding types of terrain, necessary total area, and recommended location. This information should be evaluated in terms of the distribution of historic resources to attempt to define the most appropriate areas for these actions with the least possible damage to any historic resources. Additionally, if specific military actions/projects as indicated above are most effectively placed in areas of historic resources, then appropriate data recovery should be undertaken to allow the action/project to take place.

For elaboration of planning concerns in this area, see the discussion of "Military Projects and Site Protection" in Tuggle and Welch (1996).

III. Information and instructions.

Information on the historic importance of Tinian and on the site protection areas, with identified restrictions, will be placed in all relevant instruction manuals and on operational maps, where possible. Written and oral instructions which will alert the troops

participating in exercises to the need to be careful to protect the cultural resources of the island. These instructions would involve the caution not to move, pick up, or in any way disturb artifacts or other historic properties on the island. Those participating in the exercises should be briefed on the significance of archaeological and historical resources on the island. Protective measures should be written into the instructions for the specific exercises. Prohibited and constrained areas should be clearly marked on all maps to be used during specific exercises. The military should provide sufficient oversight of the exercises to insure compliance with these mitigation measures.

IV. Program of monitoring and evaluation.

The U.S. Navy and the Historic Preservation Office of the CNMI should develop a monitoring plan for the evaluation of site protection actions after they have been implemented. This would involve, at a minimum, determining the extent to which the measures have been effectively implemented (for example, whether protection areas are marked effectively) and the extent to which the required actions and regulations are followed (for example, whether vehicles have respected the boundaries of prohibited areas). The Tinian Historic Preservation Coordinator has also suggested that in some instances, certain training activities might actually be monitored by representatives of the HPO. If this is not possible, then it is recommended that a post-exercise de-briefing take place in which the areas used during training are indicated to the CNMI HPO and may then be examined for possible damage to historic features or for violations of management or protection guidelines.

V. Interpretation.

A program of site interpretation in the MLA has been instituted by the U.S. Navy, and should be expanded. The existing program involves an interpretive brochure that is available to the public and a number of on-site interpretive signs. This program should be brought to the attention of all military users as a part of the briefing in appreciation of the history of the island and protection of its resources.

Recommended Protection Measures for the Leaseback Area and Kammer Beach

As presently defined, the use of the LBA for military exercises will be limited primarily to ground maneuvers from West Field north into the EMUA. If this remains the case, then all of the LBA (except the 8th Avenue corridor) should be considered a Category 2 constrained area; that is, pedestrian activity is allowed (with proper instructions as indicated above), but there is a prohibition on use of vehicles off established roads, and prohibition on any digging, ground disturbing activity, artifact collecting, or vandalism.

At the present time, with the exception of the 8th Avenue corridor, the area of the LBA is poorly known archaeologically, so more specific designations of site protection areas would depend on additional archaeological surveys. As shown in Figure 6, the 8th Avenue

corridor (SPA U) is recommended for Category 3 constraint, with the two other areas of the LBA (SPA T and V) recommended as Category 2.

Kammer Beach is recommended for Category 3 constraint for the area within 50 m (160 ft) of the coastline. The area from 50 to 200 m (160 to 650 ft) from the shoreline is part of the Taga site with a high potential that subsurface deposits are present and should be considered a Category 2 area in which no ground disturbance should occur and vehicle traffic should be restricted to established roads.

North Field National Historic Landmark

The boundaries of the North Field National Historic Landmark are shown in Figures 1 and 6, although, as indicated above, these boundaries and the contributing properties of the Landmark are under review.

For avoiding or mitigating any potential adverse effects of military training on the Landmark, it is recommended that the Landmark be managed according to the site protection actions proposed for each of the SPAs within which the Landmark falls.

Site Protection Areas

In the following discussion of site protection areas, only sites categorized as "significant" are listed on the tables and located on maps. These sites are listed in Appendix A, with a discussion of significance presented above.

Note that the locations of sites are shown based on the best information available, but the accuracy is limited by a number of problems, described in Tuggle and Welch (1996).

Site Protection Area A: Category 2, moderate constraint

The sites of Site Protection Area A (Fig. 7; Table 2) constitute some of the most important historic resources of the MLA. These include the atomic bomb loading area of North Field, the 509th service area (Site Z-362), the atomic bomb assembly area (Site TN-041), the Japanese Ushi Field complex (Sites TN-018, and Z-366, Z-369), numerous Japanese revetments, and the extensive prehistoric sites at Unai Babui and Puntan Tahgong (Sites TN-074 and TN-076).

The area is recommended for Category 2, with restriction of vehicles to established roads and restriction of troops to movement through the area only, with no camping or digging permitted. Unai Babui is proposed as a possible beach landing zone. Testing of the prehistoric site at Unai Babui (Fig. 8) has demonstrated that this site covers a very extensive

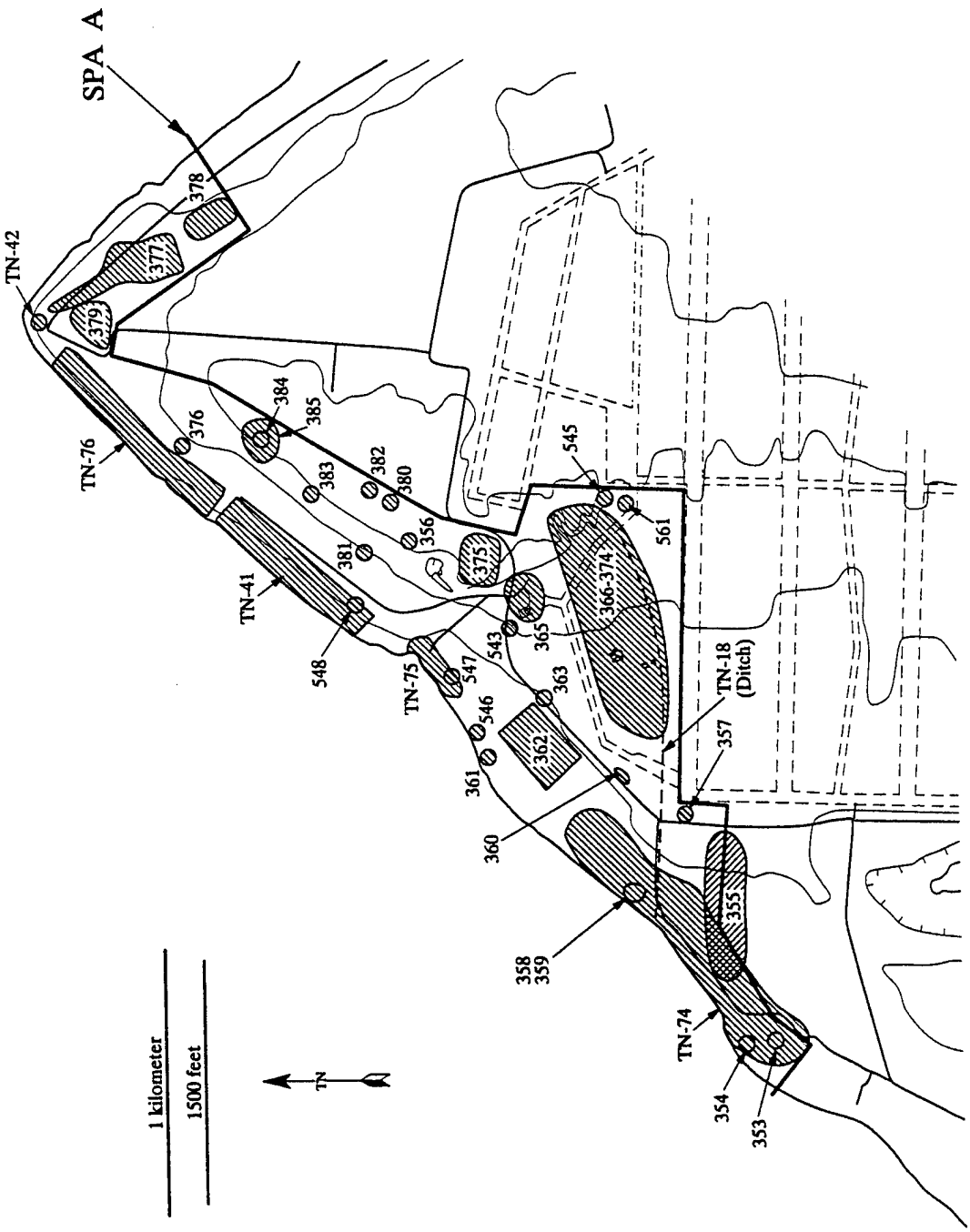


Figure 7. Significant archaeological sites, Site Protection Area A. (All site numbers without TN- prefix have Z- prefix.)

Table 2. Significant Sites of Site Protection Area A.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
TN-018	A	JM	Drainage ditch (Ushi Field Complex)	A, C, D	1	Jones 1991; Henry and Haun 1995; Henry et al. 1996	
TN-041	A	US	A-bomb assembly areas; earthen enclosures, platforms	A, B, C, D	2	Jones 1991; Henry et al. 1996; Welch and Tuggle 1996	
TN-042	A	US	17th AAA recreational structure remnant	A, B, C, D	2	Denfeld 1983; Henry et al. 1996; Jones 1991:31, 297-303	
TN-074	A	P	Unai Babui latte set; large, stratified deposit, features, (intensive, permanent occupation; Pre-Latte and Latte Phase)	A, D	3	Moore et al. 1986; Henry et al. 1996	Human remains
TN-075	A	P	Unai Lamlam ceramic deposit	A, D	3	Moore et al. 1986; Craib 1995	
TN-076	A	P	P. Tahgong latte sets stratified deposits, features; (intensive, permanent occupation; Latte Phase ceramic)	A, D	3	Moore et al. 1986; Henry et al. 1996	Human remains
Z-353	A	JC	Cistern	D	2	Henry et al. 1996	
Z-354	A	JM	Defensive enclosure, earthen	D	1	Henry et al. 1996	
Z-355	A	JM	Unai Babui defensive complex: fuel drum gun enclosures (JM, 3rd Co. 1st Battalion, 50th Infantry Division)	A, C, D	3	Henry et al. 1996; Jones 1991	
Z-356	A	JM	Gun position, fuel drum revetment	A, D	2	Donham 1986:32, 68	
Z-357	A	US	Gun position, fuel drum revetments	A, D	2	Henry et al. 1996	
Z-358	A	US	Gun position, fuel drum revetment	A, D	2	Denfeld 1983; Henry et al. 1996	
Z-359	A	US	Landing craft, and craft fragments	A, D	1	Henry et al. 1996	Human remains
Z-360	A	P	Pottery scatter	D	3	Craib 1993:8, Fig. 1	
Z-361	A	J	Trash scatter	D	1	Henry et al. 1996	
Z-362	A	US	509th Composite Group service area	A, C, D	1	Henry et al. 1996	
Z-363	A	JM	Gun emplacement	A, C, D	1	Denfeld 1983; Henry and Haun 1995	
Z-365	A	US	Atomic bomb loading pits	A, B, C, D	2	Denfeld 1983:36	
Z-366	A	JM	Air Administration staff building (Ushi Field Complex)	A, B, C, D	1	Jones 1991:29, 204-210	
Z-367	A	JM	Air Operations building (Ushi Field Complex)	A, C, D	1	Jones 1991:29, 211-214	
Z-368	A	JM	Power plant (Ushi Field Complex)	A, C, D	2	Jones 1991:30, 215-221	
Z-369	A	JM	Air raid shelters (Ushi Field Complex)	A, C, D	1	Jones 1991:30, 222-225	
Z-370	A	JM	Aircraft parking area (Ushi Field Complex)	A, D	0		
Z-371	A	JM	Housing remains, cisterns, air raid shelters, etc., west of X-370 (Ushi Field Complex)	A, D	2		

Table 2. Significant Sites of Site Protection Area A. (cont.)

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
Z-372	A	JM	Housing remains, cisterns, air raid shelters, etc., east of X-370 (Ushi Field Complex)	A, D	2		
Z-373	A	JM	Storage bunker, fuel drum (Ushi Field Complex)	A, C, D	0	Donham 1986:33, 35; Denfeld 1983	
Z-374	A	JM	Storage bunker, ammo, demolished (Ushi Field Complex)	A, C, D	0	Donham 1986:34, 52; Denfeld 1983	
Z-375	A	JM	Gun positions, fuel drum enclosures, concrete storage bunker (Ushi field defensive complex)	A, C, D	1	Donham 1986:31, 34	
Z-376	A	US	Mound, dump	D	0	Henry et al. 1996	
Z-377	A	JM/US	Defensive complex, fuel drum enclosure, earthen enclosure., slabs (Ushi Point c complex 2; reused by US)	A, C, D	1	Henry et al. 1996	
Z-378	A	JM/US	Gun position, fuel drum, encl., slabs (Ushi Point complex 1; reused by US)	A, D	1	Henry et al. 1996	
Z-379	A	US	17 AAA camp remains	A, D	3		
Z-380	A	US	Debris, equipment	D	1	Donham 1986:32, 81	
Z-381	A	P	Sherd scatter	D	3	Donham 1986:32, 83	
Z-382	A	US	A Battery, 17th AAA; foundation piers, concrete pads	A, C, D	2	Donham 1986:33, 48	
Z-383	A	P	Sherd scatter, lithics	D	3	Donham 1986:33, 84	
Z-384	A	US/JM ?	Foundation, gun revetment, debris, foxhole	A, C, D	1	Donham 1986:33, 50	
Z-385	A	P	Sherd scatter	D	3	Donham 1986:33, 83	
Z-543	A	US?	Tower bases, radio station	A, C, D	0	Donham 1986:34, 59; Denfeld 1983	
Z-545	A	US	Quonset Hut	A, C, D	0	Denfeld 1983:34	
Z-546	A	?	Airplane wreck	D	1	Henry et al. 1996	
Z-547	A	US	Landing craft remains, invasion remnants	A, D	1	Henry et al. 1996	
Z-548	A	?	Gun enclosure, earthen	D	1	Henry et al. 1996	
Z-561	A	JC	Land boundary marker	D	1	Craib 1993:4, Fig. 2	

See Appendix A for Key to Tables.

area with intact prehistoric deposits and numerous human burials (Henry et al. 1996), and it is recommended that vehicular access be restricted above the beach area (Fig. 9). Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area B: Category 4, unconstrained

Although SPA B contains a number of sites (Fig. 10, Table 3), they generally fall into clusters or are of limited significance, and it is recommended that these clusters be identified and marked as off-limits. Alternatively, most of these sites could be subjected to data recovery and removed from protective consideration. Detailed site protection recommendations for development of this area as an unconstrained zone are presented in Tuggle and Welch (1996).

Site Protection Area C: Category 2, moderate constraint

SPA C (see Fig. 7) is a complex of the well-preserved foundations of the structures used by the 72nd, 77th, 338th, and 359th service groups. This entire complex is identified as Site Z-401 and the quality of its preservation, unusual features, and identification with several major bomb groups suggests that it be restricted from use by vehicles or for any pedestrian activities except movement through the area. Digging or encampment should be prohibited. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area D: Category 3, limited constraint

SPA D (Fig. 11; Table 4) is the main runway complex of North Field (Z-364) and several adjoining areas. There are numerous sites in the area, but most are structural features associated with the field and not readily susceptible to damage. Prohibition from damage to structures and from digging within the vicinity of structures will protect these types of features. Particularly sensitive sites within the area may be marked as off-limits. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area E: Category 2, moderate constraint

SPA E (Fig. 12; Table 5) is the Chiget area of beach, cliffline, and lowland. It contains several important complexes of sites, including a series of Japanese cliff defensive features and prehistoric complexes, some with *latte* sets and burials. The area is recommended as restricted to pedestrian movement only, with no encampments, digging or other ground disturbance, and no vehicles except on established roads, with clear prohibitions against digging, artifact collection, or other disturbance in caves. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

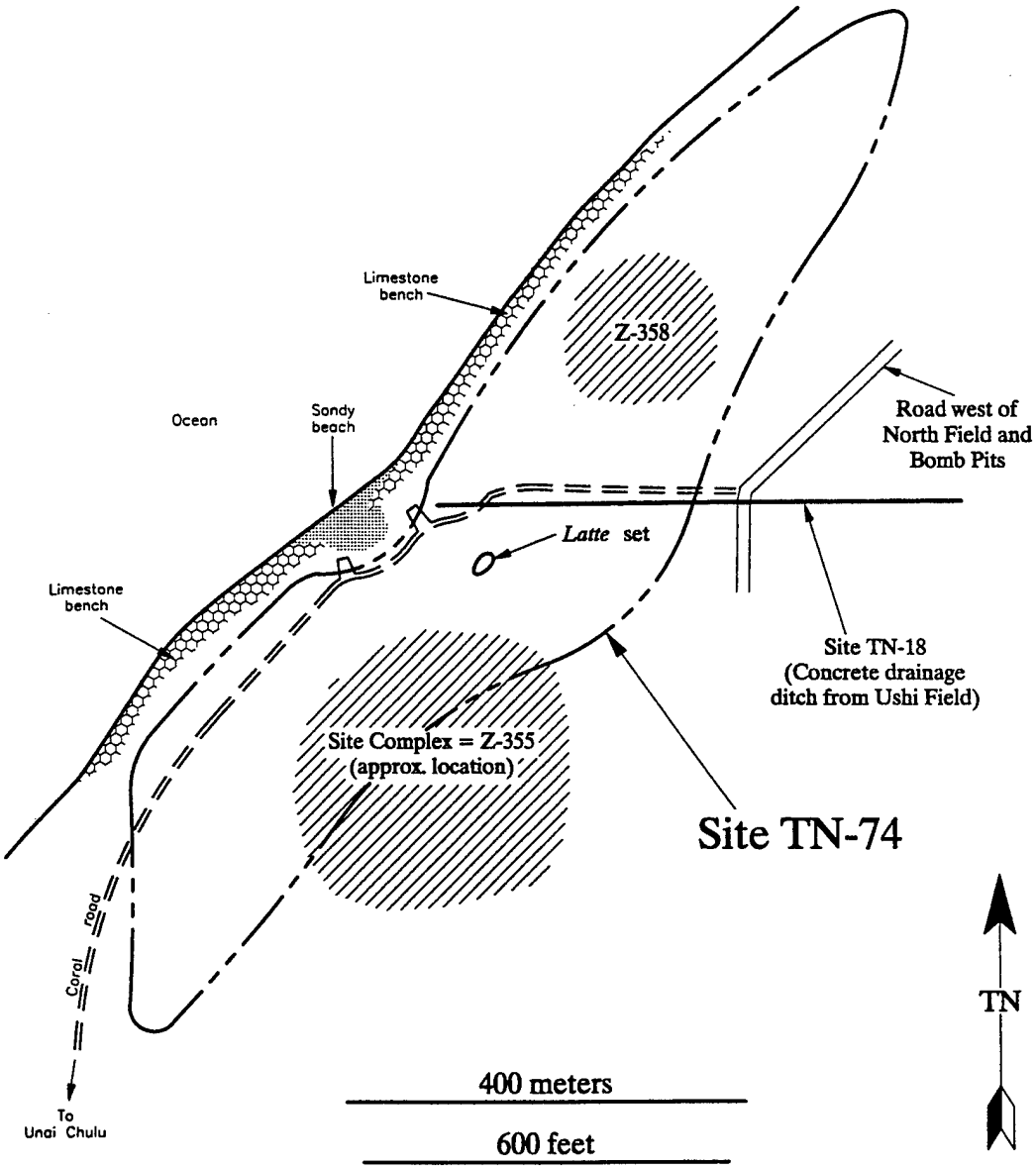


Figure 8. Detail of Unai Babui, in Site Protection Area A.

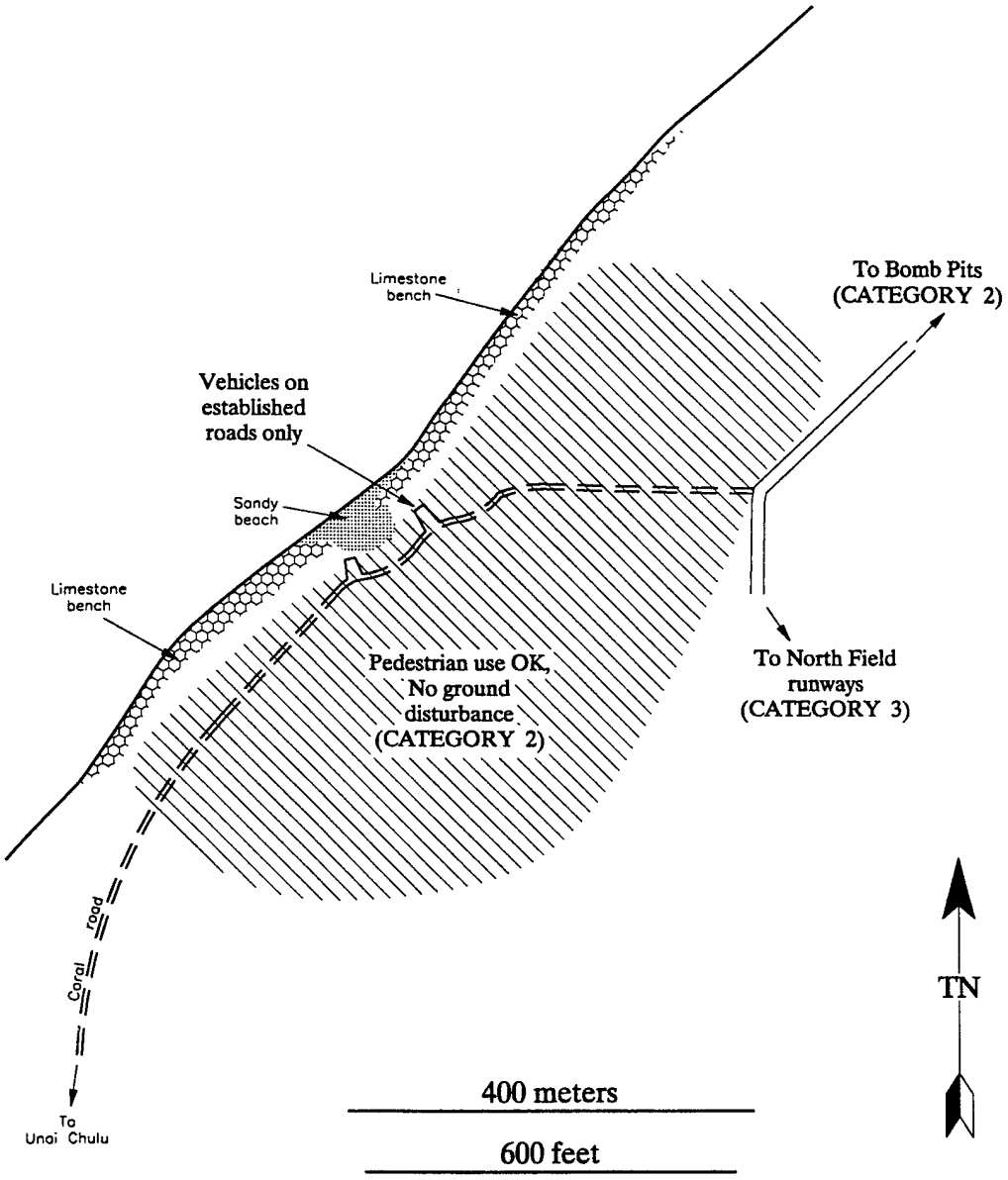


Figure 9. Constraints at Unai Babui, in Site Protection Area A.

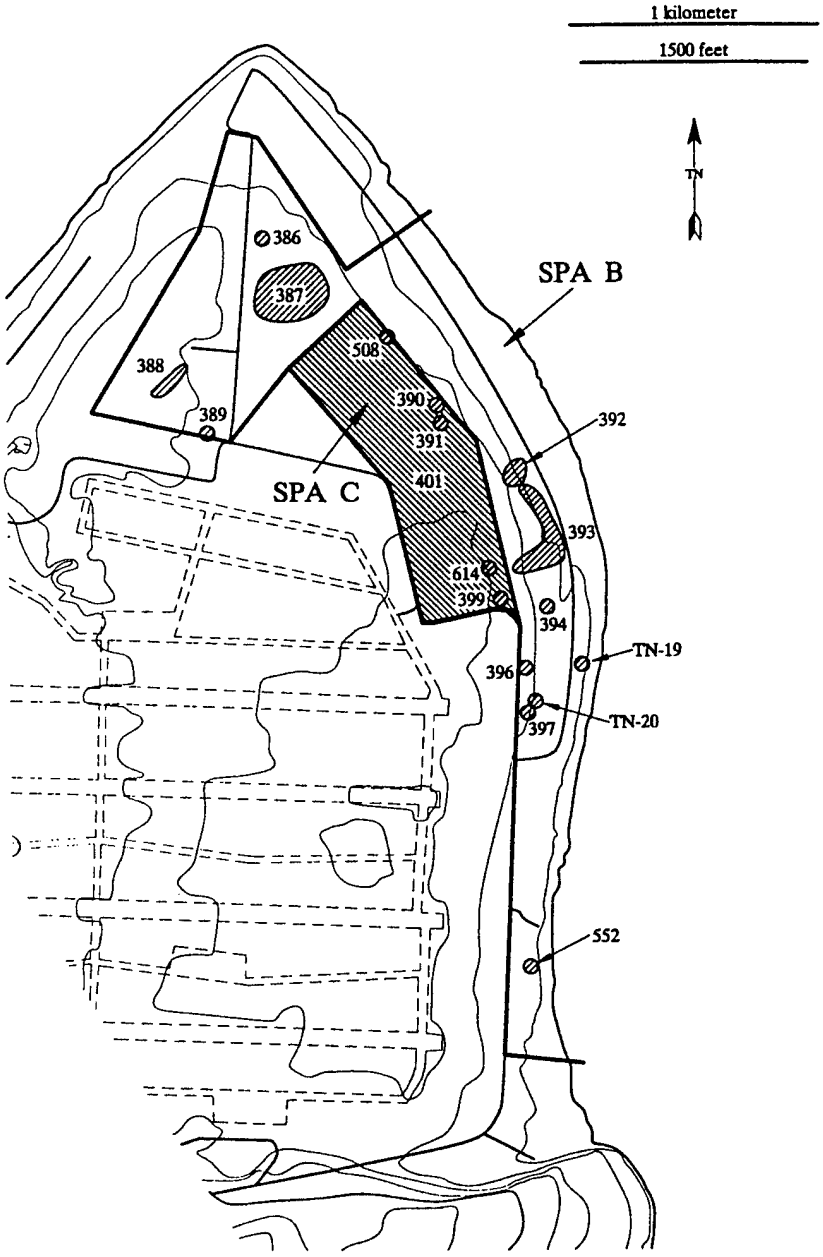


Figure 10. Archaeological sites, Site Protection Areas B and C. (All site numbers without TN- prefix have Z- prefix.)

Table 3. Significant Sites of Site Protection Area B.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References
TN-019	B	JM	Revetments, earthen; munitions storage	D	1	Henry et al. 1996
TN-020	B	JM	NE coast complex; defensive tunnels	A, D	2	Jones 1991; Henry et al. 1996
Z-386	B	P	Sherd scatter	D	3	Donham 1986:33, 86
Z-387	B	US	Rubble steps, structure remnants; trash, engine parts	D	1	Donham 1986:33, 71
Z-388	B	?	Berm, fence	D	1	Donham 1986:32, 73
Z-389	B	?	Revetment, mound	A, D	1	Donham 1986:32, 68
Z-392	B	P	Ceramics, shallow deposit, feature;	A, D	3	Henry et al. 1996
Z-393	B	US	B Battery, 17th AAA; Defensive mounds, earthen (radar/searchlights)	A, D	1	Henry et al. 1996
Z-394	B	P	Ceramics, small shallow deposit	D	33	Henry et al. 1996
Z-396	B	P	Ceramics, small shallow deposit	D	3	Henry et al. 1996
Z-397	B	JM	NE coast defensive complex, stone/earthen mounds (for radar/searchlights), trash	A, D	1	Henry et al. 1996
Z-552	B	US	Slab, dump	D	1	Henry et al. 1996

See Appendix A for Key to Tables.

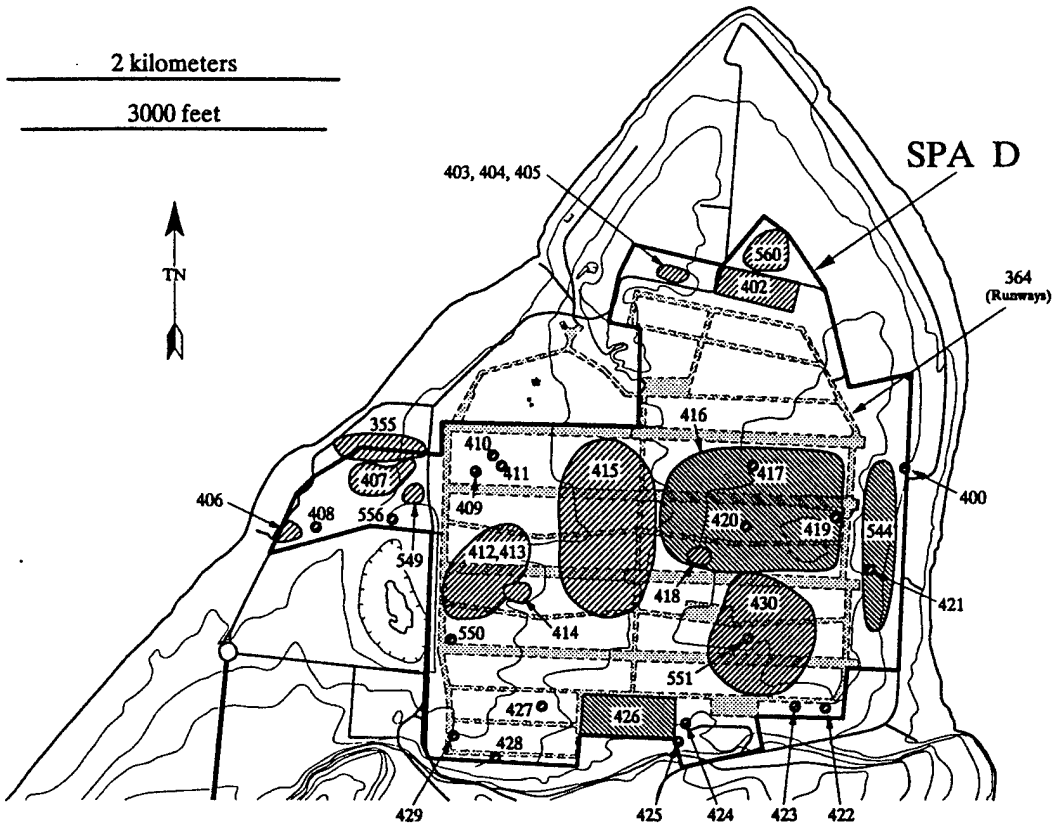


Figure 11. Significant archaeological sites, Site Protection Area D. (All site numbers without TN- prefix have Z- prefix.)

Table 4. Significant Sites of Site Protection Area D.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References
Z-364	D	US	North Field runways, hardstands, and taxiways	A, B, C, D	0	Denfeld 1983:37
Z-400	D	?	Gun enclosure, earthen	D	1	Henry et al. 1996
Z-402	D	US	B-29 service apron shop	A, B, D	1	Donham 1986:34, 54; Denfeld 1983
Z-403	D	?	Aircraft debris, rubbish, secondary	D	1	Donham 1986:32, 82
Z-404	D	P	Sherd scatters	D		Donham 1986:32, 82
Z-405	D	JM	Gun position, fuel drum revetment	A, D	1	Donham 1986:33, 68
Z-406	D	JM	Unai Chulu defensive complex; gun positions, fuel drum revetments (JM 3rd Co. 1st Battalion, 50th Infantry Division)	A, C, D	1	Henry et al. 1996
Z-407	D	JM	Unai Babui defensive complex; fuel drum revetments, earthen mounds (JM 3rd Co. 1st Battalion, 50th Infantry Division)	A, C, D	3	Henry et al. 1996
Z-408	D	US	Amtrak	A, C, D	1	Henry and Haun 1995
Z-409	D	JM	Water collection culverts for purification plant; structures	A, D	2	Denfeld 1983; Henry et al. 1996

Table 4. Significant Sites of Site Protection Area D. (cont.)

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References
Z-410	D	M	Dump with Japanese boundary marker	D	1	Henry et al. 1996
Z-411	D	US	Airplane wreck	D	1	Henry et al. 1996
Z-412	D	US	Tower base, fuel drums, and culverts, with inscriptions by 110th NSB; inscriptions by 13th NCB	A, D	0	Henry et al. 1996
Z-413	D	JM/w US?	Gun position, fuel drum enclosures; tower bases	A, D	1	Henry et al. 1996
Z-414	D	JC	Japanese Civilian habitation complex; Homestead, partial; with RR bed	A, C, D	2	Henry et al. 1996
Z-415	D	US	Cluster of destroyed machinery and steel, iron, and aluminum fragments; concrete boxes, pads, culverts, iron structure, tire dump, crane section, fuel drums	D	0	Craib 1995:59, 63
Z-416	D	US	Drums, concrete boxes, culverts Baldwin-Lima-Hamilton crane and associated debris, machinery, tower remnants	D	1	Craib 1995:58-59
Z-417	D	P	*Latte* pillars, possible; limestone fragments; pottery scatter; (some concrete fragments)	D	3	Craib 1995:59, 62
Z-418	D	P	Sherd scatter	D	3	Craib 1995:60, 69, 72
Z-419	D	P	*Latte* stones, possible	D	3	Craib 1995:60, 72-73
Z-420	D	US/JC?	Building foundations, rock-lined path, metal troughs, trash dump or latrine area; also Japanese sugar village remnant?	A, D	1	Craib 1995:60, 74, 77-78
Z-421	D	P	Ceramics, small shallow deposit	D	3	Henry et al. 1996
Z-422	D	M	Bulldozed debris	D	0	Henry et al. 1996
Z-423	D	US	Enclosure, earthen, pit; storage	D	1	Henry et al. 1996
Z-424	D	US	Dump	D	0	Henry et al. 1996
Z-425	D	US	Dump	D	0	Henry et al. 1996
Z-426	D	US	Service area and assoc. encampment, of 121st NCB (first CBs on island)	A, B, C, D	2	Henry et al. 1996
Z-427	D	US	Defensive enclosure of metal boxes	A, D	1	Henry et al. 1996
Z-428	D	US	Enclosures, earthen, storage	D	1	Henry et al. 1996
Z-429	D	US	Encampment, original 67th NCB, (moved to Site 68)	A, D	2	Henry et al. 1996
Z-430	D	US/JM ?	Defensive complex, with gun positions, fuel drum; dump	A, D	1	Henry et al. 1996
Z-544	D	US?/P	B Battery of the 17th AAA; and ABCD Annex (?); fuel drum enclosures	A, C, D	1	Henry et al. 1996
Z-549	D	US	D Battery, 17th AAA; earthen enclosure, fuel drum enclosures, metal posts	A, C, D	1	Henry et al. 1996
Z-550	D	JC/JM	Homestead, intact, reused for defense	A, D	3	Henry et al. 1996
Z-551	D	JM	Gun enclosure, fuel drum	A, D	1	Henry et al. 1996
Z-556	D	US	Cistern	D	2	Henry et al. 1996
Z-560	D	JM/US	Mixed WWII Japanese and American sites	A, D	2	Craib 1993:4, Fig. 2

See Appendix A for Key to Tables.

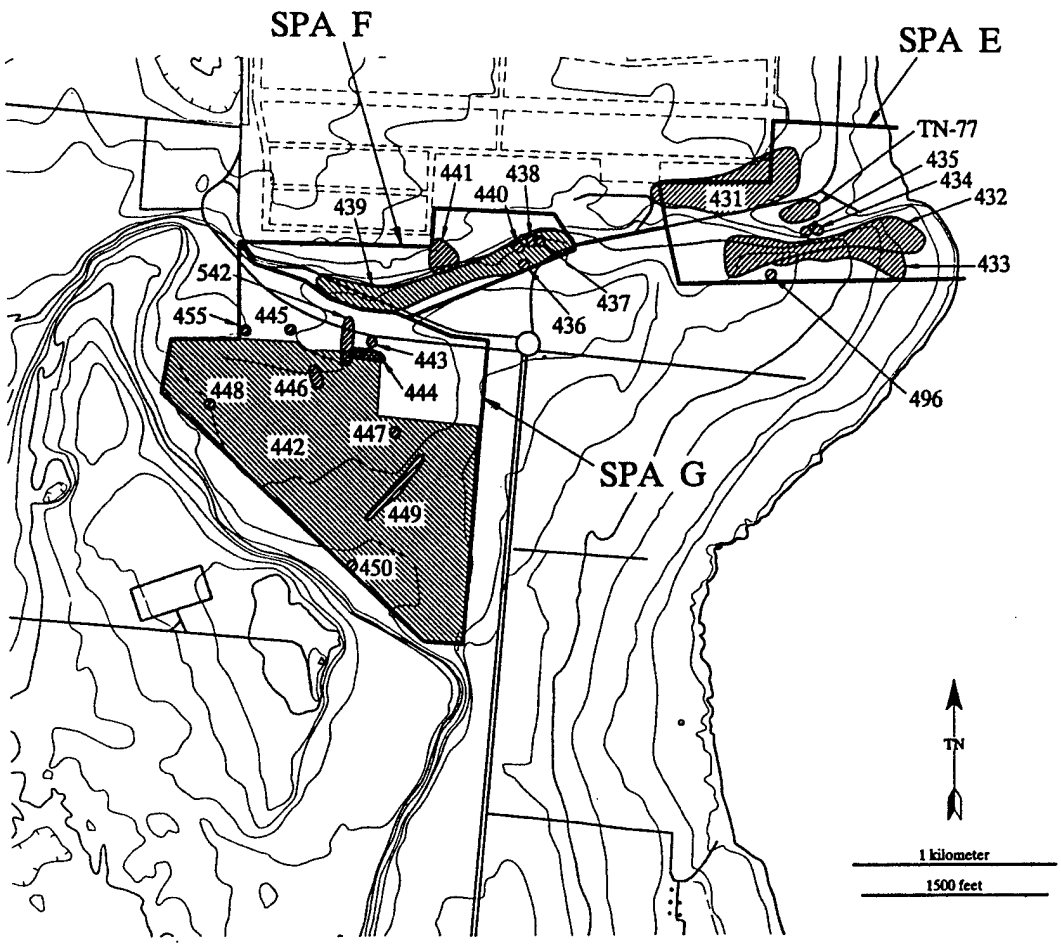


Figure 12. Significant archaeological sites, Site Protection Areas E, F, and G. (All site numbers without TN- prefix have Z- prefix.)

Table 5. Significant Sites of Site Protection Area E.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
TN-077	E	P	Unai Chiget *latte* sets, deposit; (intensive, permanent occupation)	A, D	3	Moore et al. 1986; Henry et al. 1996; Craib 1995	
Z-431	E	P	Ceramic scatters; medium size, stratified deposit; large stratified deposit	D	3	Henry et al. 1996	Human remains
Z-432	E	JM/P	Laderan Chiget defensive cave complex, rifle positions, fuel drum enclosures (assoc. with JM 2nd Battalion 50th Infantry Div.) and Cave complex, with stratified prehistoric deposits, Pre-Latte and Latte Phase (intensive, permanent occupation)	A, C, D	3	Henry et al. 1996	
Z-433	E	P	Latte sets and stratified deposits, features; Pre-Latte and Latte Phase (intensive, permanent occupation); various deposits	A, D	3	Henry et al. 1996	Human remains
Z-434	E	JC	Homestead, partial	D	2	Henry et al. 1996	
Z-435	E	JC	Railroad bed, with rails, wooden ties; stacked facing	A, C, D	1	Henry et al. 1996	
Z-496	E	JC	House, concrete	D	1	Henry et al. 1996	

See Appendix A for Key to Tables.

Site Protection Area F: Category 2, moderate constraint

SPA F (Fig. 12; Table 6), the cliffline of Gatut, contains an extensive complex of Japanese defensive features and well-preserved Japanese plantation railroad berms with dry-laid stone facings. The area should be used only for pedestrian movement, with no ground disturbance or vehicular activity. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area G: Category 4, unconstrained

SPA G (Fig. 12; Table 7) contains some ruins of Japanese homesteads, but is primarily the area of the WWII US Central Bomb Dump (Site Z-442), which consists mainly of coral roads and large pits. The site has been mapped in detail (Henry et al. 1996) and it is recommended that that the area be considered as not significant, the detailed information having been collected. (Unlike other sites recommended as not significant, Site Z-442 is listed in the site table and identified on the map because it is the primary component of the SPA.) As such, the area is proposed for unconstrained military activity, following data recovery or set-asides for the Japanese homesteads. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area H: Category 3, limited constraint

SPA H (Fig. 13; Table 8) is a large area of the eastern EMUA with numerous sites, but most of these are concrete structures, associated with Japanese plantation period occupation or World War U.S. occupation. There are also numerous open areas between sites, so that a substantial amount of activity could take place within the area if the structures are avoided and no ground disturbance takes place in their vicinity. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area I: Category 2, moderate constraint

SPA I (Fig. 14; Table 9) is the cliffline of Lasu and Mangpang and contains a large complex of Japanese defensive sites and features, as well as prehistoric deposits (Site TN-015). Like the other clifflines, this one deserves protection from disturbance, and thus should be limited to pedestrian movement only, with clear prohibitions against digging in caves, artifact collection, or other disturbance.

Table 6. Significant Sites of Site Protection Area F.

Site Number	SPA	Site	Site Description	NR eligible criteria	Threat	References
Z-436	F	JC	Railroad bed, with rails; stacked facing	A, C, D	1	Henry et al. 1996
Z-437	F	J	Railroad bed, with rails; stacked facing	A, C, D	2	Henry et al. 1996
Z-438	F	J	Railroad bed, with rails; stacked facing	A, C, D	2	Henry et al. 1996
Z-439	F	JM	Gatot; Cliffline defensive complex; tunnels, enclosures	A, C, D	3	Henry et al. 1996
Z-440	F	JC	Homestead, partial; cisterns	D	2	Henry et al. 1996
Z-441	F	P	Ceramics scatter, medium size, deposit	D	3	Henry et al. 1996

See Appendix A for Key to Tables.

Table 7. Significant Sites of Site Protection Area G.

Site Number	SPA	Site	Site Description	NR eligible criteria	Threat	References
Z-442	G	US	Central Bomb Dump	-	1	Henry et al. 1996
Z-443	G	P	Ceramics; small, shallow deposit	D	3	Henry et al. 1996
Z-444	G	JM	Dump	D	0	Henry et al. 1996
Z-445	G	JC	Homestead, partial; cisterns	D	2	Henry et al. 1996
Z-446	G	JC/P	Sinkhole with habitation debris; structure, destroyed	D	3	Henry et al. 1996
Z-447	G	JC	Homestead, partial	D	2	Henry et al. 1996
Z-448	G	JC	Homestead, partial; cisterns	D	2	Henry et al. 1996
Z-449	G	JC	Homestead, partial	D	2	Henry et al. 1996
Z-450	G	JC	Homestead, partial; cisterns	D	1	Henry et al. 1996
Z-455	G	JC	Homestead, partial	D	2	Henry et al. 1996
Z-542	G	JC	Homestead, partial	D	1	Henry et al. 1996

See Appendix A for Key to Tables.

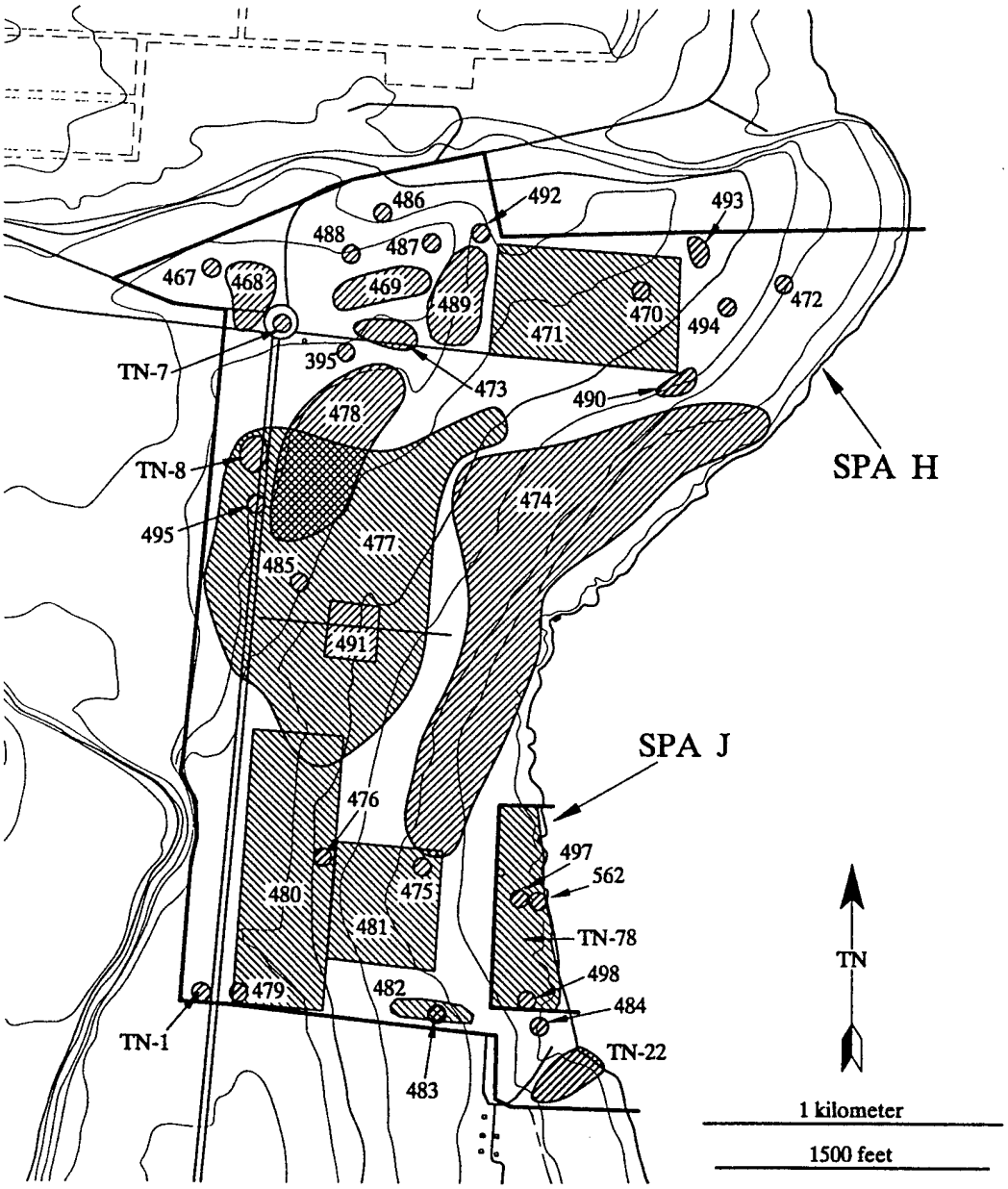


Figure 13. Significant archaeological sites, Site Protection Areas H and J. (All site numbers without TN- prefix have Z- prefix.)

Table 8. Significant Sites of Site Protection Area H.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References
TN-001	H	JC	Factories, remains	A, D	2	Jones 1991:36
TN-007	H	JC/US	Asahi (Sunrise) shrine	C, D	3	Jones 1991
TN-008	H	JC	NKK shrine	C, D	3	Jones 1991, Denfeld 1983
TN-022	H	JM	Unai Dangkulo defensive complex	A, C, D	1	Henry et al. 1996; Jones 1991; Franklin and Haun 1995
Z-395	H	JC	Bulldozed debris, demolished house	D	22	Henry et al. 1996
Z-467	H	P	Ceramics, small, shallow deposit	D	3	Henry et al. 1996
Z-468	H	JM	Laderan Gatot defensive complex (1); gun enclosures, fuel drum (machine gun position)	D	3	Henry et al. 1996
Z-469	H	JM	Laderan Gatot defensive complex (2); enclosure, stone; depressions, overhang; defensive depressions (Dual Purpose gun position), fuel drum enclosure (machine gun position)	A, C, D	3	Henry et al. 1996
Z-470	H	JM	Defensive modified depression	D	1	Henry et al. 1996
Z-471	H	US	67th NCB encampment, permanent; 1322 Engineering Regiment	A, B, C, D	1	Henry et al. 1996
Z-472	H	JM/US	Dump	?	0	Henry et al. 1996
Z-473	H	JC	Cisterns, slab, artifacts	D	1	Henry et al. 1996
Z-474	H	JM	JM Asiga Bay defense; concrete gun position, open; (held 80 mm Dual Purpose coastal gun); overhangs; combined Japanese and American use, rifle and gun positions; pillboxes, concrete gun pos., (held 6.5 mm-7.7 mm machine guns) prehistoric component with Pre-Latte and Latte Phase	A, C, D	1	Henry et al. 1996
Z-475	H	JC	Homestead, partial	D	2	Henry et al. 1996
Z-476	H	JC	Building, concrete	D	1	Henry et al. 1996
Z-477	H	JC	Homestead complexes	A, C, D	3	Henry et al. 1996
Z-478	H	US	East H-14-C N. Field, fuel tank farm	D	1	Henry et al. 1996
Z-479	H	JC	Slab, brick scatter	D	1	Henry et al. 1996
Z-480	H	US	9th NCB encampment	A, D	3	Henry et al. 1996
Z-481	H	US	509th Composite, temporary camp; 18th NCB; concrete slabs, trash	A, B, D	2	Franklin and Haun 1995: Tables 5 and 13
Z-482	H	JC	Homesteads, partial	D	3	Franklin and Haun 1995: Tables 5 and 13; 55
Z-483	H	P	Artifact scatter	D	3	Franklin and Haun 1995: Tables 5 and 13
Z-484	H	P	Artifact scatter	D	3	Franklin and Haun 1995: Tables 5 and 13
Z-485	H	JM	Gun position, fuel drum enclosure	D	1	Henry et al. 1996
Z-486	H	P	Ceramics, small, shallow deposit	D	3	Henry et al. 1996
Z-487	H	JC	Dump	D	0	Henry et al. 1996
Z-488	H	JM	Defensive, trench, fuel drum encl.	D	1	Henry et al. 1996
Z-489	H	US	C Battery, 17th AAA; (and 16th AAA?); road, mounds, posts, artifact scatters, earthen enclosures	A, D	3	Henry et al. 1996
Z-490	H	US	Dump	?	1	Henry et al. 1996
Z-491	H	US	Mine Depot No. 4; earthen structures, ARMCOs	D	1	Henry et al. 1996
Z-492	H	US	Survey marker and grill	D	0	Henry et al. 1996
Z-493	H	JM/US	Defensive complex with fuel drum enclosures	A, D	1	Henry et al. 1996
Z-494	H	US	Cave with historic artifacts	D	2	Henry et al. 1996
Z-495	H	US	Bunker, concrete	A, C, D	1	Henry et al. 1996
Z-563	H	P	Pictograph cave	A, C, D	3	Craib 1994

See Appendix A for Key to Tables.

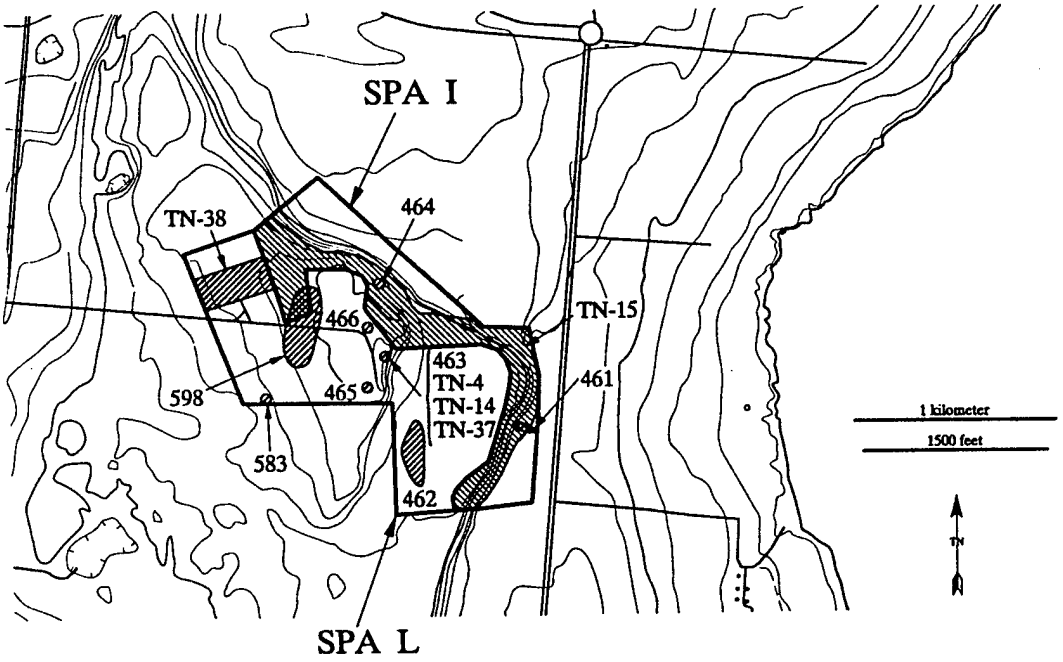


Figure 14. Significant archaeological sites, Site Protection Areas I and L. (All site numbers without TN- prefix have Z- prefix.)

Table 9. Significant Sites of Site Protection Area I.

Site Number	SPA	Site	Site Description	NR eligible criteria	Threat	References
TN-015	I	JM/P	Caves, with prehistoric deposits and WWII defensive features; (probably contains headquarters of Colonel Ogata)	A, B, C, D	3	Henry et al. 1996; Jones 1991
Z-461	I	JC	Homestead, partial	D	2	Henry et al. 1996
Z-464	I	JC	Homestead, partial	D	2	Henry et al. 1996

See Appendix A for Key to Tables.

Site Protection Area J: Category 1, off-limits

SPA J (Fig. 12; Table 10) centers on the Unai Dangkulo prehistoric complex (Site TN-078) of *latte* sets and associated deposits and burials. Because these prehistoric features are so well-preserved, but easily damaged, the Unai Dangkulo area (inland of the sand beach) is recommend for a designation of off-limits. Any beach landings or activities on the beach have an access to the inland areas by a compacted road, allowing avoidance of the site area. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area K: Category 2, moderate constraint

SPA K (Fig. 15; Table 11) is recommended for temporary placement in Category 2 because of the limited archaeological survey. Most of area K is in the EMUA, but has only been surveyed by very small samples (Eble et al. 1995; see Figure 3), and was not covered in the survey of Henry et al. (1996). Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area L: Category 2, moderate constraint

SPA L (Fig. 14; Table 12) is the Mount Lasu area, containing a number of important sites, including a Japanese shrine and the remains of the U.S. Army hospital. The area is recommended for pedestrian activity only, except on the established roads. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Table 10. Significant Sites of Site Protection Area J.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
TN-078	J	P	Unai Dangkulo latte sets, deposit; (intensive, permanent occupation)	A, C, D	3	Craib 1994; Franklin and Haun 1995; Moore et al. 1986	
Z-497	J	JC	Concrete foundations, habitation complex	D	1	Franklin and Haun 1995: Tables 5 and 13; 55	
Z-498	J	JM/P	Refuge cave; cave with water source	A, C, D	3	Franklin and Haun 1995: Tables 5 and 13	Human remains
Z-562	J	JM	Gun emplacement, enclosure	D	1	Franklin and Haun 1995: Tables 5 and 13	

See Appendix A for Key to Tables.

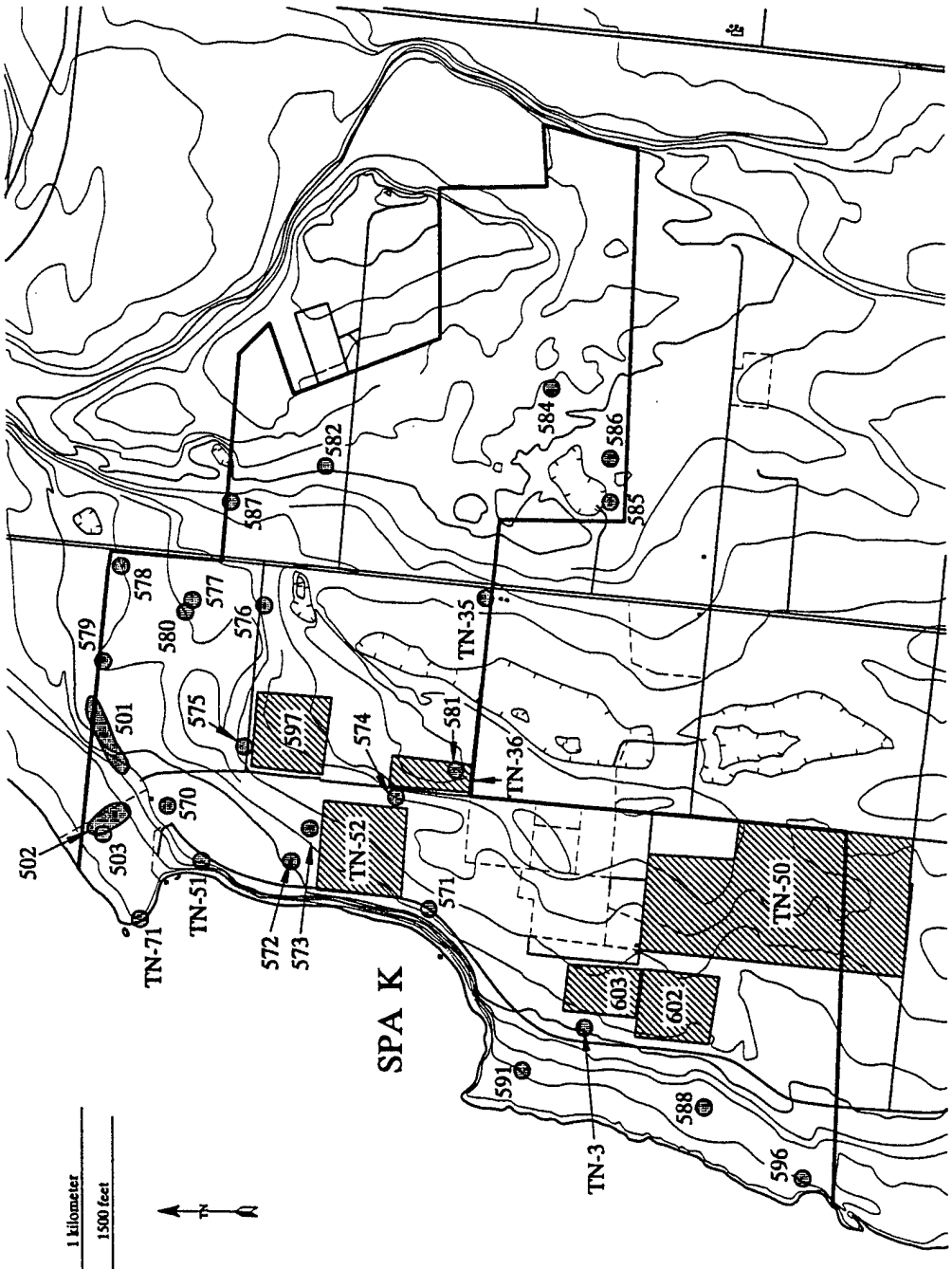


Figure 15. Significant archaeological sites, Site Protection Area K. (All site numbers without TN- prefix have Z- prefix.). The hatched site areas indicate site identification from aerial photos, without ground verification.

Table 11. Significant Sites of Site Protection Area K.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
TN-002	K	JC	Civilian Camp	A, D	3	Jones 1991:40	
TN-003	K	JC	Administration Bldg	A, D	3	Jones 1991:47	
TN-034	K	US/C	Camp Churo Cemetery	A	3	Jones 1991:261	
TN-035	K	US	Stone headwalls, street intersection	A, D	1	Jones 1991:264	
TN-036	K	US	313th Bomb Wing HQ	A, B, D	3	Eble et al. 1995; Jones 1991	
TN-051	K	US	Guard rail	?	1	Eble et al. 1995; Jones 1991	
TN-052	K	US	504 Bomb Group Camp	A, B, D	3	Eble et al. 1995; Jones 1991	
TN-071	K	P	San Hilo pictographs	A, C, D	3	Eble et al. 1995; Moore et al. 1986	
Z-501	K	JM	San Hilo defensive cliffline complex; concrete gun position; overhangs, enclosures; tunnel	A, C, D	3	Henry et al. 1996	
Z-502	K	JC	Homesteads, intact	A, C, D	2	Henry et al. 1996	
Z-503	K	JM	San Hilo defensive complex; defensive enclosure, stone	A, D	1	Henry et al. 1996	
Z-564	K	JC	Cistern	D	1	Henry and Haun 1995	
Z-570	K	US	Refuse dump, and crash site	D	0	Eble et al. 1995	
Z-571	K	US	Camp	A, D	2	Eble et al. 1995	
Z-572	K	JM?	Concrete structure	A, D	1	Eble et al. 1995	
Z-573	K	JM?	Bunker; fuel drum	D	1	Eble et al. 1995	
Z-574	K	J	Concrete structure, unknown function	D	1	Eble et al. 1995	
Z-575	K	JC	Concrete stairway; shrine or residence	D	1	Eble et al. 1995	
Z-576	K	JC	Cistern	D	2	Eble et al. 1995	
Z-577	K	P	Sherd scatter	D	3	Eble et al. 1995	
Z-578	K	JC	Homestead	A, D	2	Eble et al. 1995	
Z-579	K	P	Sherd scatter	D	3	Eble et al. 1995	
Z-580	K	JC	Cistern	D	2	Eble et al. 1995	
Z-581	K	P	Sherd scatter	D	3	Eble et al. 1995	
Z-582	K	JC	Homestead	D	2	Eble et al. 1995	
Z-584	K	J/US	Massive concrete structure; US use	D	1	Eble et al. 1995	
Z-585	K	M	Dump, mixed US, Japanese	D	0	Eble et al. 1995	
Z-586	K	?	Cobble paving, small; unknown age	D	2	Eble et al. 1995	
Z-587	K	JC	Homesteads	A, C, D	2	Eble et al. 1995	
Z-588	K	P/JC	Rockshelter, *latte*, and cistern	A, D	3	Eble et al. 1995	Human remains
Z-591	K	P	Latte sets, quarry, mortars	A, D	3	Moore et al. 1986:175	
Z-596	K	P	Surface material	D	3	Moore et al. 1986:175	
Z-597*	K	US	505th Bomb Group	A, D	2	*	
Z-602*	K	US	6th Bomb Group	A, D	2	*	
Z-603*	K	US	9th Bomb Group	A, D	2	8	
Z-608*	K	US	Civilian Affairs	A, D	2	*	

See Appendix A for Key to Tables.

Table 12. Significant Sites of Site Protection Area L.

Site Number	SPA	Site	Site Description	NR eligible criteria	Threat	References
TN-004	L	JC	Mt. Lasu shrine	C, D	3	Jones 1991; Henry and Haun 1995; Eble et al. 1995
TN-014	L	JM	Radar tower supports	D	3	Jones 1991
TN-037	L	US	B-29 homing tower	A, D	1	Jones 1991; Eble et al 1995
TN-038	L	US	Army hospital	A, D	2	Denfeld 1983; Jones 1991; Eble et al. 1995
Z-462	L	P	Ceramics, medium size scatter, deposit	D	3	Henry et al. 1996
Z-463	L	JM	JM Mt. Lasu observation post and defensive complex; platform, stone enclosures (for radar/searchlights; guns)	A, C, D	3	Henry et al. 1996
Z-465	L	JC	Homestead	A, D	2	Eble et al. 1995
Z-466	L	US	Mt. Lasu complex, military	A, D	2	Henry and Haun 1995
Z-583	L	P	Sherd scatter	D	3	Eble et al. 1995
Z-598*	L	US	Radio Transmission St.	D	2	*

See Appendix A for Key to Tables.

Site Protection Area M: Category 2, moderate constraint

SPA M (Fig. 16; Table 13), on the western side of the EMUA, contains a large prehistoric *latte* complex and associated deposits (Site TN-072) and an extensive distribution of well-preserved Okinawan farm houses. Activity in the area is recommended to pedestrian movement, with no ground disturbance and no vehicular use off established roads. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area N: Category 3, limited constraint

SPA N (Fig. 16, Table 14) contains a variety of sites, but they are generally avoidable or not readily susceptible to damage. The area is recommended for Category 3 protection, allowing general activity in the area, with some individual site protection, and the avoidance of ground disturbance within three feet of structures. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area O: Category 2, moderate constraint

SPA O (Fig. 17, Table 15), the Laderan As Mahalang cliffline to the west of Gatut, contains several complexes of Japanese defensive sites, and is recommended for Category 2 protection, including the prohibition on digging in caves and artifact collection. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

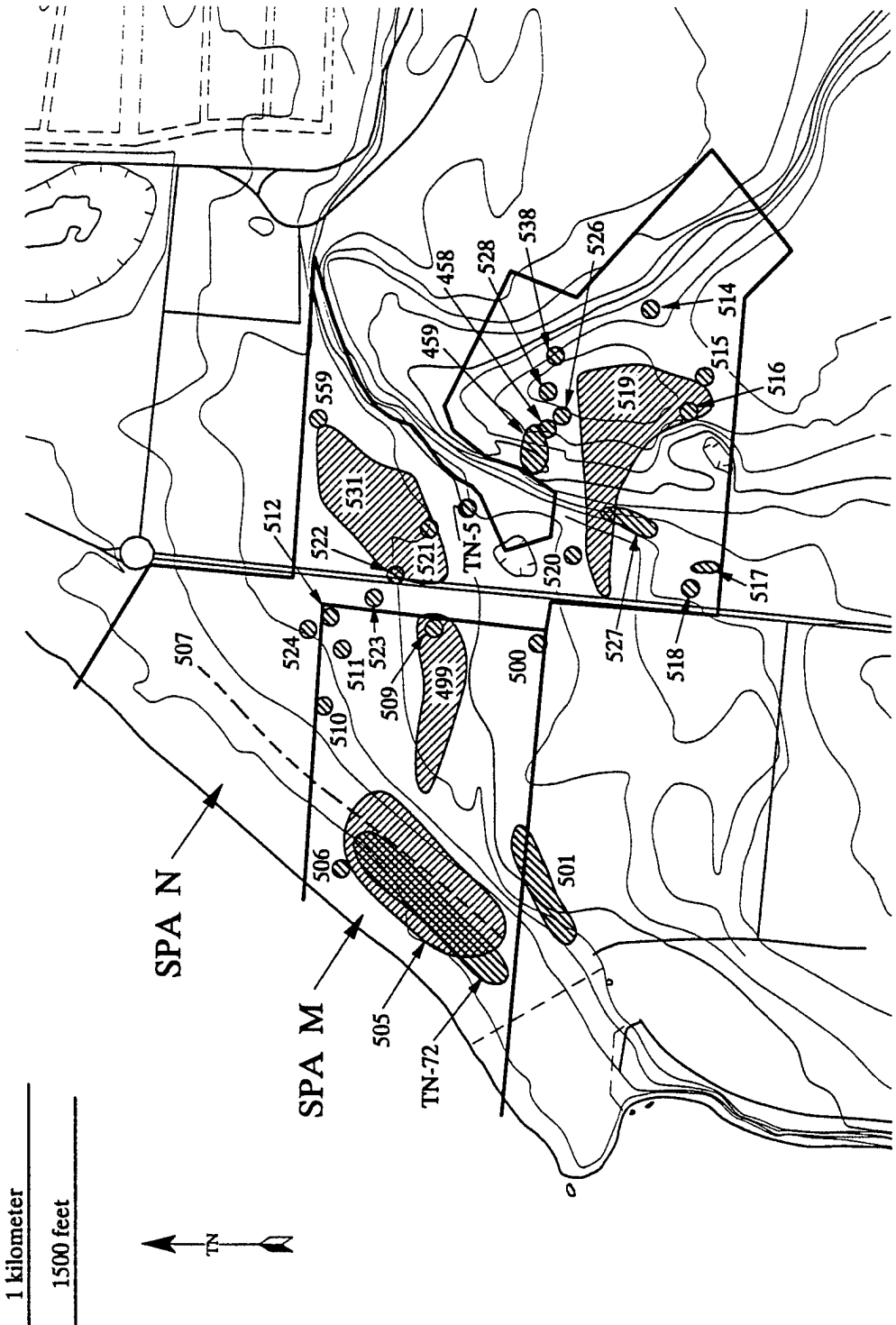


Figure 16. Significant archaeological sites, Site Protection Areas M and N. (All site numbers without TN- prefix have Z- prefix.)

Table 13. Significant Sites of Site Protection Area M.

Site Number	SPA	Site	Site Description	NR eligible criteria	Threat	References	Notes
TN-072	M	P	Latte sets at Sab. Fam, with stratified deposits; features; (intensive, permanent occupation; Pre-Latte and Latte Phase)	A, C, D	3	Moore et al. 1986; Henry et al. 1996	Human remains
Z-499	M	JC	Homestead complexes, intact	A, C, D	3	Henry et al. 1996	
Z-500	M	JM	Defensive stone platform	D	1	Henry et al. 1996	
Z-505	M	JM	Homestead complexes, intact	A, C, D	3	Henry et al. 1996	
Z-506	M	JM/P	Defensive modified depression	D	1	Henry et al. 1996	
Z-507	M	JC	Railroad bed; with rails; stacked facing	C, D	1	Henry et al. 1996	
Z-509	M	JM	Defensive modified depression	D	1	Henry et al. 1996	
Z-510	M	JC	Homestead, intact	A, D	2	Henry et al. 1996	
Z-511	M	JC	Homestead, intact	A, D	2	Henry et al. 1996	
Z-512	M	JC	Homestead, intact	A, C, D	2	Henry et al. 1996	

See Appendix A for Key to Tables.

Table 14. Significant Sites of Site Protection Area N.

Site Number	SPA	Site Type	Site Description	NR eligible criteria	Threat	References	Notes
TN-005	N	US	Asphalt plant, wall foundation	A, D	1	Henry et al. 1996; Jones 1991	
Z-458	N	JM	JM Laderan Lasu defensive complex; stone enclosures; rifle pit/foxholes	A, C, D	1	Henry et al. 1996	
Z-459	N	JC	Habitation complex	D	2	Henry et al. 1996	
Z-514	N	JC	Homestead, partial	D	2	Henry et al. 1996	
Z-515	N	JC	Homestead, intact	A, D	2	Henry et al. 1996	
Z-516	N	JC	Homestead, partial; cisterns	D	2	Henry et al. 1996	
Z-517	N	P	Ceramics, small, shallow deposit	D	3	Henry et al. 1996	
Z-518	N	JC	Homestead, intact	A, C, D	2	Henry et al. 1996	
Z-519	N	?	Defensive complex with fuel drum encl.	A, C, D	1	Henry et al. 1996	
Z-520	N	JC	Homestead, intact	C, D	2	Henry et al. 1996	
Z-521	N	JM/P	Sinkhole, with trash; Prehistoric component; Latte Phase ceramics	D	3	Henry et al. 1996	Human remains
Z-522	N	P?	Rock overhang	A, D	3	Henry and Haun 1995	Human remains
Z-523	N	JC	Cistern	D	1	Henry and Haun 1995	
Z-524	N	JM	Famalaoan defensive complex; modified depressions, rifle pit/foxholes	A, C, D	1	Henry et al. 1996	
Z-525	N	US	Defensive earthen platform	D	1	Henry et al. 1996	
Z-525	N	US	Defensive earthen platform	D	1	Henry et al. 1996	
Z-526	N	?	Gun position, fuel drum enclosure	A, D	1	Henry et al. 1996	
Z-527	N	JM	Cliffline defensive complex; caves, stone terraces	A, C, D	3	Henry et al. 1996	
Z-528	N	JM	Observation post, survey marker; platform	D	1	Henry et al. 1996	
Z-529	N	US	Bulldozed debris	D	0	Henry et al. 1996	
Z-530	N	?	Road on Maga	D	1	Henry et al. 1996	
Z-531	N	US	West H-14-C N Field, fuel tank farm; earthen enclosures	D	1	Henry et al. 1996	
Z-559	N	P	Pottery scatter	D	3	Craib 1993: Fig. 22	

See Appendix A for Key to Tables.

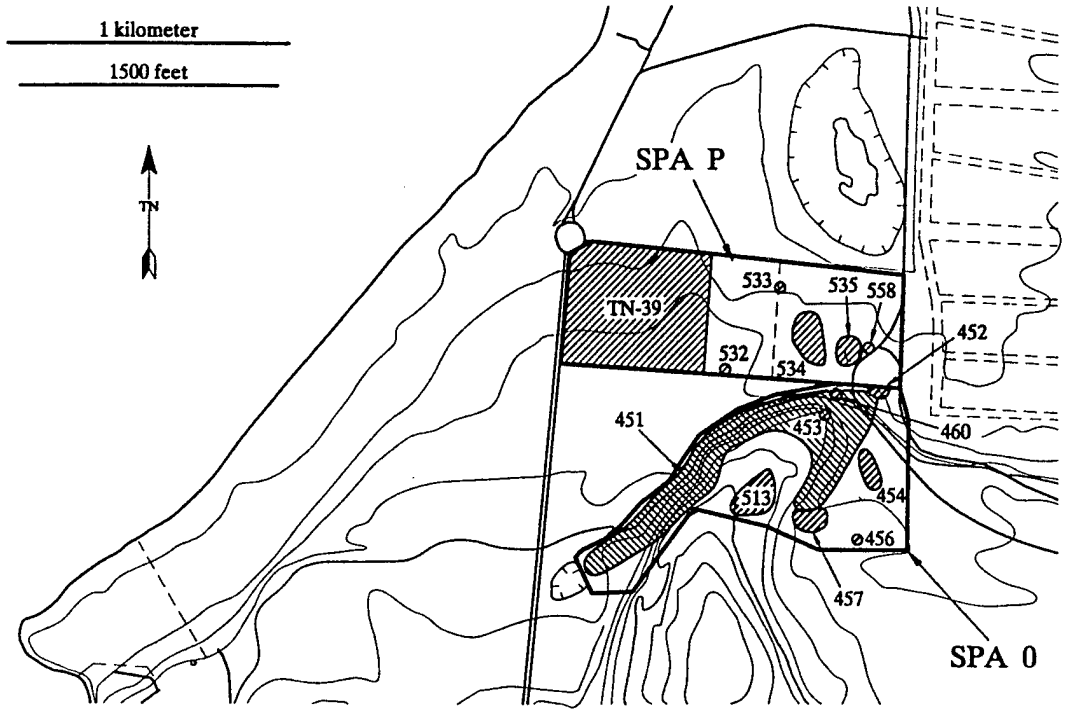


Figure 17. Significant archaeological sites, Site Protection Areas O and P. (All site numbers without TN- prefix have Z- prefix.)

Table 15. Significant Sites of Site Protection Area O.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
Z-451	O	JM/P	Cliffline defensive complex; gun enclosure, stone; depressions, rifle pits; with prehistoric deposits (Latte Phase ceramics)	A, C, D	3	Henry et al. 1996	
Z-452	O	JC	Homestead, intact	A, C, D	2	Henry et al. 1996	
Z-453	O	US/P	Temporary encampment; slabs, depressions; prehistoric component	D	1	Henry et al. 1996	Human remains
Z-454	O	P	Ceramics, medium size, deposit	D	3	Henry et al. 1996	
Z-456	O	JC	Homestead, partial, cisterns	D	2	Henry et al. 1996	
Z-457	O	JC	Homestead complex, cave with trash	A, C, D	3	Henry et al. 1996	
Z-457	O	JC	Cistern	D	2	Henry et al. 1996	
Z-460	O	?	Road	D	1	Henry et al. 1996	
Z-513	O	US	Munitions storage? large earthen enclosures	D	1	Henry et al. 1996	

See Appendix A for Key to Tables.

Site Protection Area P: Category 2, moderate constraint

SPA P (Fig. 17) is the location of the camp of the 509th composite group (Site TN-039). The foundations of the camp are well-preserved and its significant historical association with the atomic bomb support a recommendation for Category 2 protection. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area Q: Category 1, off-limits

SPA Q (Figs. 18, 19, and 20; Table 16) focuses on Unai Chulu and the important prehistoric complex (Site TN-073), including *latte* remains, burials, and one of the earliest habitation sites in the Marianas (Jimenez et al. 1996). The importance of the location is also enhanced by the fact that this was one of the two primary U.S. invasion beaches of World War II.

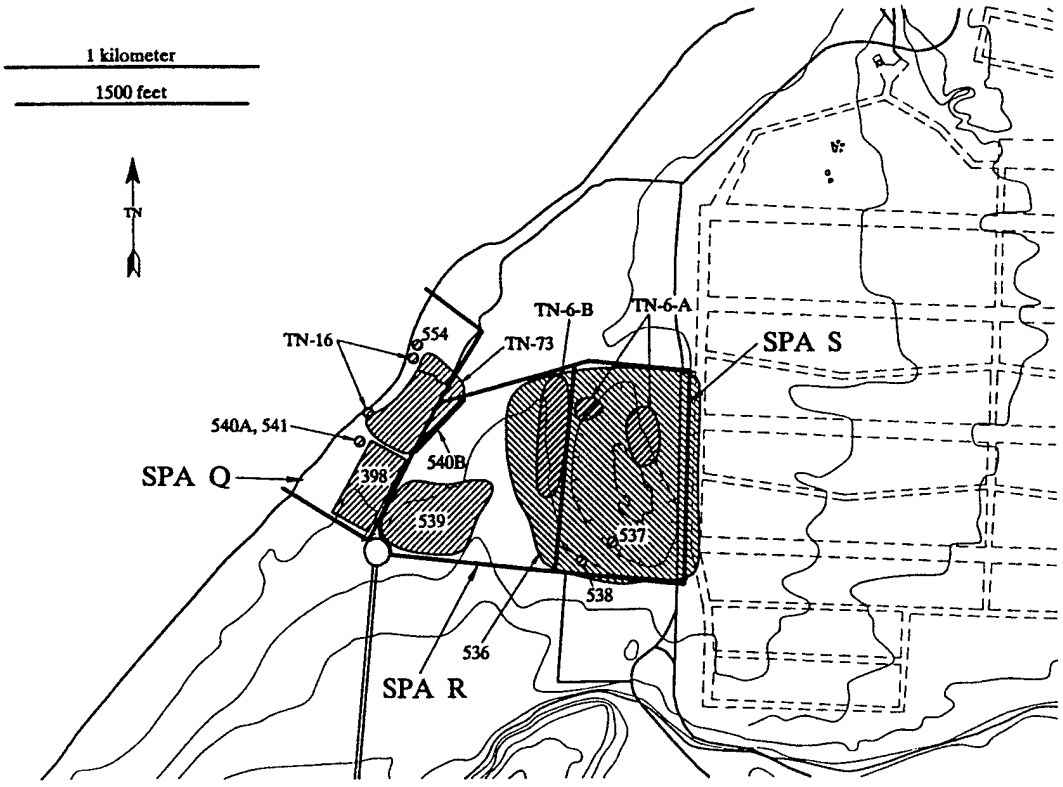


Figure 18. Significant archaeological sites, Site Protection Areas Q, R, and S. (All site numbers without TN- prefix have Z- prefix.)

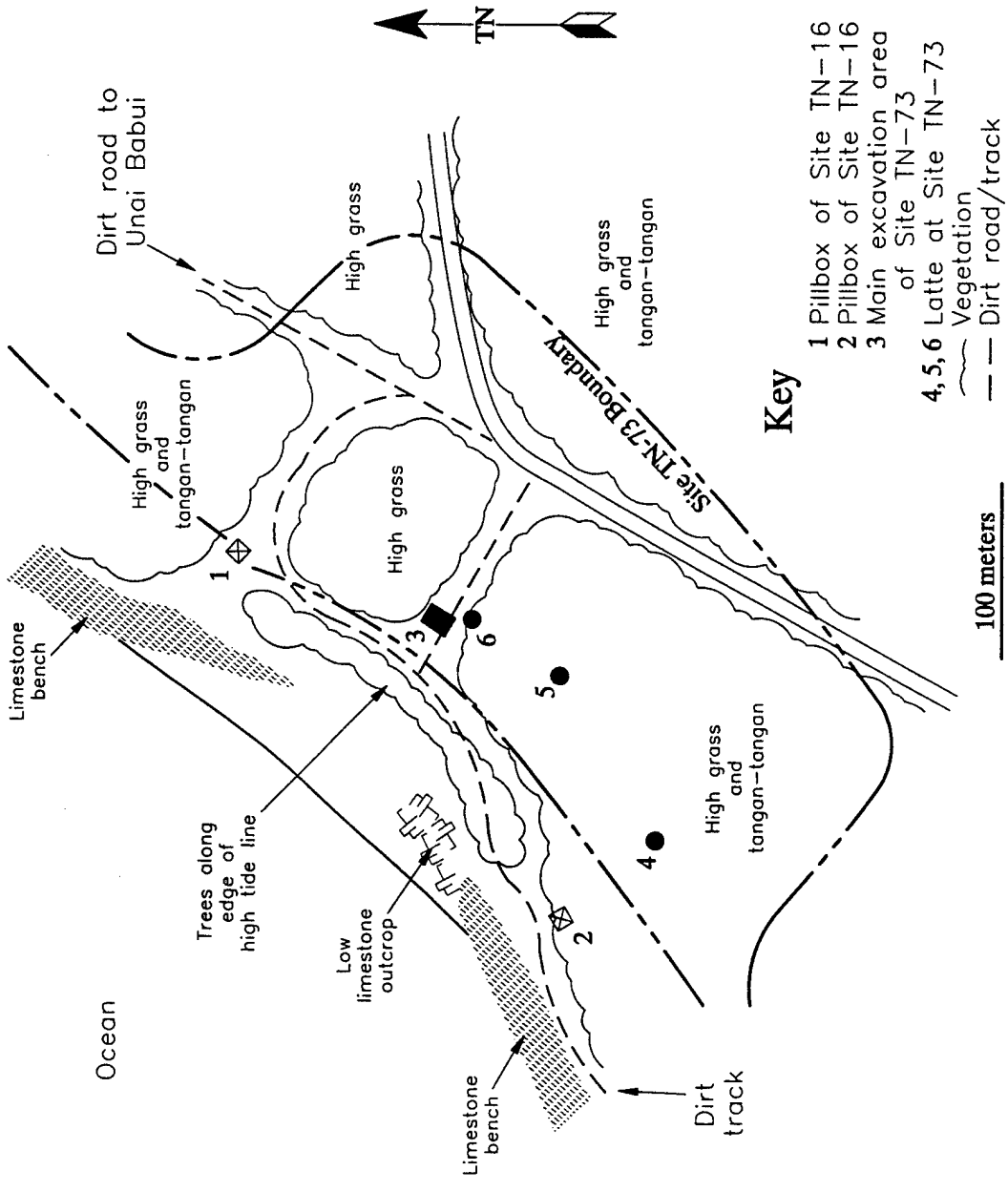


Figure 19. Detail of Unai Chulu, Site Protection Area Q.

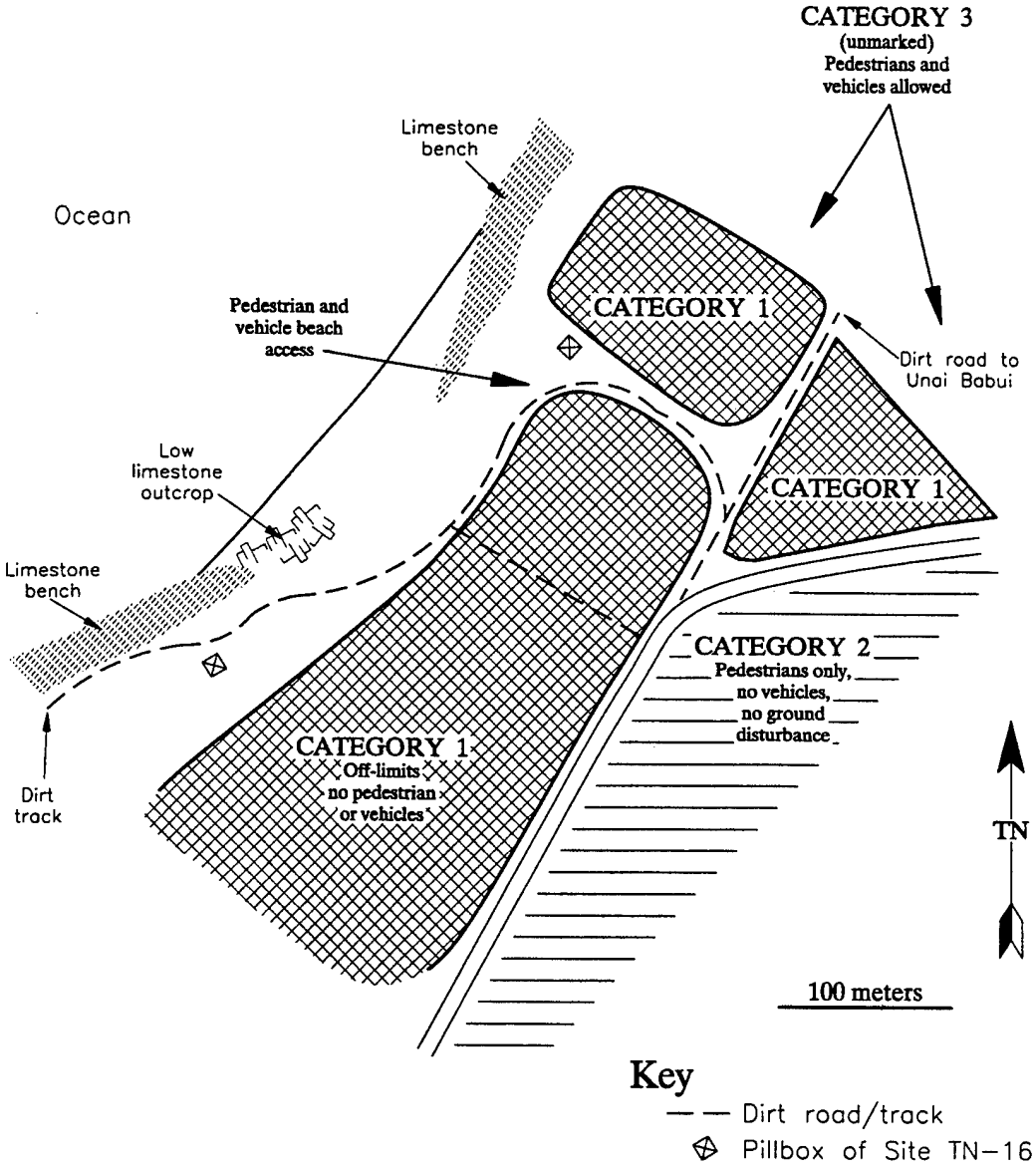


Figure 20. Constraints at Unai Chulu.

Table 16. Significant Sites of Site Protection Area Q.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
TN-016	Q	JM	Unai Chulu pillboxes; (held 20 mm cannons); JM 3rd Co 1st Battalion, 50th Infantry	A, C, D	1	Jones, 1991; Denfeld 1983; Henry et al. 1996; Henry and Haun 1995	
TN-073	Q	P	Unai Chulu latte sets, disturbed; deposit; (intensive, permanent occupation; Pre-Latte and Latte Phase)	A, C, D	3	Craib 1993:8-9; Jimenez et al. 1996; Moore et al. 1986; Henry et al. 1996	Human remains
Z-398	Q	US	American Military Cemetery, Former (2nd and 4th Marine Divisions)	A, C, D	1	Denfeld 1983, Jones 1991	
Z-540a	Q	?	Trench, military?	D	1	Henry et al. 1996	
Z-541	Q	?	Airplane wreck	D	1	Henry et al. 1996	
Z-554	Q	US	Landing craft fragments	A, D	1	Henry et al. 1996	

See Appendix A for Key to Tables.

The July 1996 field inspection of Unai Chulu indicated that the previously cleared areas of the prehistoric site are now heavily overgrown with grasses, except for the east-west bulldozed track through the middle of the site. This is now being used as a road. Because of the significance of Unai Chulu, it is recommended that the entire area of site TN-073 west of the paved road be designated Category 1, off-limits, that the bulldozed track through the site, now in use as a road, be closed off, and that all activity in the area be restricted to the sandy beach and the access road to the north of the main beach (Fig. 20).

It is recommended that Site TN-073 be set aside for long-term preservation (with some restricted research allowed), with particular emphasis on protecting the areas of the site that contain the earliest components. If it is necessary for military purposes to contract the size of the area proposed as off-limits (see Fig. 19), then data recovery should be conducted in those areas taken out of "off-limits". It is proposed in the *Site Protection Plan* that the off-limits area be identified with fencing (Tuggle and Welch 1996). However, in no case should the off-limits area as defined by fencing be moved inside the areas of the earliest components.

Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area R: Category 2, moderate constraint

SPA R (Fig. 18; Table 17), between Unai Chulu and Lake Hagoi contains portions of the Unai Chulu prehistoric site (Site TN-073) and of the Japanese village that once existed at Hagoi (Site TN-006). It is recommended for Category 2, with prohibition on vehicles and ground disturbance. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Site Protection Area S: Category 1, off-limits

SPA S is the region of Lake Hagoi (Fig. 18; Table 18), the entire area of which has been found to contain prehistoric deposits (Site Z-536) and remnants of the Japanese village (Site TN-006) that existed here prior to World War II. It is recommended as off-limits. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Table 17. Significant Sites of Site Protection Area R.

Site Number	SPA	Site	Site Description	NR eligible criteria	Threat	References	Notes
TN-006b	R	JC	Village (Hagoi)	A, D	3	Franklin and Haun 1995; Jones 1991	
Z-536a	R	P	Artifact scatter, extensive, undisturbed deposits; (intensive, permanent occupation)	A, C, D	3	Franklin and Haun 1995: Tables 5 and 13; 51; Craib 1993; Henry et al. 1996	Human remains
Z-539	R	JM	Military complex; plus civilian features; railroad bed and roads	A, C, D	1	Franklin and Haun 1995: Tables 5 and 13	
Z-540b	R	?	Trench, military?	D	1	Franklin and Haun 1995: Tables 5 and 13	

Area R also contains a portion of Site TN-073 (the prehistoric Unai Chulu deposit). See Appendix A for Key to Tables.

Table 18. Significant Sites of Site Protection Area S.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References	Notes
TN-006a	S	JC	Village (Hagoi) w/Railroad line	A, D	3	Craib 1993; Henry et al. 1996; Jones 1991	
Z-536b	S	P	Artifact scatter, extensive, undisturbed deposits; (intensive, permanent occupation)	A, C, D	3	Franklin and Haun 1995: Tables 5 and 13; 51; Craib 1993; Henry et al. 1996	Human remains
Z-537	S	JC/US	Homestead, modified as pumping station; cisterns, slabs, concrete box	A, D	2	Henry et al. 1996	
Z-538	S	JC	Homestead, partial	D	2	Henry et al. 1996	

See Appendix A for Key to Tables.

Site Protection Area T, U, and V: Categories 2 and 3

Of the three Site Protection Areas in the Leaseback Area (T, U, and V; Fig. 21; Table 19), T and V are recommended for temporary placement in Category 2 because of the lack of archaeological survey of the areas. In Figure 20, it should be noted that all of the sites marked with hatched lines are identified primarily from aerial photographs of the late 1940s and their current conditions are unknown. Future surveys in these areas would make the site information current and would allow a refined categorization of site protection areas.

One of the main roads through the Leaseback area (8th Avenue) has been surveyed (Area U) and is placed in Category 3, having only a limited number of features to avoid. Detailed site protection recommendations are presented in Tuggle and Welch (1996).

Specific Military Training Actions

Certain specific actions in the scoping documents are proposed for locations that may result in a direct impact on cultural resources. In particular these include locations for bivouacs, urban warfare, and weapons training (see Fig. 2). If locations for bivouacs and urban warfare impact on Category Areas 1 or 2, the activities should be relocated to Category Areas 3 or 4, if possible. If this is not feasible, then site protection and mitigation plans specific to each project should be developed. It should be emphasized that the level of detail on historic resources in a number of SPAs is not adequate for specific project planning. As described elsewhere in this *Assessment* and in the *Site Protection Plan,* not all areas have been surveyed at an inventory level, and many of the surveys that have been conducted have not been reported in detail.

Additional detail on proposed training facilities is provided in Figure 22. This includes a fire and maneuver range for small arms (which overlaps a proposed mortar range), two possible locations for construction of a shooting house (for urban training), the use of the WWII Japanese air administration staff building (not shown on Figure 22) for urban training, and development of two base support camp sites. The old mortar range (see Fig. 2; "weapons training") is to remain closed. Additional details are provided in Belt Collins Hawaii (1996b:2-32; Figures 2-12 and 2-13).

Fire and Maneuver Range; Mortar Range

The Fire and Maneuver Range will involve construction of a berm west of the public road and removal of tangantangan. The mortar range will require no construction or vegetation clearance, but will have target areas and an associated impact and safety zone.

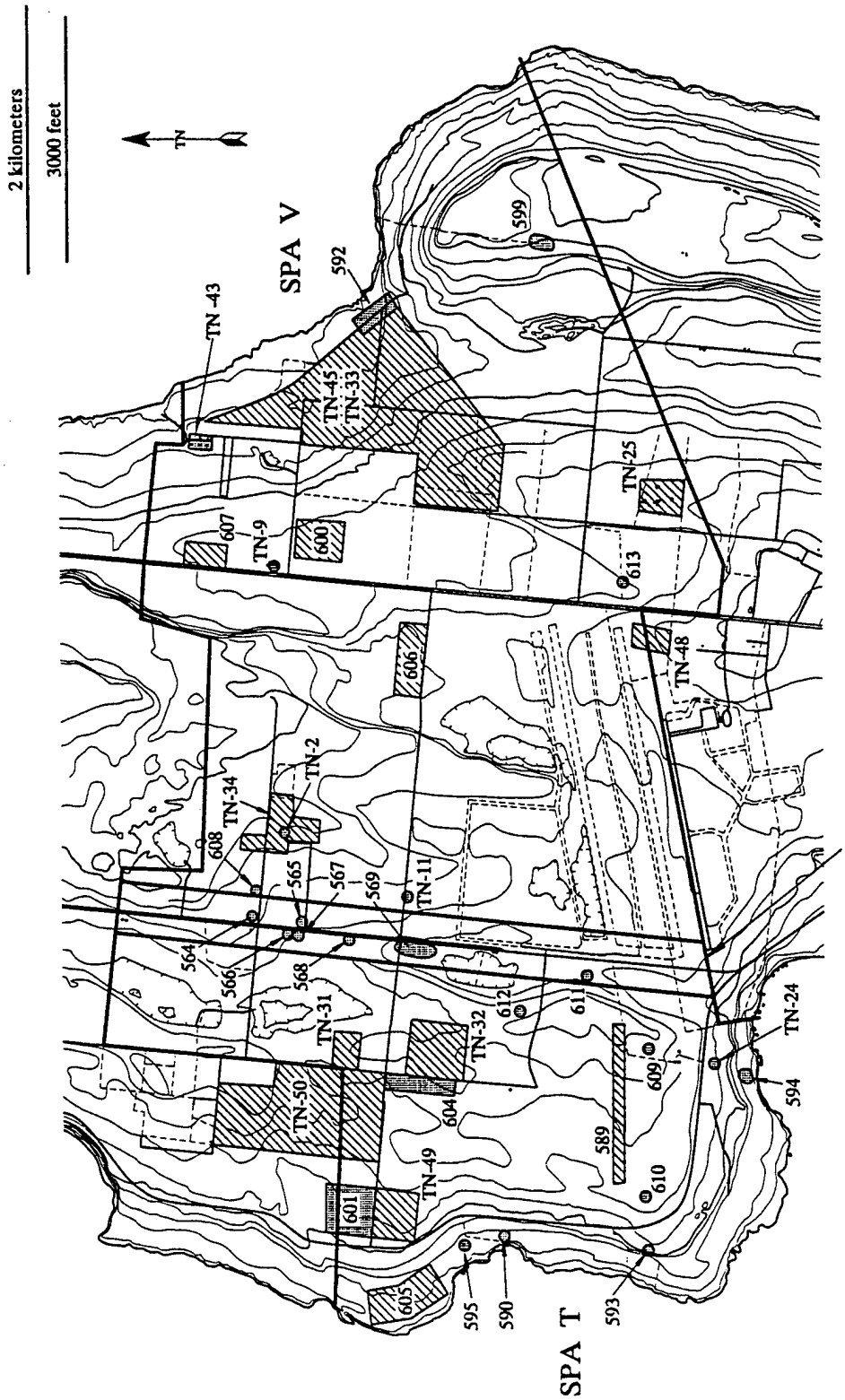


Figure 21. Significant archaeological sites, Site Protection Areas T, U, and V. (All site numbers without TN- prefix have Z- prefix.) The hatched site areas indicate site identification from aerial photos, without ground verification.

Table 19. Significant Sites of Site Protection Areas T, U, V.

Site Number	SPA	Site Type	Site Description	NR eligible Criteria	Threat	References
TN-024	T	JM	Peipeinigul Gun	A, C, D	2	Jones 1991:192
TN-031	T	US	58th Wing HQ	A, B, D	3	Jones 1991: 246
TN-032	T	US	107th NCB Area	A, B, D	3	Jones 1991:251
TN-049	T	US	462nd Bomb Group Camp	A, B, C, D	3	Jones 1991:324
TN-050	T	US	Army Garrison Forces Depot	A, B, D	3	Jones 1991: 327
Z-589	T	JM	Gurguan Point Airfield	A, D	1	Jones 1991:201
Z-590	T	P	*Latte* sets (2), mortars	A, D	3	Moore et al. 1986:175
Z-593	T	P	Rock shelters (2) mortars, pottery	A, D	3	Moore et al. 1986:175
Z-594	T	P	Mortar, pottery	D	3	Moore et al. 1986:175
Z-595	T	P	Surface material	D	3	Moore et al. 1986:175
Z-601*	T	US	444th BG	A, D	2	*
Z-604*	T	US	468th BG	A, D	2	*
Z-605*	T	US	40th BG	A, D	2	*
Z-609*	T	US	C Battery, 18th AAA	A, D	2	*
Z-610*	T	US	A Battery, 180th SCA	A, D	2	*
Z-612*	T	US	Napalm Bomb Dump	A, D	0	*
TN-030	U	US	West Field (on-ramps)	C, D	1	Jones 1991: 240-245; Henry and Haun 1995
Z-565	U	P	Sherd scatter	D	3	Henry and Haun 1995
Z-566	U	PWC	Camp Churo ditch	A, D	1	Henry and Haun 1995
Z-567	U	US	Quarry	D	0	Henry and Haun 1995
Z-568	U	JC	Habitation complex	A, D	2	Henry and Haun 1995
Z-569	U	JC	Habitation complex	A, D	2	Henry and Haun 1995
Z-611*	U	US	HQ LAA 18th AAA	A, D	2	*
TN-009	V	J	Radio Communication Complex	A, D	2	Jones 1991: 98-110
TN-011	V	JC	86th St. Shinto Shrine	A, C, D	3	Jones 1991: 126
TN-025	V	JM	Antenna Tower Supports	D	1	Jones 1991:196
TN-033	V	US	Masalog Storage Quonset Huts	A, D	1	Jones 1991:258
TN-043	V	US	Munitions Storage Quonset Huts	A, D	1	Jones 1991: 304-307
TN-045	V	US	Masalog Storage Revetments	A, D	1	Jones 1991: 311
TN-048	V	US	Naval Air Base	A, B, C, D	1	Jones 1991
Z-592	V	P	*Latte* sets (5), mortars, quarry	A, D	3	Moore et al. 1986:175
Z-599*	V	US	696 Sig. AW Co	A, D	2	*
Z-600*	V	US	Hospital	A, D	2	*
Z-606*	V	US	87 & 25 Service Corps	A, D	2	*
Z-607*	V	US	240 Ord Ammo Co; 813, 827, 891 Chem. Co.	A, D	2	*
Z-613*	V	US	D Battery, 18th AAA	A, D	2	*

See Appendix A for Key to Tables.

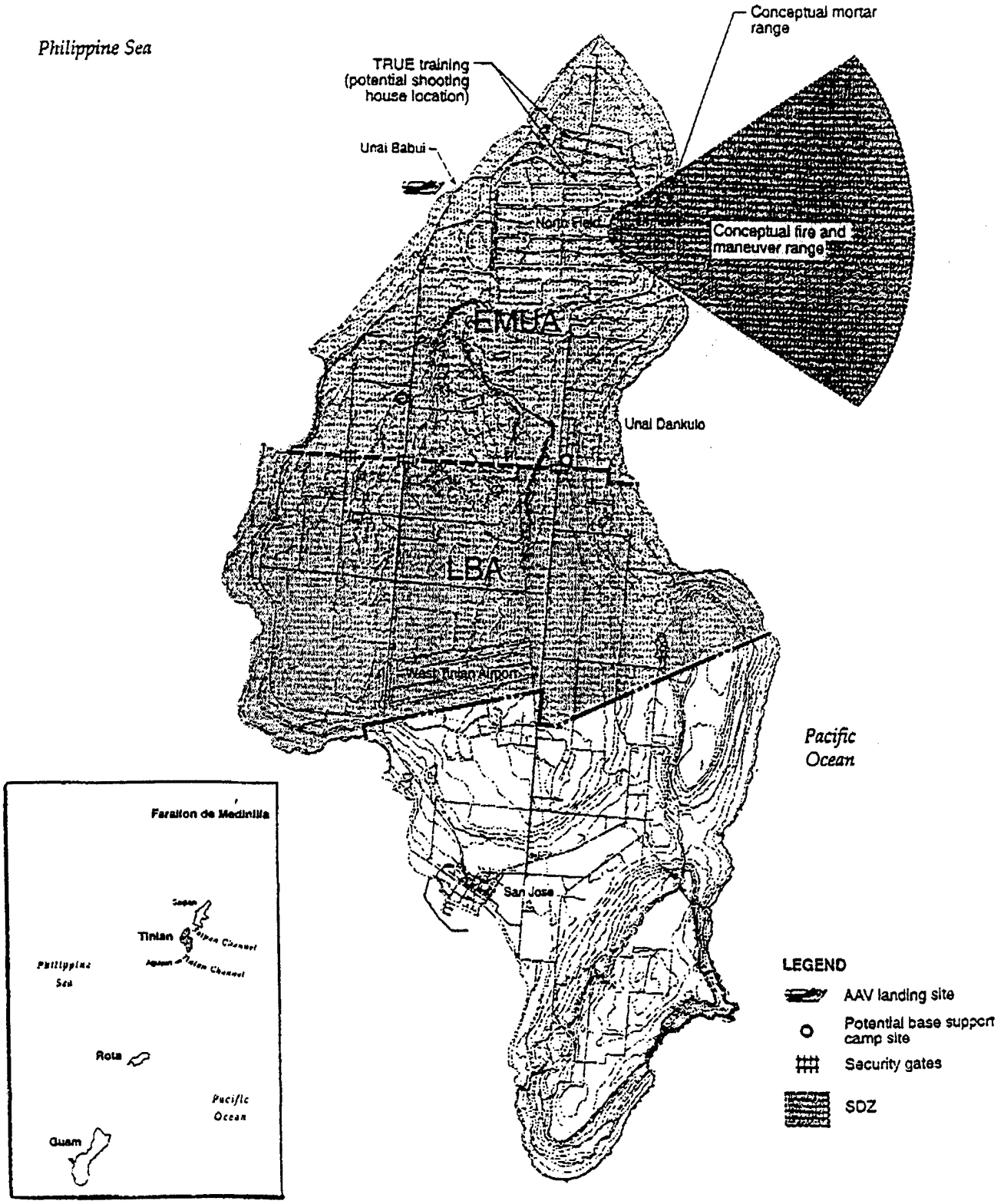


Figure 22. Proposed Tinian Training. (From Belt Collins Hawaii 1996b:Figure 2-10.)

These activities and facilities are proposed for an area in SPA D (see Fig. 11), with the safety fan for the Fire and Maneuver Range extending into SPA B (see Fig. 10). As indicated in the figures, there are several archaeological sites in the range area in SPA D (Category 3, limited constraint) including runways and taxiways (Site Z-364) of the North Field National Landmark, a variety of military debris (Site Z-416), a *latte* fragment (Site Z-419), a prehistoric sherd scatter (Site Z-421), and two WWII battery complexes (Sites Z-400 and Z-544). One important complex (Site Z-420) lies just to the west of the range. The portion of the range and safety fan that covers SPA B (Category 4, unconstrained, with protective actions implemented) is primarily in the old mortar range, which has no recorded sites, but the northeastern portion of the fan includes four sites in SPA B (see Fig. 10), WWII defensive complexes (Sites TN 19, TN-20, and Z-397) and one ceramic deposit (Site Z-396). All of these sites in the project area are recommended as eligible to the NRHP (Appendix A).

There are several sites in this area for which there would probably be little effect resulting from development and use of the firing ranges, including Sites Z-396, Z-397, Z-400, Z-419, TN-19, and TN-20. These sites all fall along the outer edge of the small arms safety fan for the Fire and Maneuver Range and are not in the Mortar Range.

Sites for which there could probably be an adverse impact resulting from berm construction and mortar firing include Z-364, Z-416, Z-421, and Z-544. The runways of Site Z-364 would be damaged by errant mortar fire. These is no way to avoid this threat, but damage should be mitigated by a program of runway repair. Sites Z-416 and Z-421 are recommended as significant for their information content, and suitable for mitigation of any adverse effect by means of data recovery (Appendix A). Appropriate data recovery of the military features of Site Z-416 would be detailed mapping and recording and collection of appropriate artifacts. Data recovery of Site Z-421, a prehistoric pottery scatter and partially disturbed deposit, should consist of a sample excavation (see Henry et al. 1996:38, B-10, field site no. 501). Site Z-544 is a large complex of US defensive features, probably including B Battery of the 17th AAA, and is recommended for preservation as a part of the North Field complex (Appendix A; also see Henry et al. 1996;B-135 and C-256, field site no. 332). However, if the location of the mortar range, which falls within the boundaries of Z-544, is deemed necessary, then the affected portion of Z-544 should be subject to data recovery. This should consist of detailed mapping and collection of appropriate artifacts.

Site Z-420 appears to be removed from the area of activity, but this well-preserved activity locale (see Craib 1995:Figure 16; field site no. 40) should be protected by some form of demarcation to avoid inadvertent damage and the area should be archaeologically monitored during berm construction.

Shooting Houses and Urban Training

The construction of a shooting house in one of two possible locations is proposed for North Field (Fig. 22), as well as the use of the Japanese Air Administration Staff Building

(Site Z-366) for urban training employing small arms fire. The shooting house would be a two-story concrete structure.

One of the proposed locations is immediately north of North Field runway number 1 and the second location is within a northern hardstand complex (Fig. 22), both within SPA D (Category 3, limited constraint), which is part of the North Field National Landmark. The first location is in an area surveyed by Craib (1995:93; survey area 3A) who reports a "low site density" with a total of six concrete structures in the entire survey area. However, the locations and descriptions of these sites are not indicated in the draft report and thus the sites have not been included in the assessment However, given the low site density, it would appear that the shooting house could be constructed without effect on historic properties in the area. It is recommended that if this locale is selected for construction that the shooting house be placed to avoid the existing structures.

The second location considered for the shooting house was surveyed by Donham (1986:Figure 4), with no sites identified in the area except hardstands (Donham 1986:Figure 6).

The Japanese Air Administration Staff Building, in the North Field National Landmark (and in SPA A, Category 2, moderate constraint), is proposed for use of live fire exercises in urban training. Protection of the structure is to be accomplished by the use of temporary bullet traps (Belt Collins Hawaii 1996b:2-32). However, this is one of the two most important standing structures in the North Field Landmark (along with the Air Operations Building), and heavy use of the building and potential failure of the bullet traps could result in serious damage. This structure is also recommended for long-term preservation and stabilization or rehabilitation (Tuggle and Welch 1996). It is recommended that construction of a shooting house or houses be chosen as the preferred alternative for urban warfare, and that the use of the Air Administration Staff Building (as well as the Air Operations Building) should be avoided if at all possible.

If it is decided to undertake the urban training using the Air Administration Staff Building or Air Operations Building, then appropriate mitigation measures should be implemented. These should include written and photographic documentation of the present condition of the building prepared by an architectural historian prior to initiation of the training exercises, followed by periodic monitoring of the building's condition to verify that live fire training is not damaging the building. If damage occurs, the training should be discontinued. The military should clean the area following each training exercise, but should not make any repairs of any damage they might cause. Repairs should be part of a historic rehabilitation program (see Tuggle and Welch 1996).

Base Support Camp Sites

One possible location for a base support camp is on the western side of the EMUA (Fig. 22), in SPA K. This area has not been archaeologically surveyed. It is recommended that such a survey be conducted prior to the development of the base camp.

A second possible location for a base support camp is in on the eastern side of the EMUA (Fig. 22) in SPA H (Category 3, limited constraint), in the vicinity of Sites Z-479 and Z-480, both of which are probably remnants of the 9th NCB encampment, with associated demolished pre-war Japanese structures. It is probable that the camp would have no effect on these remnants (which have been mapped) and it is recommended that no additional preservation action needs to take place in this locale related to the base camp development.

Management of Site Protection Areas

As noted above in the description of the Site Protection Areas, in general it is recommended that long-term protection be afforded areas by a variety of measures including permanent fencing for those areas that are eventually agreed to be designated as off-limits, and appropriate signage for selected portions of the Category 2 and Category 4 areas. Details on proposed management of site protection areas are provided in the *Site Protection Plan* (Tuggle and Welch 1996).

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APPENDIX A: SIGNIFICANT SITES (AS RECOMMENDED) IN THE MILITARY LEASE AREA OF TINIAN

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian.

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
?	?	P	Cave with sherds		D		?	3	H-035	Henry et al. 1996	
?	?	US	Truck, tanker		D		?	1	H-024	Henry et al. 1996	
TN-001	H	JC	Factories, remains		A, D		X	2	J-1001	Jones 1991:36	
TN-002	K	JC	Civilian Camp		A, D		X	3	J-1002	Jones 1991:40	
TN-003	K	JC	Administration Bldg		A, D		X	3	J-1003	Jones 1991:47	
TN-004	L	JC	Mt. Lasu shrine		C, D		X	3	J-1004: BS-T-25	Jones 1991; Henry and Haun 1995; Eble et al. 1995	
TN-005	N	US	Asphalt plant, wall foundation		A, D	X		1	J-1005; H-433	Henry et al. 1996; Jones 1991	
TN-006a	S	JC	Village (Hagoi)w/Railroad line		A, D		X	3	OG-J-7; J-1006; (H-367-369; HS-7)	Craib 1993; Henry et al. 1996; Jones 1991	
TN-006b	R	JC	Village (Hagoi)		A, D		X	3	HS-6; J-1006	Franklin and Haun 1995; Jones 1991	
TN-007	H	JC/US	Asahi (Sunrise) shrine		C, D		X	3	J-1007	Jones 1991	
TN-008	H	JC	NKK shrine		C, D		X	3	J-1008; D-11	Jones 1991, Denfeld 1983	
TN-009	V	J	Radio Communication Complex		A, D		X	2	J-1009	Jones 1991: 98-110	
TN-011	V	JC	86th St. Shinto Shrine		A, C, D		X	3	J-1011	Jones 1991: 126	
TN-014	L	JM	Radar tower supports		D	X		3	J-2003	Jones 1991	
TN-015	I	JM/P	Caves, with prehistoric deposits and WWII defensive features; (probably contains headquarters of Colonel Ogata)		A, B, C, D		X	3	(H-284,457, 512); J-2004	Henry et al. 1996; Jones 1991	
TN-016	Q	JM	Unai Chulu pillboxes; (held 20 mm cannons); JM 3rd Co 1st Battalion, 50th Infantry		A, C, D		X	1	D-26 J-2005; H-356; 1571-11	Jones, 1991; Denfeld 1983; Henry et al. 1996; Henry and Haun 1995	
TN-018	A	JM	Drainage ditch (Ushi Field Complex)		A, C, D		X	1	D-8; J-2007; H-155	Jones 1991; Henry and Haun 1995; Henry et al. 1996	
TN-019	B	JM	Revetments, earthen; munitions storage		D		X	1	J-2008; H-316	Henry et al. 1996	
TN-020	B	JM	NE coast complex; defensive tunnels		A, D		X	2	J-2008; H-314	Jones 1991; Henry et al. 1996	
TN-022	H	JM	Unai Dangkulo defensive complex		A, C, D		X	1	DS-25; J-2011; (H-330, 331)	Henry et al. 1996; Jones 1991; Franklin and Haun 1995	
TN-024	T	JM	Peipeinigul Gun		A, C, D		X	2	J-2013	Jones 1991:192	
TN-025	V	JM	Antenna Tower Supports		D	X		1	J-2014	Jones 1991:196	
TN-030	U	US	West Field (on-ramps)		C, D		X	1	J-3005	Jones 1991: 240-245; Henry and Haun 1995	
TN-031	T	US	58th Wing HQ		A, B, D		X	3	J-3006	Jones 1991: 246	
TN-032	T	US	107th NCB Area		A, B, D	?	?	3	J-3007	Jones 1991:251	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
TN-033	V	US	Masalog Storage Quonset Huts		A, D	X		1	J-3008	Jones 1991:258	
TN-034	K	US/C	Camp Churo Cemetery		A		X	3	J-3009	Jones 1991:261	
TN-035	K	US	Stone headwalls, street intersection		A, D		X	1	J-3010	Jones 1991:264	
TN-036	K	US	313th Bomb Wing HQ		A, B,		X	3	J-3011; (BS-T-18,-20)	Eble et al. 1995; Jones 1991	
TN-037	L	US	B-29 homing tower		A, D		X	1	J-3012; BS-T-26	Jones 1991; Eble et al 1995	
TN-038	L	US	Army hospital		A, D		X	2	J-3013; (BS-T-21, 22)	Denfeld 1983; Jones 1991; Eble et al. 1995	
TN-039	P	US	509th Composite Group encampment (prev. 18th NCB)		A, B, C, D		X	3		Craib 1993; Jones 1991	
TN-041	A	US	A-bomb assembly areas; earthen enclosures, platforms		A, B, C, D		X	2	D-14; J-3016; H-497	Jones 1991; Henry et al. 1996; Welch and Tuggle 1996	
TN-042	A	US	17th AAA recreational structure remnant		A, B, C, D		X	2	D-13; J-3017;H-521	Denfeld 1983; Henry et al. 1996; Jones 1991:31, 297-303	
TN-043	V	US	Munitions Storage Quonset Huts		A, D	X		1	J-3018	Jones 1991: 304-307	
TN-045	V	US	Masalog Storage Revetments		A, D	X		1	J-3020	Jones 1991: 311	
TN-048	V	US	Naval Air Base		A, B, C, D		X	1	J-3023	Jones 1991	
TN-049	T	US	462nd Bomb Group Camp		A, B, C, D		X	3	J-3024	Jones 1991:324	
TN-050	T	US	Army Garrison Forces Depot		A, B, D		X	3	J-3025	Jones 1991: 327	
TN-051	K	US	Guard rail		?	X		1	J-3026, BS-T-02	Eble et al. 1995; Jones 1991	
TN-052	K	US	504 Bomb Group Camp		A, B, D		X	3	J-3027; BS-T-03; (part of 0052 TN)	Eble et al. 1995; Jones 1991	
TN-071	K	P	San Hilo pictographs		A, C, D		X	3	M-28; BS-T-05	Eble et al. 1995; Moore et al. 1986	
TN-072	M	P	Latte sets at Sab. Fam. with stratified deposits; features; (intensive, permanent occupation; Pre-Latte and Latte Phase)	X	A, C, D		X	3	(M-27; H-417)	Moore et al. 1986; Henry et al. 1996	
TN-073	Q	P	Unai Chulu latte sets, disturbed; deposit; (intensive, permanent occupation; Pre-Latte and Latte Phase)	X	A, C, D		X	3	(H-48, 354, 359; M-7)	Craib 1993:8-9; Jimenez et al. 1996; Moore et al. 1986; Henry et al. 1996	
TN-074	A	P	Unai Babui latte set; large, stratified deposit, features, (intensive, permanent occupation; Pre-Latte and Latte Phase)	X	A, D		X	3	(M-23; H-486)	Moore et al. 1986; Henry et al. 1996	
TN-075	A	P	Unai Lamlam ceramic deposit		A, D		X	3	M-2; C-48	Moore et al. 1986; Craib 1995	
TN-076	A	P	P. Tahgong latte sets stratified deposits, features; (intensive, permanent occupation; Latte Phase ceramic)	X	A, D		X	3	(M-1; H-505)	Moore et al. 1986; Henry et al. 1996	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
TN-077	E	P	Unai Chiget latte sets, deposit; (intensive, permanent occupation)		A, D		X	3	C-52, 53; H-252,253; M-29	Moore et al. 1986; Henry et al. 1996; Craib 1995	
TN-078	J	P	Unai Dangkulo latte sets, deposit; (intensive, permanent occupation)		A, C, D		X	3	DS-21; (M-11-21) H-278	Craib 1994; Franklin and Haun 1995; Moore et al. 1986	
Z-353	A	JC	Cistern		D		X	2	H-065	Henry et al. 1996	
Z-354	A	JM	Defensive enclosure, earthen		D		X	1	H-019	Henry et al. 1996	
Z-355	A	JM	Unai Babui defensive complex: fuel drum gun enclosures (JM, 3rd Co. 1st Battalion, 50th Infantry Div.)		A, C, D		X	3	(H-004, 005, 007-013, 015, 017, 018, 050)	Henry et al. 1996; Jones 1991	(1)
Z-356	A	JM	Gun position, fuel drum revetment		A, D		X	2	0218-T-22	Donham 1986:32, 68	
Z-357	A	US	Gun position, fuel drum revetments		A, D		X	2	(H-123, H-022)	Henry et al. 1996	
Z-358	A	US	Gun position, fuel drum revetment		A, D		X	2	D-22; H-021	Denfeld 1983; Henry et al. 1996	
Z-359	A	US	Landing craft, and craft fragments	X	A, D	X		1	(H-023, 028)	Henry et al. 1996	
Z-360	A	P	Pottery scatter		D	X		3	OG-P-03	Craib 1993:8, Fig. 1	
Z-361	A	J	Trash scatter		D	X		1	H-034	Henry et al. 1996	
Z-362	A	US	509th Composite Group service area		A, C, D		X	1	H-001	Henry et al. 1996	
Z-363	A	JM	Gun emplacement		A, C, D		X	1	D-1	Denfeld 1983; Henry and Haun 1995	
Z-364	D	US	North Field runways, hardstands, and taxiways		A, B, C, D		X	0	(D-20, H-210-214)	Denfeld 1983:37	(2)
Z-365	A	US	Atomic bomb loading pits		A, B, C, D		X	2	D-19	Denfeld 1983:36	
Z-366	A	JM	Air Administration staff building (Ushi Field Complex)		A, B, C, D		X	1	D-5, J-2016	Jones 1991:29, 204-210	
Z-367	A	JM	Air Operations building (Ushi Field Complex)		A, C, D		X	1	D-7; J-2017	Jones 1991:29, 211-214	
Z-368	A	JM	Power plant (Ushi Field Complex)		A, C, D		X	2	D-4; J-2018	Jones 1991:30, 215-221	
Z-369	A	JM	Air raid shelters (Ushi Field Complex)		A, C, D		X	1	D-6; J-2019	Jones 1991:30, 222-225	
Z-370	A	JM	Aircraft parking area (Ushi Field Complex)		A, D		X	0			
Z-371	A	JM	Housing remains, cisterns, air raid shelters, etc., west of X-370 (Ushi Field Complex)		A, D		X	2			
Z-372	A	JM	Housing remains, cisterns, air raid shelters, etc., east of X-370 (Ushi Field Complex)		A, D		X	2	OG-J-08		
Z-373	A	JM	Storage bunker, fuel drum (Ushi Field Complex)		A, C, D		X	0	D-3; 0218-T-45	Donham 1986:33, 35; Denfeld 1983	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-374	A	JM	Storage bunker, ammo, demolished (Ushi Field Complex)		A, C, D		X	0	D-3; 0218-T-46	Donham 1986:34, 52; Denfeld 1983	
Z-375	A	JM	Gun positions, fuel drum enclosures, concrete storage bunker (Ushi field defensive complex)		A, C, D		X	1	(0218-T-01, 0218-T-03-16)	Donham 1986:31, 34	
Z-376	A	US	Mound, dump		D	X		0	H-348	Henry et al. 1996	
Z-377	A	JM/US	Defensive complex, fuel drum enclosure, earthen enclosure., slabs (Ushi Point complex 2; reused by US)		A, C, D		X	1	(H-344, 350)	Henry et al. 1996	
Z-378	A	JM/US	Gun position, fuel drum, encl., slabs (Ushi Point complex 1; reused by US)		A, D		X	1	H-329	Henry et al. 1996	
Z-379	A	US	17 AAA camp remains		A, D	X		3	various IOs (isolated objects, see Henry et al. 1996:Figure 180)		
Z-380	A	US	Debris, equipment		D	X		1	0218-T-24	Donham 1986:32, 81	
Z-381	A	P	Sherd scatter		D	X		3	0218-T-23	Donham 1986:32, 83	
Z-382	A	US	A Battery, 17th AAA; foundation piers, concrete pads		A, C, D		X	2	(0218-T-31.32.34)	Donham 1986:33, 48	
Z-383	A	P	Sherd scatter, lithics		D	X		3	0218-T-36	Donham 1986:33, 84	
Z-384	A	US/JM ?	Foundation, gun revetment, debris, foxhole		A, C, D	X		1	(0218-T-33, 48, 49)	Donham 1986:33, 50	
Z-385	A	P	Sherd scatter		D	X		3	0218-T-35	Donham 1986:33, 83	
Z-386	B	P	Sherd scatter		D	X		3	0218-T-44	Donham 1986:33, 86	
Z-387	B	US	Rubble steps, structure remnants; trash, engine parts		D	X		1	(0218-T-38, 40-42)	Donham 1986:33, 71	
Z-388	B	?	Berm, fence		D	X		1	(0218-T-28, 30)	Donham 1986:32, 73	
Z-389	B	?	Revetment, mound		A, D	X		1	0218-T-29	Donham 1986:32, 68	
Z-390	C	US	Dump		D	X		0	H-325	Henry et al. 1996	(3)
Z-391	C	JM	Gun complex, fuel drum enclosures		D		X	1	H-326	Henry et al. 1996	
Z-392	B	P	Ceramics, shallow deposit, feature		A, D		X	3	H-504	Henry et al. 1996	
Z-393	B	US	B Battery, 17th AAA; Defensive mounds, earthen (radar/searchlights)		A, D		X	1	H-319	Henry et al. 1996	
Z-394	B	P	Ceramics, small shallow deposit		D	X		33	H-503	Henry et al. 1996	
Z-395	H	JC	Bd debris, demolished house		D	X		22	H-231	Henry et al. 1996	
Z-396	B	P	Ceramics, small shallow deposit		D	X		3	H-502	Henry et al. 1996	
Z-397	B	JM	NE coast defensive complex, stone/earthen mounds (for radar/searchlights), trash		A, D		X	1	(H-309, 313)	Henry et al. 1996	
Z-398	Q	US	American Military Cemetery, Former (2nd and 4th Marine Divisions)		A, C, D		X	1	D-21; J-3029	Denfeld 1983, Jones 1991	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-399	C	US	Dump		D	X		0	H-318	Henry et al. 1996	
Z-400	D	?	Gun enclosure, earthen		D		X	1	H-339	Henry et al. 1996	
Z-401	C	US	313th Wing Base Service Command, service group shop area (359th, 358th, 77th, and 72nd Service Groups)		A, B, D		X	3	D-18; P-1; OG-U-01	Denfeld 1983:35; Dilli and Haun 1991:16-17); Craib 1993	
Z-402	D	US	B-29 service apron shop		A, B, D		X	1	D-17; 0218-T-47	Donham 1986:34, 54; Denfeld 1983	
Z-403	D	?	Aircraft debris, rubbish, secondary		D	X		1	0218-T-17	Donham 1986:32, 82	
Z-404	D	P	Sherd scatters		D	X			(0218-T-18-21, 26)	Donham 1986:32, 82	
Z-405	D	JM	Gun position, fuel drum revetment		A, D		X	1	0218-T-25	Donham 1986:33, 68	
Z-406	D	JM	Unai Chulu defensive complex; gun positions, fuel drum revetments (JM 3rd Co. 1st Battalion, 50th Infantry Division)		A, C, D		X	1	(H-056-59)	Henry et al. 1996	
Z-407	D	JM	Unai Babui defensive complex; fuel drum revetments, earthen mounds (JM 3rd Co. 1st Battalion, 50th Infantry Division)		A, C, D		X	3	(H-040-42, 45, 48, 49, 51, 52, 54, 55)	Henry et al. 1996	
Z-408	D	US	Amtrak		A, C, D		X	1	1571-T-15	Henry and Haun 1995	
Z-409	D	JM	Water collection culverts for purification plant; structures		A, D		X	2	D-8, H-156	Denfeld 1983; Henry et al. 1996	
Z-410	D	M	Dump with Japanese boundary marker		D	X		1	H-154	Henry et al. 1996	
Z-411	D	US	Airplane wreck		D	X		1	H-153	Henry et al. 1996	
Z-412	D	US	Tower base, fuel drums, and culverts, with inscriptions by 110th NSB; inscriptions by 13th NCB		A, D		X	0	(H-126, 129)	Henry et al. 1996	
Z-413	D	JM/w US?	Gun position, fuel drum enclosures; tower bases		A, D		X	1	(H-130-134,136, 143)	Henry et al. 1996	
Z-414	D	JC	Japanese Civilian habitation complex; Homestead, partial; with RR bed		A, C, D		X	2	(H-139, 140, 145)	Henry et al. 1996	
Z-415	D	US	Cluster of destroyed machinery and steel, iron, and aluminum fragments; concrete boxes, pads, culverts, iron structure, tire dump, crane section, fuel drums		D	X		0	(C-08-11, 13,-23)	Craib 1995:59, 63	
Z-416	D	US	Drums, concrete boxes, culverts Baldwin-Lima-Hamilton crane and associated debris, machinery, tower remnants		D	X		1	(C-01, 02,05-06, 24-29, 31, 35-37, 39, 41-43)	Craib 1995:58-59	
Z-417	D	P	*Latte* pillars, possible; limestone fragments; pottery scatter; (some concrete fragments)		D	X		3	(C-03-04)	Craib 1995:59, 62	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-418	D	P	Sherd scatter		D	X		3	C-30	Craib 1995:60, 69, 72	
Z-419	D	P	*Latte* stones, possible		D	X		3	C-34	Craib 1995:60, 72-73	
Z-420	D	US/JC ?	Building foundations, rock-lined path, metal troughs, trash dump or latrine area; also Japanese sugar village remnant?		A, D	X		1	C-40	Craib 1995:60, 74, 77-78	
Z-421	D	P	Ceramics, small shallow deposit		D	X		3	H-501	Henry et al. 1996	
Z-422	D	M	Bd debris		D	X		0	H-215	Henry et al. 1996	
Z-423	D	US	Enclosure, earthen, pit; storage		D	X		1	H-247	Henry et al. 1996	
Z-424	D	US	Dump		D	X		0	H-209	Henry et al. 1996	
Z-425	D	US	Dump		D	X		0	H-219	Henry et al. 1996	
Z-426	D	US	Service area and assoc. encampment, of 121st NCB (first CBs on island)		A, B, C, D		X	2	H-245, D-28	Henry et al. 1996	
Z-427	D	US	Defensive enclosure of metal boxes		A, D	X		1	H-194	Henry et al. 1996	
Z-428	D	US	Enclosures, earthen, storage		D	X		1	H-296	Henry et al. 1996	
Z-429	D	US	Encampment, original 67th NCB, (moved to Site 68)		A, D		X	2	H-201	Henry et al. 1996	
Z-430	D	US/JM ?	Defensive complex, with gun positions, fuel drum; dump		A, D		X	1	(H-167, 176-178, 334)	Henry et al. 1996	
Z-431	E	P	Ceramic scatters; medium size, stratified deposit; large stratified deposit	X	D	X		3	(H-220, 482, 484)	Henry et al. 1996	
Z-432	E	JM/P	Laderan Chiget defensive cave complex, rifle positions, fuel drum enclosures (assoc. with JM 2nd Battalion 50th Infantry Div.) and Cave complex, with stratified prehistoric deposits; with Pre-Latte and Latte Phase (intensive, permanent occupation)		A, C, D		X	3	(H-88, 89, 91-94, 104-109, 116, 118-121, 250, 254), (C-49-51, 54-56)	Henry et al. 1996	
Z-433	E	P	Latte sets and stratified deposits, features; Pre-Latte and Latte Phase (intensive, permanent occupation); various deposits	X	A, D		X	3	(H-255, 479-481)	Henry et al. 1996	
Z-434	E	JC	Homestead, partial		D	X		2	H-251	Henry et al. 1996	
Z-435	E	JC	Railroad bed, with rails, wooden ties; stacked facing		A, C, D		X	1	H-090	Henry et al. 1996	
Z-436	F	JC	Railroad bed, with rails; stacked facing		A, C, D		X	1	H-083	Henry et al. 1996	
Z-437	F	J	Railroad bed, with rails; stacked facing		A, C, D		X	2	H-287	Henry et al. 1996	
Z-438	F	J	Railroad bed, with rails; stacked facing		A, C, D		X	2	H-289	Henry et al. 1996	
Z-439	F	JM	Gatot; Cliffline defensive complex; tunnels, enclosures		A, C, D		X	3	(H-286, 288, 290293, 297)	Henry et al. 1996	
Z-440	F	JC	Homestead, partial; cisterns		D	X		2	H-294	Henry et al. 1996	
Z-441	F	P	Ceramics scatter, medium size, deposit		D	X		3	H-488	Henry et al. 1996	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-442	G	US	Central Bomb Dump		-	?		1	H-509	Henry et al. 1996	
Z-443	G	P	Ceramics; small, shallow deposit		D	X		3	H-500	Henry et al. 1996	
Z-444	G	JM	Dump		D	X		0	(H-304, H-305)	Henry et al. 1996	
Z-445	G	JC	Homestead, partial; cisterns		D	X		2	H-525	Henry et al. 1996	
Z-446	G	JC/P	Sinkhole with habitation debris; structure, destroyed		D	X		3	(H-523, H-524)	Henry et al. 1996	
Z-447	G	JC	Homestead, partial		D	X		2	H-519	Henry et al. 1996	
Z-448	G	JC	Homestead, partial; cisterns		D	X		2	H-467	Henry et al. 1996	
Z-449	G	JC	Homestead, partial		D	X		2	H-520	Henry et al. 1996	
Z-450	G	JC	Homestead, partial; cisterns		D	X		1	H-510	Henry et al. 1996	
Z-451	O	JM/P	Cliffline defensive complex; gun enclosure, stone; depressions, rifle pits; with prehistoric deposits (Latte Phase ceramics)		A, C, D		X	3	(H-386, 388, 391-393, 432, 435,466)	Henry et al. 1996	
Z-452	O	JC	Homestead, intact		A, C, D		X	2	H-383	Henry et al. 1996	
Z-453	O	US/P	Temporary encampment; slabs, depressions; prehistoric component	X	D		X	1	H-437	Henry et al. 1996	
Z-454	O	P	Ceramics, medium size, deposit		D	X		3	H-496	Henry et al. 1996	
Z-455	G	JC	Homestead, partial		D	X		2	H-465	Henry et al. 1996	
Z-456	O	JC	Homestead, partial, cisterns		D	X		2	H-468	Henry et al. 1996	
Z-457	O	JC	Homestead complex, cave with trash		A, C, D		X	3	(H-427, 428, 470-472)	Henry et al. 1996	
Z-457	O	JC	Cistern		D	X		2	H-472	Henry et al. 1996	
Z-458	N	JM	JM Laderan Lasu defensive complex; stone enclosures; rifle pit/foxholes		A, C, D		X	1	H-447	Henry et al. 1996	
Z-459	N	JC	Habitation complex		D		X	2	(H-441, 444, 445)	Henry et al. 1996	
Z-460	O	?	Road		D	X		1	H-387	Henry et al. 1996	
Z-461	I	JC	Homestead, partial		D	X		2	H-285	Henry et al. 1996	
Z-462	L	P	Ceramics, medium size scatter, deposit		D	X		3	H-494	Henry et al. 1996	
Z-463	L	JM	JM Mt. Lasu observation post and defensive complex; platform, stone enclosures (for radar/searchlights; guns)		A, C, D		X	3	H-455	Henry et al. 1996	(4)
Z-464	I	JC	Homestead, partial		D	X		2	H-454	Henry et al. 1996	
Z-465	L	JC	Homestead		A, D		X	2	BS-T-24	Eble et al. 1995	
Z-466	L	US	Mt. Lasu complex, military		A, D		X	2	1571-09	Henry and Haun 1995	
Z-467	H	P	Ceramics, small, shallow deposit		D	X		3	H-489	Henry et al. 1996	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-468	H	JM	Laderan Gatot defensive complex (1); gun enclosures, fuel drum (machine gun position)		D		X	3	(H-079, 302, 303)	Henry et al. 1996	
Z-469	H	JM	Laderan Gatot defensive complex (2); enclosure, stone; depressions, overhang; defensive depressions (Dual Purpose gun position), fuel drum enclosure (machine gun position)		A, C, D		X	3	(H-070, 74, 75, 82)	Henry et al. 1996	
Z-470	H	JM	Defensive modified depression		D		X	1	H-111	Henry et al. 1996	
Z-471	H	US	67th NCB encampment, permanent; 1322 Engineering Regiment		A, B, C, D		X	1	(H-068, 71, 95, 98, 112)	Henry et al. 1996	
Z-472	H	JM/US	Dump		?	X		0	H-256	Henry et al. 1996	
Z-473	H	JC	Cisterns, slab, artifacts		D	X		1	H-077	Henry et al. 1996	
Z-474	H	JM	JM Asiga Bay defense; concrete gun position, open; (held 80 mm Dual Purpose coastal gun); overhangs; combined Japanese and American use, rifle and gun positions; pillboxes, concrete gun pos., (held 6.5 mm-7.7 mm machine guns)prehistoric component with Pre-Latte and Latte Phase		A, C, D		X	1	(H-243, 244, 258, 262, 263, 265, 268	Henry et al. 1996	
Z-475	H	JC	Homestead, partial		D	X		2	H-276	Henry et al. 1996	
Z-476	H	JC	Building, concrete		D	X		1	H-279	Henry et al. 1996	
Z-477	H	JC	Homestead complexes		A, C, D		X	3	(H-233-225, 227,228, 230,234-237, 241,242, 261, 267, 270, 307, 513, 514, 516, 517)	Henry et al. 1996	
Z-478	H	US	East H-14-C N. Field, fuel tank farm		D	X		1	H-229	Henry et al. 1996	
Z-479	H	JC	Slab, brick scatter		D	X		1	H-281	Henry et al. 1996	
Z-480	H	US	9th NCB encampment		A, D		X	3	H-271	Henry et al. 1996	
Z-481	H	US	509th Composite, temporary camp; 18th NCB; concrete slabs, trash		A, B, D		X	2	(DS-09, 10, 12-14, 17, 22-24, H-269, 272, 274, 277, 283)	Franklin and Haun 1995: Tables 5 and 13	
Z-482	H	JC	Homesteads, partial		D	X		3	(DS-01, 03)	Franklin and Haun 1995: Tables 5 and 13; 55	
Z-483	H	P	Artifact scatter		D	X		3	DS-02	Franklin and Haun 1995: Tables 5 and 13	
Z-484	H	P	Artifact scatter		D	X		3	DS-05	Franklin and Haun 1995: Tables 5 and 13	
Z-485	H	JM	Gun position, fuel drum enclosure		D	X		1	H-515	Henry et al. 1996	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-486	H	P	Ceramics, small, shallow deposit		D	X		3	H-483	Henry et al. 1996	
Z-487	H	JC	Dump		D	X		0	H-076	Henry et al. 1996	
Z-488	H	JM	Defensive, trench, fuel drum encl.		D	X		1	H-081	Henry et al. 1996	
Z-489	H	US	C Battery, 17th AAA; (and 16th AAA?); road, mounds, posts, artifact scatters, earthen enclosures		A, D		X	3	(H-069,73, 84, 86, and 87)	Henry et al. 1996	
Z-490	H	US	Dump		?	X		1	(H-115, 264), J-3022	Henry et al. 1996	
Z-491	H	US	Mine Depot No. 4; earthen structures, ARMCOs		D	X		1	(H-239, 240, 259, 260)	Henry et al. 1996	
Z-492	H	US	Survey marker and grill		D	X		0	H-072	Henry et al. 1996	
Z-493	H	JM/US	Defensive complex with fuel drum enclosures		A, D		X	1	(H-096, 113)	Henry et al. 1996	
Z-494	H	US	Cave with historic artifacts		D	X		2	H-114	Henry et al. 1996	
Z-495	H	US	Bunker, concrete		A, C, D		X	1	H-495	Henry et al. 1996	
Z-496	E	JC	House, concrete		D	X		1	H-099	Henry et al. 1996	
Z-497	J	JC	Concrete foundations, habitation complex		D	X		1	DS-19	Franklin and Haun 1995: Tables 5 and 13; 55	
Z-498	J	JM/P	Refuge cave; cave with water source	X	A, C, D		X	3	(DS-07, 08)	Franklin and Haun 1995: Tables 5 and 13	
Z-499	M	JC	Homestead complexes, intact		A, C, D		X	3	(H-404, 419-422)	Henry et al. 1996	
Z-500	M	JM	Defensive stone platform		D		X	1	H-460	Henry et al. 1996	
Z-501	K	JM	San Hilo defensive cliffline complex; concrete gun position; overhangs, enclosures; tunnel		A, C, D		X	3	(H-418, 458, 462)	Henry et al. 1996	
Z-502	K	JC	Homesteads, intact		A, C, D		X	2	(H-415, 459)	Henry et al. 1996	
Z-503	K	JM	San Hilo defensive complex; defensive enclosure, stone		A, D		X	1	H-416	Henry et al. 1996	
Z-505	M	JM	Homestead complexes, intact		A, C, D		X	3	(H-405-408, 410, 411, 414)	Henry et al. 1996	
Z-506	M	JM/P	Defensive modified depression		D	X		1	H-413	Henry et al. 1996	
Z-507	M	JC	Railroad bed; with rails; stacked facing		C, D		X	1	(H-412, 425)	Henry et al. 1996	(5)
Z-508	C	JC	Village remains		A, D	X		3	?	Haun 1988	
Z-509	M	JM	Defensive modified depression		D	X		1	H-424	Henry et al. 1996	
Z-510	M	JC	Homestead, intact		A, D		X	2	H-400	Henry et al. 1996	
Z-511	M	JC	Homestead, intact		A, D		X	2	H-401	Henry et al. 1996	
Z-512	M	JC	Homestead, intact		A, C, D		X	2	H-402	Henry et al. 1996	
Z-513	O	US	Munitions storage? large earthen enclosures		D		X	1	H-442	Henry et al. 1996	
Z-514	N	JC	Homestead, partial		D	X		2	H-507	Henry et al. 1996	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-515	N	JC	Homestead, intact		A, D		X	2	H-491	Henry et al. 1996	
Z-516	N	JC	Homestead, partial; cisterns		D	X		2	H-490	Henry et al. 1996	
Z-517	N	P	Ceramics, small, shallow deposit		D	X		3	H-485	Henry et al. 1996	
Z-518	N	JC	Homestead, intact		A, C, D		X	2	H-478	Henry et al. 1996	
Z-519	N	?	Defensive complex with fuel drum encl.		A, C, D		X	1	H-449	Henry et al. 1996	
Z-520	N	JC	Homestead, intact		C, D		X	2	H-446	Henry et al. 1996	
Z-521	N	JM/P	Sinkhole, with trash; Prehistoric component; Latte Phase ceramics	X	D	X		3	H-399	Henry et al. 1996	
Z-522	N	P?	Rock overhang	X	A, D	X		3	1571-06	Henry and Haun 1995	
Z-523	N	JC	Cistern		D	X		1	1571-T-22	Henry and Haun 1995	
Z-524	N	JM	Famalaoan defensive complex; modified depressions, rifle pit/foxholes		A, C, D		X	1	H-403	Henry et al. 1996	
Z-525	N	US	Defensive earthen platform		D	X		1	H-364	Henry et al. 1996	(3)
Z-525	N	US	Defensive earthen platform		D	X		1	H-365	Henry et al. 1996	
Z-526	N	?	Gun position, fuel drum enclosure		A, D		X	1	H-450	Henry et al. 1996	
Z-527	N	JM	Cliffline defensive complex; caves, stone terraces		A, C, D		X	3	(H-476, H-477)	Henry et al. 1996	
Z-528	N	JM	Observation post, survey marker; platform		D		X	1	H-429	Henry et al. 1996	
Z-529	N	US	Bd debris		D	X		0	H-430	Henry et al. 1996	
Z-530	N	?	Road on Maga		D		X	1	H-493	Henry et al. 1996	
Z-531	N	US	West H-14-C N. Field, fuel tank farm; earthen enclosures		D	X		1	H-395	Henry et al. 1996	
Z-532	P	JM	Gun enclosure, earthen		D	X		1	H-389	Henry et al. 1996	
Z-533	P	JC	Cisterns		D	X		2	(H-373, 375)	Henry et al. 1996	
Z-534	P	P	Ceramics, medium size scatter, deposit		D	X		3	H-487	Henry et al. 1996	
Z-535	P	JC/US ?	Homestead, partial, modified		D		X	2	H-381	Henry et al. 1996	
Z-536a	R	P	Artifact scatter, extensive, undisturbed deposits; (intensive, permanent occupation)	X	A, C, D		X	3	(HS-01, 15, 19, 20, 31, 36. 41; H-506) Og-P-06	Franklin and Haun 1995: Tables 5 and 13; 51; Craib 1993; Henry et al. 1996	
Z-536b	S	P	Artifact scatter, extensive, undisturbed deposits; (intensive, permanent occupation)	X	A, C, D		X	3	(HS-01, 15, 19, 20, 31, 36. 41; H-506) Og-P-06	Franklin and Haun 1995: Tables 5 and 13; 51; Craib 1993; Henry et al. 1996	
Z-537	S	JC/US	Homestead, modified as pumping station; cisterns, slabs, concrete box		A, D	X		2	(H-370. 374)	Henry et al. 1996	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-538	S	JC	Homestead, partial		D	X		2	H-371	Henry et al. 1996	
Z-539	R	JM	Military complex; plus civilian features; railroad bed and roads		A, C, D		X	1	(H-027, 30, 49, 51, 52, 54)	Franklin and Haun 1995: Tables 5 and 13	
Z-540a	Q	?	Trench, military?		D	X		1	H-358	Henry et al. 1996	
Z-540b	R	?	Trench, military?		D	X		1	HS-34	Franklin and Haun 1995: Tables 5 and 13	
Z-541	Q	?	Airplane wreck		D	X		1	H-357	Henry et al. 1996	
Z-542	G	JC	Homestead, partial		D	X		1	H-522	Henry et al. 1996	
Z-543	A	US?	Tower bases, radio station		A, C, D	X		0	0218-T-50; D-2	Donham 1986:34, 59; Denfeld 1983	
Z-544	D	US?/P	B Battery of the 17th AAA; and ABCD Annex (?); fuel drum enclosures		A, C, D		X	1	H-332; D-21	Henry et al. 1996	
Z-545	A	US	Quonset Hut		A, C, D	X		0	D-16	Denfeld 1983:34	
Z-546	A	?	Airplane wreck		D	X		1	H-002	Henry et al. 1996	
Z-547	A	US	Landing craft remains, invasion remnants		A, D		X	1	H-003	Henry et al. 1996	
Z-548	A	?	Gun enclosure, earthen		D	X		1	H-036	Henry et al. 1996	
Z-549	D	US	D Battery, 17th AAA; earthen enclosure, fuel drum enclosures, metal posts		A, C, D		X	1	(H-039, 66, 67)	Henry et al. 1996	
Z-550	D	JC/JM	Homestead, intact, reused for defense		A, D		X	3	H-128	Henry et al. 1996	
Z-551	D	JM	Gun enclosure, fuel drum		A, D		X	1	H-179	Henry et al. 1996	
Z-552	B	US	Slab, dump		D	X		1	H-336	Henry et al. 1996	(3)
Z-553	?	J	Overhang with trash		D	X		2	H-311	Henry et al. 1996	
Z-554	Q	US	Landing craft fragments		A, D		X	1	H-355	Henry et al. 1996	
Z-555	?	US	Water pumping station; slab, with 12th CB inscription		A, D		X	1	H-362	Henry et al. 1996	
Z-556	D	US	Cistern		D	X		2	H-376	Henry et al. 1996	
Z-557	?	JM	Water pumping complex		D		X	2	H-379	Henry et al. 1996	(6)
Z-558	P	?	Gun position, fuel drum enclosure		A, D		X	1	H-380	Henry et al. 1996	
Z-559	N	P	Pottery scatter		D	X		3	OG-P-08 (T4-JMP-1)	Craib 1993: Fig. 22	
Z-560	D	JM/US	Mixed WWII Japanese and American sites		A, D	X		2	P1; OG-J-01	Craib 1993:4, Fig. 2	
Z-561	A	JC	Land boundary marker		D	X		1	OG-J-02	Craib 1993:4, Fig. 2	
Z-562	J	JM	Gun emplacement, enclosure		D	X		1	DS-15; J-2010?	Franklin and Haun 1995: Tables 5 and 13	
Z-563	H	P	Pictograph cave		A, C, D		X	3	?	Craib 1994	(3)
Z-564	K	JC	Cistern		D	X		1	1571-T-37	Henry and Haun 1995	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-565	U	P	Sherd scatter		D	X		3	1571-T-39	Henry and Haun 1995	
Z-566	U	PWC	Camp Churo ditch		A, D		X	1	1571-T-40	Henry and Haun 1995	
Z-567	U	US	Quarry		D	X		0	1571-T-41	Henry and Haun 1995	
Z-568	U	JC	Habitation complex		A, D		X	2	1571-T-43	Henry and Haun 1995	
Z-569	U	JC	Habitation complex		A, D		X	2	1571-T-47, 50	Henry and Haun 1995	
Z-570	K	US	Refuse dump, and crash site		D	X		0	BS-T-01	Eble et al. 1995	
Z-571	K	US	Camp		A, D		X	2	BS-T-04	Eble et al. 1995	
Z-572	K	JM?	Concrete structure		A, D	X		1	BS-T-07	Eble et al. 1995	
Z-573	K	JM?	Bunker; fuel drum		D		X	1	BS-T-08	Eble et al. 1995	
Z-574	K	J	Concrete structure, unknown function		D	X		1	BS-T-10	Eble et al. 1995	
Z-575	K	JC	Concrete stairway; shrine or residence		D		X	1	BS-T-11	Eble et al. 1995	
Z-576	K	JC	Cistern		D	X		2	BS-T-12	Eble et al. 1995	
Z-577	K	P	Sherd scatter		D	X		3	BS-T-13	Eble et al. 1995	
Z-578	K	JC	Homestead		A, D		X	2	BS-T-14	Eble et al. 1995	
Z-579	K	P	Sherd scatter		D	X		3	BS-T-15	Eble et al. 1995	
Z-580	K	JC	Cistern		D	X		2	BS-T-17	Eble et al. 1995	
Z-581	K	P	Sherd scatter		D	X		3	BS-T-19	Eble et al. 1995	
Z-582	K	JC	Homestead		D		X	2	BS-T-23	Eble et al. 1995	
Z-583	L	P	Sherd scatter		D	X		3	BS-T-27	Eble et al. 1995	
Z-584	K	J/US	Massive concrete structure; US use		D		X	1	BS-T-28	Eble et al. 1995	
Z-585	K	M	Dump, mixed US, Japanese		D	X		0	BS-T-29	Eble et al. 1995	
Z-586	K	?	Cobble paving, small; unknown age		D	X		2	BS-T-30	Eble et al. 1995	
Z-587	K	JC	Homesteads		A, C, D		X	2	BS-T-31	Eble et al. 1995	
Z-588	K	P/JC	Rockshelter, *latte*, and cistern	?	A, D		X	3	BS-T-32	Eble et al. 1995	
Z-589	T	JM	Gurguan Point Airfield		A, D		X	1	J-2015	Jones 1991:201	
Z-590	T	P	*Latte* sets (2), mortars		A, D		X	3	M-05	Moore et al. 1986:175	
Z-591	K	P	Latte sets, quarry, mortars		A, D		X	3	M-06	Moore et al. 1986:175	
Z-592	V	P	*Latte* sets (5), mortars, quarry		A, D		X	3	M-08-10	Moore et al. 1986:175	
Z-593	T	P	Rock shelters (2) mortars, pottery		A, D		X	3	M-22	Moore et al. 1986:175	
Z-594	T	P	Mortar, pottery		D		X	3	M-24	Moore et al. 1986:175	
Z-595	T	P	Surface material		D	X		3	M-25	Moore et al. 1986:175	
Z-596	K	P	Surface material		D	X		3	M-26	Moore et al. 1986:175	
Z-597*	K	US	505th BG		A, D	?	?	2		*	
Z-598*	L	US	Radio Transmission St.		D	?	?	2		*	
Z-599*	V	US	696 Sig. AW Co		A, D	?	?	2		*	

Table A-1. Significant Sites (as recommended) in the Military Lease Area of Tinian. (cont.)

Site Number	SPA	Site Assoc.	Site Description	HR	NR eligible criteria	Sig: DR	Sig: P	Threat	Other No.	References	Notes
Z-600*	V	US	Hospital		A, D	?	?	2		*	
Z-601*	T	US	444th BG		A, D	?	?	2		*	
Z-602*	K	US	6th BG		A, D	?	?	2		*	
Z-603*	K	US	9th BG		A, D	?	?	2		8	
Z-604*	T	US	468th BG		A, D	?	?	2		*	
Z-605*	T	US	40th BG		A, D	?	?	2		*	
Z-606*	V	US	87 & 25 Service Corps		A, D	?	?	2		*	
Z-607*	V	US	240 Ord Ammo Co; 813, 827, 891 Chem. Co.		A, D	?	?	2		*	
Z-608*	K	US	Civilian Affairs		A, D	?	?	2		*	
Z-609*	T	US	C Battery, 18th AAA		A, D	?	?	2		*	
Z-610*	T	US	A Battery, 180th SCA		A, D	?	?	2		*	
Z-611*	U	US	HQ LAA 18th AAA		A, D	?	?	2		*	
Z-612*	T	US	Napalm Bomb Dump		A, D	?	?	0		*	
Z-613*	V	US	D Battery, 18th AAA		A, D	?	?	2		*	
Z-614	C	JC	Tori (?) remains		A, D		X	1	777-T2	Haun, Brown, and Dili 1990	

KEY;

Site Number: TN=CNMI DHP numbers; Z= Site Protection Plan numbers in CNMI DHP sequence (see text); Z-* = sites identified primarily from historic aerial photographs.

SPA: Site Protection Area

Site Assoc. J = Japanese (civilian or military); JC =Japanese civilian; JM = Japanese military; M =mixed; P =prehistoric; PWC = post-war civilian; US = US WWII military; ? =uncertain.

Site Description: site description provides composite functional and formal characteristics. For details see references.

HR =human skeletal remains present at site.

NR eligible criteria = criteria under which site is recommended eligible to the National Register of Historic Places' site has integrity and meets one or more of the following:

A: sites that are associated with events that have made a significant contribution to the broad patterns of our history
B: sites that are associated with the lives of persons significant in our past

C: sites that embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction

D: sites that have yielded, or may be likely to yield, information important in prehistory or history

(after NRHP Criteria Evaluation from National Register Bulletin 16, U.S. Department of the Interior, National Park Service, Interagency Resources Division)

Sig. DR: site is recommended as significant and appropriate for data recovery as a means of mitigation of adverse impact if preservation is not possible.

Sig. P: Site is recommended as significant and as appropriate for long-term preservation; adverse effects should be avoided.

Other Number:

0218-T-*	Donham (1986) with the project number "218".
1571-T-	Henry and Haun (1995). (Site numbers in the EMUA that represent locales with limited pottery or artifact scatters are not included here).
BS*	(Eble et al. 1995): Number (T-n) with BS prefix added.
C*	Craib (1995).
D*	Denfeld (1983).
H-	Henry et al. (1996).
DS	Prefix for Dangkulo survey site numbers in Franklin and Haun (1995a).
HS	Prefix for Hagoi survey site numbers in Franklin and Haun (1995a).
J*	Jones (1991) 1000, 2000, 3000 series.
M*	Moore et al. (1986).
OG-P-*	Prehistoric sites recorded in Craib (1993).
OG-J-*	Pre-WWII and WWII Japanese sites recorded in Craib (1993).
OG-U-*	WWII U.S. sites recorded in Craib (1993).

*Indicates a prefix added to the investigator's site number.

Threat

"Threat" represents a ranking of susceptibility to damage (0=low susceptibility; 3=high susceptibility).

0=threat posed only by bulldozing;

1=threat posed only by heavy vehicles and/or tracked vehicles;

2= threat posed by heavy vehicles and/or tracked vehicles; light vehicles, and general ground disturbance;

3= threat posed by heavy vehicles and/or tracked vehicles; light vehicles, general ground disturbance; pedestrians, intensive digging, and vandalism.

Notes: (1) overlaps SPA D; (2) overlaps SPA A; (3) exact location uncertain; (4) overlaps SPA N; (5) same as TN-14?; (6) Maga Ridge/Hagoi area?

APPENDIX B: SITES RECOMMENDED AS NOT SIGNIFICANT, MILITARY LEASE AREA, TINIAN

Table B-1. Sites Recommended as Not Significant, Military Lease Area, Tinian.

Site Number	Site Assoc.	Site Description	References
0218-T-02	US	Metal rack and trough, secondary	Donham 1986:31, 77
0218-T-13	?	Rubble mound	Donham 1986:31, 73
0218-T-20	?	Secondary trash	Donham 1986:32, 79
0218-T-27	?	Secondary trash	Donham 1986:32, 81
0218-T-39	?	Backdirt from pit	Donham 1986:33, 71
0218-T-43	J	Rails, debris	Donham 1986:33, 81
1571-02	M	Sherd scatter	Henry and Haun 1995
1571-04	M	Artifact scatter	Henry and Haun 1995
1571-T-32	US	Culvert	Henry and Haun 1995
1571-T-35	M	Sherd scatter	Henry and Haun 1995
1571-T-38	M	Artifact scatter	Henry and Haun 1995
1571-T-42	M	Artifact scatter	Henry and Haun 1995
1571-T-44-46	M	Artifact scatter	Henry and Haun 1995
1571-T-54-57	M	Sherd scatters	Henry and Haun 1995
BS-T-06	JM?	Bunker, fuel drum	Eble et al. 1995
BS-T-09	JM	Debris, disturbed?	Eble et al. 1995
BS-T-16	US	Military refuse	Eble et al. 1995
C-07	US recent	Sandbag enclosure	Craib 1995:59, 63
C-12	P	Sherd scatter	Craib 1995:59, 66
C-33	US	Cluster of broken asphalt	Craib 1995:60, 72
C-38	US, modern	Tire dump; iron box	Craib 1995:60, 74
C-44	US	Concrete pads	Craib 1995:60, 81
C-45	US	Concrete pad	Craib 1995:60, 81
C-47	P	Sherd scatter	Craib 1995:64
DS-04	JM	Cement bag blocks, military, secondary	Franklin and Haun 1995: Tables 5 and 13; 31
H-006	?	Steel beams and concrete trench	Henry et al. 1996
H-014	JM	Slabs with drainage holes	Henry et al. 1996
H-016	?	Metal boxes (ammo*)	Henry et al. 1996
H-025	?	Alignment of 3 fuel drums	Henry et al. 1996
H-026	US	Trash scatter	Henry et al. 1996
H-027	US	Dump	Henry et al. 1996
H-029	US	Alignment, stone	Henry et al. 1996
H-030	?	Mound, stone	Henry et al. 1996
H-031	?	Pit cut into limestone	Henry et al. 1996
H-032	US	Pile of concrete bags, solidified	Henry et al. 1996
H-033	?	Stone wall and pipes	Henry et al. 1996
H-037	?	Concrete block	Henry et al. 1996
H-038	?	Truck frame remnant	Henry et al. 1996
H-043	US	Dump	Henry et al. 1996
H-044	mixed	Bulldozed pile of debris	Henry et al. 1996
H-046	US	Slab, trash	Henry et al. 1996
H-047	US	Slab, pit; encampment	Henry et al. 1996
H-053	?	Dump	Henry et al. 1996
H-060	US	Dump	Henry et al. 1996
H-061	US	Trash scatter	Henry et al. 1996
H-062	US	Temporary encampment; slab, pit;	Henry et al. 1996
H-063	US	Dump	Henry et al. 1996

Table B-1. Sites Recommended as Not Significant, Military Lease Area, Tinian. (cont.)

Site Number	Site Assoc.	Site Description	References
H-064	US	Pontoons, 3	Henry et al. 1996
H-069	?	Road	Henry et al. 1996
H-080	US	Trash scatter	Henry et al. 1996
H-084	US	Trash scatter	Henry et al. 1996
H-085	JC?	Pipeline	Henry et al. 1996
H-086	?	Metal posts	Henry et al. 1996
H-097	US	Slabs, footings, pontoons, trash	Henry et al. 1996
H-100	US	Pipeline	Henry et al. 1996
H-101	mixed	Bulldozed pile of debris	Henry et al. 1996
H-102	?	Trench, concrete	Henry et al. 1996
H-103	?	Metal posts	Henry et al. 1996
H-110	?	Pipeline	Henry et al. 1996
H-117	US	Dump	Henry et al. 1996
H-122	?	Pipeline	Henry et al. 1996
H-124	?	Culvert	Henry et al. 1996
H-125	JM	Pipeline	Henry et al. 1996
H-127	US	Cart, metal	Henry et al. 1996
H-137	?	Tower base	Henry et al. 1996
H-138	?	Trench	Henry et al. 1996
H-141	?	Culvert	Henry et al. 1996
H-142	mixed	Dump	Henry et al. 1996
H-144	?	Trench	Henry et al. 1996
H-146	mixed	Bulldozed debris	Henry et al. 1996
H-147	?	Slabs	Henry et al. 1996
H-148	US	Slab, depression; encampment,	Henry et al. 1996
H-149	US	Slab; encampment?	Henry et al. 1996
H-150	?	Slabs, trash	Henry et al. 1996
H-151	?	Concrete boxes, trash	Henry et al. 1996
H-152	?	Metal tower	Henry et al. 1996
H-157	US	Dump	Henry et al. 1996
H-158	US	Bulldozed debris	Henry et al. 1996
H-159	US	Dump	Henry et al. 1996
H-160	US	Dump	Henry et al. 1996
H-161	?	Pipeline	Henry et al. 1996
H-162	?	Road bed	Henry et al. 1996
H-163	US	Dump	Henry et al. 1996
H-164	?	Concrete boxes	Henry et al. 1996
H-165	US	Slabs, depression	Henry et al. 1996
H-166	?	Slab	Henry et al. 1996
H-168	US	Slabs	Henry et al. 1996
H-169	US	Road bed	Henry et al. 1996
H-170	?	Defensive enclosure, stone	Henry et al. 1996
H-171	US	Tower base	Henry et al. 1996
H-172	US	Tower base	Henry et al. 1996
H-173	?	Culvert	Henry et al. 1996
H-174	?	Culvert	Henry et al. 1996
H-175	US	Tower base, Bulldozed	Henry et al. 1996
H-180	?	Metal posts	Henry et al. 1996
H-181	JC	Bulldozed debris, primarily Japanese material	Henry et al. 1996
H-183	US	Dump	Henry et al. 1996

Table B-1. Sites Recommended as Not Significant, Military Lease Area, Tinian. (cont.)

Site Number	Site Assoc.	Site Description	References
H-184	mixed	Bulldozed debris	Henry et al. 1996
H-185	mixed	Bulldozed debris	Henry et al. 1996
H-186	?	Culvert	Henry et al. 1996
H-187	?	Culvert	Henry et al. 1996
H-188	US	Slab, compartmentalized	Henry et al. 1996
H-189	US	Temporary encampment, slabs, encampment	Henry et al. 1996
H-190	mixed	Bulldozed debris	Henry et al. 1996
H-191	mixed	Bulldozed debris	Henry et al. 1996
H-192	mixed	Bb debris	Henry et al. 1996
H-193	US	Slabs, encampment	Henry et al. 1996
H-195	?	Culvert	Henry et al. 1996
H-196	US	Dump	Henry et al. 1996
H-197	mixed	Dump	Henry et al. 1996
H-198	US	Slab	Henry et al. 1996
H-199	?	Culvert	Henry et al. 1996
H-200	?	Culvert	Henry et al. 1996
H-202	US	Slab, encampment	Henry et al. 1996
H-203	?	Stone mound	Henry et al. 1996
H-204	?	Culvert	Henry et al. 1996
H-205	US	Slab	Henry et al. 1996
H-206	mixed	Bulldozed debris	Henry et al. 1996
H-207	mixed	Bulldozed debris	Henry et al. 1996
H-208	US	Slabs and road bed	Henry et al. 1996
H-216	US	Trash	Henry et al. 1996
H-217	?	Culvert	Henry et al. 1996
H-218	?	Slab	Henry et al. 1996
H-221	US	Trash	Henry et al. 1996
H-222	?	Concrete blocks	Henry et al. 1996
H-226	JC	Curb	Henry et al. 1996
H-232	?	Slab	Henry et al. 1996
H-233	US	Trash	Henry et al. 1996
H-238	JM	Mound, stone	Henry et al. 1996
H-246	JM	Wall, stone	Henry et al. 1996
H-248	?	Pipeline	Henry et al. 1996
H-249	US	Dump	Henry et al. 1996
H-257	US	Dump	Henry et al. 1996
H-266	?	Slabs	Henry et al. 1996
H-273	US	Trash	Henry et al. 1996
H-275	US	Slabs and trash	Henry et al. 1996
H-280	?	Culvert	Henry et al. 1996
H-282	US	Pontoon	Henry et al. 1996
H-298	?	Slab	Henry et al. 1996
H-299	?	Pier blocks	Henry et al. 1996
H-300	US	Slabs	Henry et al. 1996
H-301	?	Pipeline	Henry et al. 1996
H-306	?	Slab	Henry et al. 1996
H-308	?	Alignment, stone	Henry et al. 1996
H-310	?	Slab	Henry et al. 1996
H-312	US	Metal posts	Henry et al. 1996
H-315	US	Trash	Henry et al. 1996

Table B-1. Sites Recommended as Not Significant, Military Lease Area, Tinian. (cont.)

Site Number	Site Assoc.	Site Description	References
H-317	US	Slabs and stone walls, temporary encampment	Henry et al. 1996
H-320	US	Dump	Henry et al. 1996
H-321	US	Slab, pit	Henry et al. 1996
H-322	US	Trash	Henry et al. 1996
H-323	US	Alignment, stone; trash	Henry et al. 1996
H-324	US	Alignment, stone	Henry et al. 1996
H-327	US	Tent stakes	Henry et al. 1996
H-328	US	Dump	Henry et al. 1996
H-333	US	Slabs, stone walls	Henry et al. 1996
H-335	?	Pipeline	Henry et al. 1996
H-337	US	Dump	Henry et al. 1996
H-338	?	Pad	Henry et al. 1996
H-340	?	Sinkhole with debris	Henry et al. 1996
H-341	US	Dump	Henry et al. 1996
H-342	J	Trash	Henry et al. 1996
H-343	US	Trash	Henry et al. 1996
H-345	?	Alignment, stone	Henry et al. 1996
H-346	?	Slab	Henry et al. 1996
H-347	US	Slabs	Henry et al. 1996
H-349	US	Asphalt pads	Henry et al. 1996
H-351	US	Bottle dump	Henry et al. 1996
H-352	?	Pads, tower base?	Henry et al. 1996
H-360	?	Trench, concrete	Henry et al. 1996
H-361	?	Tank, metal	Henry et al. 1996
H-363	?	Road and bricks	Henry et al. 1996
H-366	?	Culvert	Henry et al. 1996
H-372	?	Mound, stone	Henry et al. 1996
H-377	JC	Cistern	Henry et al. 1996
H-378	?	Culvert	Henry et al. 1996
H-385	?	Pipeline	Henry et al. 1996
H-387	?	Road	Henry et al. 1996
H-390	JC	Cistern	Henry et al. 1996
H-394	?	Boxes, metal	Henry et al. 1996
H-395	US	Fuel storage, earthen enclosures	Henry et al. 1996
H-396	US	Trash	Henry et al. 1996
H-397	?	Pipeline	Henry et al. 1996
H-398	?	Dump	Henry et al. 1996
H-409	US	Metal posts	Henry et al. 1996
H-423	US	Trash	Henry et al. 1996
H-426	US	Slabs	Henry et al. 1996
H-431	US	Dump	Henry et al. 1996
H-433	?	Wall foundation	Henry et al. 1996
H-434	?	Foundation, tank	Henry et al. 1996
H-436	US	Slab, road	Henry et al. 1996
H-438	US	Metal posts	Henry et al. 1996
H-439	US	Dump	Henry et al. 1996
H-440	US	Slab, pontoon	Henry et al. 1996
H-443	?	Pipeline	Henry et al. 1996
H-448	?	Metal frames	Henry et al. 1996
H-452	US	Trash	Henry et al. 1996

Table B-1. Sites Recommended as Not Significant, Military Lease Area, Tinian. (cont.)

Site Number	Site Assoc.	Site Description	References
H-453	JC	Cistern	Henry et al. 1996
H-456	?	Wall, stone	Henry et al. 1996
H-461	US	Dump	Henry et al. 1996
H-463	JM?	Mounds, stone	Henry et al. 1996
H-469	?	Trench	Henry et al. 1996
H-473	?	Tank, metal	Henry et al. 1996
H-474	?	Alignment, stone	Henry et al. 1996
H-475	?	Wall, stone	Henry et al. 1996
H-492	US	Trash	Henry et al. 1996
H-511	JM	Trash	Henry et al. 1996
H-512	JM	Trash	Henry et al. 1996
HS-07	J	Transportation complex	Franklin and Haun 1995: Tables 5 and 13
HS-12	?	Road debris, construction	Franklin and Haun 1995: Tables 5 and 13
OG-U-02	US	Quonset hut foundations	Craib 1993:Fig. 3
H-020	?	Slab	Henry et al. 1996
H-353	?	Metal boxes	Henry et al. 1996
H-358	?	Trench	Henry et al. 1996
H-374	JC	Concrete box	Henry et al. 1996
H-509	US	Central bomb dump	Henry et al. 1996

APPENDIX C:

IDENTIFICATION OF THE ATOMIC BOMB ASSEMBLY AREA

During the planning for the interpretive program and the preparation of earlier drafts of archaeological assessments, we became concerned with the identification of the location of the atomic bomb assembly areas. A photograph of an assembly building had been published in several sources, but the location of the building had never been determined. Because of the importance of the assembly buildings as part of the overall historic complex associated with the atomic bomb, an effort was made to identify the location. The conclusion regarding this is presented here in order that appropriate attention can be given to the area in EIS preservation planning and in other related cultural resource management of the MLA, including redefining the boundaries of the National Historic Landmark. We propose that the area of the atomic bomb assembly, as identified below, be included in the Landmark.

It had been suggested that the assembly took place in the camp of the 509th Composite Group or in the 509th service area. An examination of the sites of these areas, maps, and other documents indicated that these are unlikely locations for the assembly buildings. This review did suggest the probability that assembly took place in buildings located in the three large earthen revetments located on the northwest coast of Tinian. These were designated Site 3016 by Jones (1991) who proposed that these may have been related to the atomic bombs because of the roadway leading from them to the airfield bomb pits, but he did not recognize these as the assembly areas. Jones site 3016 was subsequently designated CNMI Site TN-047. The use of the features as the atomic bomb assembly areas was suggested to us by their location and connection to the airfield, by the similarity of their features to the detail shown in the WWII photographs of an assembly building, and by WWII map designations indicating this was a "special projects" area. The identification was confirmed through an interview with Mr. Henry Fleming conducted in November 1994. Mr. Fleming came to the island immediately after the war, worked for the military, was involved with the filling of the bomb pits, and was quite familiar with the location and use of the assembly buildings (still standing in the late 1940s). The recent survey of these features (Henry et al. 1996, Site H-497) has provided the detailed measurements of the concrete pads inside the revetments. A comparison of these measurements with the assembly building's dimensions estimated from a photograph shows that they are consistent, and further supports this identification.

Appendix P

Draft Socioeconomic Report for Tinian

DRAFT - FOR DISCUSSION PURPOSES ONLY

I - Introduction

Under contract with the U.S. Department of the Navy, Belt Collins Hawaii is completing an Environmental Impact Statement (EIS) pertaining to the conduct of military exercises in the Mariana Islands. As part of the study leading to the EIS, Ernst & Young LLP was engaged to compile and report on information relevant to socioeconomic factors. This report is intended for the use of Belt Collins Hawaii as it pertains to the island of Tinian.

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Information for this report was obtained from publicly available government records and from interviews with selected individuals on Tinian and Saipan. Every effort was made to ensure the reasonableness of information received from sources but no assurance is provided as to the accuracy or completeness of this report.

II - Background

The island of Tinian is the least developed of the four major islands in the Mariana chain; major island being defined as one with a public power supply. Together with Saipan, Rota and several minor islands, Tinian is a part of the Commonwealth of the Northern Mariana Islands (CNMI), a United States Commonwealth similar in status to Puerto Rico.

The Covenant which created the CNMI in 1976 brought tremendous extended financial support from the U.S.; established jurisdiction of U.S. laws, agencies and programs; provided for a CNMI Constitution, elected government and defined self-rule; and bestowed full U.S. citizenship upon CNMI residents.

In return for perceived benefits, the CNMI committed to numerous political, economic and social actions over an extended period of years. In addition, the U.S. Department of Defense received complete control and possession of the northern approximately 71% of the island of Tinian under several complex land-holding arrangements. A return of 1,245 acres around the harbor in 1995 reduced the total federal holding to approximately 16,550 acres, or 66% of the island.

Since the Covenant became effective in 1976, the Military Area has often been used for training exercises but no military personnel are stationed on Tinian. When not in use for exercises, access to the Military Area is unrestricted but land may not be privately owned and no one may live or develop there. The people of Tinian in general, even the younger generation, strongly regard the surrender of two-thirds of their island to be the major concession made to the U.S. under the CNMI Compact.

Economic growth has been slow to occur on Tinian despite enactment of a popular initiative in 1989 which legalized casino gambling (Section V below). However, development of the other major Mariana Islands (Guam, Saipan and Rota) can best be described as explosive over the last ten years. These events have perplexed Tinian residents and led to a closer scrutiny of the only significant socioeconomic anomaly which does exist on the island, the Military Area.

III - Demographic Adjustments

During research on this engagement, data were identified which serve to update or more realistically state certain publicly available demographic figures of Tinian on an estimated basis. The figures shown for "Population" and "Population Density" in Exhibit III-A are mathematical estimates incorporating currently available data.

3.1 Population - The increase in population is based on extrapolated airport activity figures as presented in Exhibit IV-A. It is assumed that the number of tourists and existing residents arriving on Tinian during the reporting period is equal to those departing. Though not exact in interpretation, Exhibit IV-A clearly shows an excess of arrivals over departures at the Tinian airport of 1,789 persons during the last four years, resulting in an estimated population of Tinian island at the end of 1995 of 3,718. It is very unlikely that a person would arrive on Tinian by air and depart by sea. On rare occasions, a seaman has arrived on Tinian by air to depart on a ship in port, but, for practical purposes, excess arrivals at the airport can be assumed to represent new residents.

Based on local awareness and casual confirmation, it is logical to assume that this 45% increase in the population of Tinian in the last four years is basically correct. It is also logical that most of these new residents were alien contract workers. Lone Star Casino was closed and all employees departed before the end of 1995. Nothing else of local explanation is noteworthy except for the accelerated trend throughout the CNMI toward more alien workers.

3.2 Population Density - Exhibit III-A also shows an estimated recalculation of population density utilizing the 1995 population estimate and only the one-third of Tinian land mass which is available for use by the local population. Excluding the Military Area from the population density calculation results in a more true density of approximately 285 persons per square mile at the end of 1995. This is roughly 3.5 times the density of Rota but still does not begin to approach the 1992 published figure of 1,062 persons per square mile on Saipan.

IV - Existing Economy of Tinian

Due to the inadequacy of existing public records, any statistical measurement of economic activity on Tinian is impossible without a comprehensive private sector survey which was beyond the scope of this engagement. Generally, however, the Tinian economy can be segmented as follows:

4.1 Government Employment - Considering the lack of any significant industry, natural resource or export, the indigenous population of Tinian remains relatively affluent with the latest statistical data available showing the mean annual income on Tinian in 1990 to be $33,651 per family (SOURCE: 1993 Commonwealth of the Northern Mariana Islands Statistical Yearbook). This relative prosperity is due to the artificially large percentage of the local work force engaged in government employment. No statistical information is available to quantify labor force segments on Tinian. However, it is safe to say that the CNMI percentage trend away from government service and towards private sector employment cannot be observed on Tinian. Excluding alien contract workers, the percentage of the Tinian labor force employed in government jobs is usually estimated at around 75% by local officials.

4.2 Tourism - Though insignificant when compared to Saipan, tourist visits to Tinian appear to have increased substantially during recent years. Reliable visitor arrival information does not exist due to the CNMI practice of recording visitors only when they clear customs in Saipan. However, there are currently six small tour operators on Tinian who bring day-trip tourists from Saipan on a daily basis. Four of the tour operators are Korean, one is Japanese and a locally-owned operator caters to history-seekers for ground tours of WWII historical sites.

Tinian Tour Operators

Sunshine Tours (Korean)	Mideco (Korean)
Friendly Tour (Korean)	Meitetsu Fleming (Japanese)
Tour Tinian (Korean)	Tourific Tinian (local independent)

Information provided by one operator indicates that an average of 400 to 600 Japanese visit Tinian from Saipan each month, most as a day-trip optional tour though a few stay overnight in the Meitetsu Fleming Hotel. Casual physical observations of arriving Korean groups over the last several months indicate that there may be 30 to 50 Korean visitors per day provided by the four operators combined. Including the sporadic groups of war veterans served by Tourific Tinian and occasional FIT eco-tourists, hikers and cyclers; an educated guess of total visitor arrivals to Tinian is roughly 1,200 to 2,000 per month or say 60 per day as a working average.

All tourist arrivals to Tinian come by air with the exception of the *Emerald II* , a tour boat which brings Japanese day-trip visitors to Tinian from Saipan daily. Most optional day-trip tours for Japanese and Koreans include a half-day at a beach in San Jose Village, lunch and a tour of North Field and other Japanese and American historical sites within the Military Area of the island.

Tinian currently has only about 30 hotel rooms housed in three small sub-standard motels; Lori Lynn's, Meitetsu Fleming and Main Street. Car rental concessions are operated at the Tinian airport by Islander and Budget.

4.3 Agriculture and Fishing - There is limited commercial farming on Tinian with produce being marketed on the island and also shipped to Saipan. Crops include cucumbers, egg plant, sweet potatoes, Chinese cabbage, long beans, shallots, taro, watermelon, bananas and papaya. A poultry and egg farm ceased operation about two years ago but the breeding and training of fighting cocks is a very popular part of local culture practiced by many Chamorro men.

The Bar K Ranch has operated for many years on grazing land leased within the Military Area and on other private land. The Bar K includes a fully equipped slaughter house and cold storage facility. With the discontinuance of sophisticated artificial insemination and experimental breeding programs three years ago, herd size has attrited from a high of approximately 10,000 head to the present modest size of around 1,000. Tinian Beef from the Bar K is sold in supermarkets in Saipan and Guam as a low-cost alternative to U.S. and Australian beef. There are also three small family-owned ranches on Tinian and many people raise beef or pork for family consumption.

Most Tinian families include fishing (line, net and underwater) as some portion of their personal subsistence. There is no commercial fishing operation based on Tinian but tuna transshipment is an often busy if inconsistent enterprise. At times, there may be eight or ten commercial tuna fishing boats and two or three large cold storage transport ships in the Tinian port. At other times, the port sits empty for weeks. When tuna transshipment is active on Tinian, it is a solid contributor to the island economy, primarily the two stevedore companies, local nightclubs and the dockside fueling facility operated by Mobil Oil.

4.4 Consumer Trade - The retail community of Tinian includes several convenience stores, about six nightclubs, gift shops, two hardware stores, three gas stations, an auto parts store, two bakeries, four small restaurants, a print shop and assorted other small businesses. Available consumer services include branches of the Bank of Guam and Bank of Saipan, two part-time independent insurance agents, a certified public accountant and several manpower agencies supplying alien contract workers.

4.5 Air Service and Airport Operations - The life-line of daily existence and commerce on Tinian is West Tinian Airport. Regular air travel to Saipan for business and shopping is a routine but critical part of life for residents of Tinian, most of whom take the 10-minute flight at least monthly with many flying weekly and some even daily. Presently, all Tinian scheduled air service is to and from Saipan utilizing 6-seat, 19-seat and 30-seat propeller aircraft operated by Freedom Air and Pacific Island Aviation. Other airlines, including Continental Micronesia, have served Tinian in the past with direct flights to Guam and Rota and may do so again in the future.

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As shown in Exhibit IV-A, total passenger traffic at West Tinian Airport has increased steadily over the last four years from an average of 165 passengers a day in 1992 to 265 a day in 1995. Exhibit IV-B is a graphic depiction of monthly passenger traffic from 1992 to 1995. As seen in the exhibit, the month of May is normally the heaviest for Tinian air traffic. This is explained by the San Jose Fiesta and San Isidro Fiesta which annually consume available Tinian facilities with visitors from Guam and Saipan during the first and fourth weekends in May, and also by off-island students returning to Tinian for the summer break. The record-breaking 11,965 total passengers (386 per day) in May 1995 is attributed to the opening of Lone Star Casino on May 1.

Substantial renovation of the airport, including a new runway to accommodate B-747 aircraft, is planned by the Commonwealth Ports Authority if a major hotel/casino begins construction on Tinian. This project is discussed more fully in Section V below.

V - Tinian's Casino Industry

The people of Tinian, as a unit, have fought for a casino industry since 1986 in a concerted effort of the citizenry rarely witnessed anywhere. The movement has spanned the terms of three mayors representing both political parties and five municipal councils. The casino issue also successfully overcame the opposition of the powerful Catholic church and steadily grew to the point that, today, virtually every resident is pro-casino.

5.1 History - A local initiative to legalize casino gambling on Tinian first appeared on the ballot in 1987. It was narrowly defeated by 14 votes. The Mayor's Task Force on Gaming Industry for Tinian was then created to pursue the issue more formally for the 1989 election. A cross-section of 20 Tinian public and private sector leaders were appointed to the Task Force with the mission of learning all they could about the casino industry and then educating the people of Tinian prior to the 1989 election.

The Task Force was divided into two groups and over the course of a year members of each group visited various casino operations of the world and reported their findings back to the Task Force. One group traveled to casinos in Asia and Australia while the other visited casinos in North America and the Caribbean. For the six months immediately preceding the election, the Task Force staged an effective public awareness campaign and on November 4, the people of Tinian approved the Tinian Casino Gaming Control Act of 1989 (Act) by an overwhelming vote of 90% in favor. The Act remains as the only popular initiative ever approved in the 30-year history of the CNMI.

The Act proscribed the appointment of a five-member Tinian Casino Gaming Control Commission (TCGCC) to regulate the industry and issue the five hotel/casino licenses allowed. The original commissioners assumed their offices early in 1990 and, quickly, Tinian became a known player in the booming international casino market. During 1990-91, serious inquiries were received from and meetings held with such renowned casino developers as Caesar's World, Golden Nugget, ITE Sheraton, Hilton, Casinos Austria and the Korean Shilla Group. Land

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prices skyrocketed to ten times their former value on Tinian and local citizens began building apartments and expanding businesses in anticipation of long-awaited development.

During the first application acceptance period set by TCGCC, seven completed applications were received for the five possible licenses, each applicant submitting $200,000 as a non-refundable fee. Since passage of the Act, TCGCC has received over 100 inquiries of varying interest from different groups, processed some 15 applications for a Tinian casino license and actually issued two licenses, yet no casino currently operates or is under construction on Tinian. The reasons for this involve complex political, cultural, economic and personality issues. For whatever reasons, failure to capitalize on the casino boom years of 1990-92 while the Japanese economy was also at full strength has forced Tinian to now seriously compete with other potential locations in trying to attract a casino developer. That process continues today.

[Section 5.2 has since been revised. Refer to page 21 for updated version.]

5.2 Current Status - The only casino to open on Tinian was Lone Star Casino which opened in a converted small office building in May 1995. Questions have been raised by the CNMI Governor and others as to the legality of Lone Star because of the absence of a 300-room hotel as required by the Act. Suffice it to say that Lone Star appears to have been an ill-conceived, under-capitalized and poorly managed venture which was licensed by TCGCC in an act of desperation. Lone Star Casino closed on December 20, 1995 and the license is scheduled for formal revocation.

On March 12, 1996, the Tinian Casino Gaming Control Commission (TCGCC) issued two new final casino operator licenses to the separate Hong Kong companies of Hong Kong Entertainment Investments Ltd. and CNMI Touring and Entertainment, Inc.

Both companies have paid the $500,000 licensing fee and appear to be serious and immediate in their development plans for Tinian. Capitalization and financing for the Hong Kong Entertainment project were presented at the licensing hearing in final form and US$20 million has been deposited in a local bank as the first financing draw. Heavy construction equipment, including a gantry crane, is reportedly on the water from Hong Kong bound for Tinian and the permitting process is actively underway on the Hong Kong Entertainment project with ground-breaking scheduled to occur immediately upon permit approvals.

Both new licensees have apparently been evaluating the possibility of developing casinos on Tinian for some time. However, the immediacy of their interest was a well-kept secret, unknown even to the TCGCC commissioners, until announcement of the public licensing hearing. Indications from Hong Kong Entertainment management are that they do not believe that the casino initiative in Guam will pass and that the advantages offered by the CNMI in taxation, minimum wage and immigration make it very attractive. The impending return of Hong Kong to China in 1997 may have provided the urgency being exhibited by these companies.

As reported, one hotel-casino will contain 300 rooms with 400 rooms planned for the other project. Construction methods will be fast-track with the Hong Kong Entertainment casino resort schedule to open by the end of 1997. This is an optimistic schedule as hotel projects in

Guam and Saipan historically have taken three years to complete. More detailed information on these two casino resorts was not immediately available. However, the projects are apparently being taken seriously by CNMI government authorities.

Initial survey work has begun for the expansion of West Tinian Airport and the Commonwealth Ports Authority has assured the licenses that the project will be complete prior to opening of the first resort. Refer to Exhibit V-B for estimated passenger traffic to be generated by operating casino resorts on Tinian.

A summary of announced casino resort projects, including the two aforementioned projects, follows:.

Active Tinian Casino Ventures

Name	Origin	Proposed Project	Status
Tinian Marine Resorts	Taiwan & Saipan	2 phases-500 rms each; large casino; golf course; marina; theme park; $500M project	Casino license issued Nov 95; $500,000 license fee unpaid
HK Entertainment	Hong Kong	300 rooms; casino; other	Paid $500,000 license fee, construction pending
CNMI Touring and Entertainment, Inc.	Hong Kong	400 rooms, casino, golf course	Paid $500,000 license fee, construction pending
The Team Company Ltd.	Tokyo	Floating 50,000 SF casino; floating 500-rm hotel	Announced by CNMI Governor; no license application or fee filed

In addition to these, TCGCC has recently received new inquiries from other Japanese and Macau casino developers and continues to actively solicit interest.

5.3 Prognosis and Projections - A big factor in the future of a casino industry on Tinian is the pending local casino initiative in Guam, already certified for the ballot and expected to be voted on in a special election this summer. Guam, with it's existing world-class tourism infrastructure and rapidly approaching 2,000,000 visitors a year would provide formidable competition in attracting a casino developer to Tinian. If the Guam initiative passes, it is difficult to imagine a legitimate casino developer choosing Tinian in the near future. On the other hand, if the initiative fails in Guam, developers who have awaited the election may exhibit a new enthusiasm

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for Tinian in their quest to establish an Asia-Pacific casino on the only U.S. soil where they can legally do so.

If major casino development does occur on Tinian, it will affect life on the island in virtually every respect, including planning for future military exercises. Exhibit V-A superimposes the most popularly discussed hotel/casino and golf course locations onto a militarily delineated map of Tinian which was presented by Belt Collins Hawaii at a scoping meeting held on Tinian in preparation for development of the EIS.

The Governor has publicly pledged CNMI funds for construction of public infrastructure necessary to support a Tinian casino industry. In keeping with that promise, the Commonwealth Ports Authority (CPA) recently announced formal plans to rebuild an abandoned runway parallel to the existing runway at West Tinian Airport to allow 24-hour access by wide-body aircraft.

In addition to the 8,700' runway, the Tinian airport project will include a new terminal building, customs and immigration facilities and a bus staging area. Tinian will be formally designated as an international port-of-entry for the CNMI. As stated by CPA, funding, designs and planning are complete for the new airport and the project could be completed in one year. It only awaits the beginning of actual construction of a hotel/casino on Tinian.

Exhibit V-B provides projections of estimated air passenger traffic to Tinian assuming various levels of casino industry development. In the projections, the average hotel is assumed to consist of 400 rooms. This is considered reasonably conservative as the minimum rooms required under the Act is 300. Actual projects being put forth range from 300 rooms to 1,000 in the second phase of one project. Average passengers per international flight is assumed to be 200 to allow for the presumption that wide-body aircraft will probably not be used on all long-haul flights and many will be of the B-727 class.

As shown in Exhibit V-B, the opening of just one hotel/casino resort on Tinian could be expected to add approximately 17 flights a day of 30-seat commuter aircraft and one international flight per day direct from cities in Asia. One full-scale hotel/casino in operation on Tinian is estimated to effectively increase the existing Tinian passenger traffic tabled in Exhibit IV-A by a factor of 5 to 7.

Though not assumed in the projection, it is likely that any full casino operation would also include "gambler's express" flights several days a week in it's marketing mix. Passengers on these international flights do not stay overnight in the hotel but rather spend six to ten hours at the casino before being flown back to their city of origin.

It should also be noted that there would be a dramatic increase to the number of residents on Tinian if the casino resorts are completed. Using information provided by a large casino gaming company, a 450 room hotel with approximately 25,000 square feet of casino space would employ approximately 1,100 employees. Resort hotels in Guam and Saipan report a ratio of slightly less than 1:1 employees to rooms. If the current two projects are completed, it would be expected that at least 1,500 employees would be hired for hotel and casino operations. If five

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casino resorts, averaging 300 rooms per resort, are constructed (the maximum allowed under the Tinian Casino Gaming Initiative), it would be expected that 3,500 to 5,000 employees would be required for the resorts' operations. With the addition of these hotel projects, it would not be unreasonable to assume that 2,000 to 3,000 additional people would be required for support services, including the various government agencies such as public safety, revenue and taxation and customs/quarantine/immigration.

Given current population demographics, these new employees would most likely be recruited from sources outside of Tinian and the CNMI. In the case of the Lone Star Casino which recently closed, most of the employees were recruited from the US mainland. After the casino's closure, most of these expatriates left Tinian with a few exceptions. As noted above, the first project is expected to be complete in 1997 and, accordingly, the impact of future projects would not be expected to occur until 1998 or 1999.

With the significant increase to population from the casino resorts, the island's existing infrastructure would be severely strained. Currently, power, water and sewer facilities are inadequate. It is expected that the casino resort developers would contribute to a central development fund for infrastructure improvement. However, the casino gaming law is not specific as to how the investment would be made. Conceivably, the resorts could install their own equipment for power generation, water wells and sewage treatment.

VI - Impact of Past Military Exercises

The impact of a military exercise on socioeconomic elements of the Tinian community appears to vary greatly depending on the number of personnel participating and the nature of billeting arrangements, field bivouac or lodging in San Jose Village.

Tandem Thrust 95, held on Tinian in November and December of 1994, was the largest exercise of the last few years. It included a total of roughly 2,000 personnel located on Tinian some of whom stayed in the Village while others bivouacked in the Military Area. Approximately 300 were housed in the municipal gymnasium.

Interviews were conducted with prominent government and business leaders on Tinian to gain insight into the impact and mitigation of Tandem Thrust 95 and other military exercises over the years. Their comments and observations are collectively summarized here.

6.1 Private Sector - There is general agreement among business owners that military exercises on Tinian are good for the economy, though no specific figures are available. There is a feeling, however, that the extent of annual economic contribution falls short of expectations established in the '70s during Compact negotiations when it was agreed to reserve two-thirds of Tinian island for the military. Specifically, the perception is that hotels and nightclubs do fairly well during exercises while stores and other businesses realize little benefit.

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Tandem Thrust 95 contributed sporadically to the economy of Tinian throughout the year of 1994 as various parties of two to ten persons visited the island for several days at a time on numerous occasions. During the exercise itself, every hotel room, vacant apartment and rental car on Tinian was in use by military personnel. The extra revenues were welcomed by the Tinian hospitality sector but regular tourism and business visitors were displaced for about three weeks.

From small ranchers, two incidents of disruptions to livestock from low-flying and hovering helicopters were reported. Though not directly related to exercises, a specific complaint was registered that the Navy contract for cleaning and maintaining North Field was awarded to a Hawaii vendor and never offered for bid to interested local companies who could probably be lower on price and more attentive.

6.2 Tourism - During most exercises, civilian access to North Field and the Military Area is restricted. A regular daily tour business of these historic sites is prospering and growing on Tinian. 1995 was an especially busy year for these sites because of the many American, Japanese and Korean religious orders, ancestors and veteran's groups which came to Tinian for various WWII 50th anniversary commemorations.

Tour operators and the Marianas Visitors Bureau complain that they are often notified only two or three days in advance of Military Area closure, forcing last minute cancellations and refunds to Japanese and Korean tourists some of whom paid for their tour of North Field months before as part of a package. These tourists are in the CNMI for only three or four days. They select Tinian as a day-trip component of their package only to waste that day, reportedly, when access to the shrines, monuments and artifacts is unexpectedly denied.

Most Japanese tourists to the CNMI arrive on a structured prepaid excursion sold to them by one of the enormous travel agencies in Japan. Local tour operators regularly sell reservations to travel agencies up to six months in advance in return for discounting the cost. To allow an orderly force majeure type cancellation of tour reservations and reroute the tourists to another optional tour, the operators believe they need to be notified at least one month in advance of access restrictions to the Military Area.

No complaints were registered over the loss of tour revenues from closure of the Military Area, only the lack of timely, systematic notification.

6.3 Commercial Aviation - West Tinian Airport is of great importance to island residents for business, medical care, shopping and the regular supply of cargo and mail. Two scheduled airlines fly approximately 50 flights every day of the year over the Military Area to traverse the Saipan/Tinian channel. During military exercises, alternate civil aviation flight paths are utilized but, out of necessity, the amount of traffic in the corridor remains the same. As with the tourism sector, the several reports of disruption to civil aviation during Tandem Thrust 95 seem to have in common some degree of breakdown in communication.

- Advance notification of military flight patterns, landings and parachute drops was not sufficient at times to allow proper warnings to civilian aircraft.

- Three large troop-transport helicopters suddenly landed on the runway at West Tinian Airport during daylight hours and began discharging troops and equipment apparently in a mock situation of securing the airfield. Two commercial flights were forced to return to Saipan and other flights were suspended while Tinian airport officials tried to make sense of the unexpected intrusion. Military personnel walking on the runway at other times reportedly also delayed commercial flights.

- Reportedly, landings and takeoffs at North Field do not receive clearance from civil aviation control and are only known as they appear on radar.

On the positive side, the Commonwealth Ports Authority (CPA) reports that it is regularly reimbursed for all costs associated with military exercises with no problems, including overtime pay to CPA personnel. The Tinian airport manager is grateful for the barrels of runway foam which are often donated upon conclusion of an exercise.

6.4 Public Safety - As reported, the military exercises of recent years have presented far fewer public safety problems than those in the '80s. During Tandem Thrust 95, no complaints arose involving military personnel in the Village other than two skirmishes with local men at the gymnasium/barracks which apparently were instigated by the local individuals. The military policy of restricting town passes to a limited number of personnel at a time is appreciated by DPS and comments were made that military personnel were well behaved even in the bars.

Much unreimbursed overtime was recorded by police officers during Tandem Thrust 95. However, the continual shortage of officers routinely forces a large amount of overtime at DPS anyway and it is believed that no claim for reimbursement was ever submitted.

6.5 Other Government Services - After Tandem Thrust 95, several invoices for overtime of customs and quarantine officers were reportedly submitted to Andersen Air Force Base but payment was never received. A copy of a representative invoice is attached as Exhibit VI-A. As can be seen, the invoice is not very descriptive and is not directed to any particular party or department. It was admitted that no procedure or designated party was established with the military for invoicing overtime costs. The total amount involved, around $10,000, represents the marginal costs of customs and quarantine officers (two different agencies) meeting arriving flights around the clock at West Tinian Airport and North Field for ten to twelve days.

6.6 Community Life - Loss of use of the municipal gym and multi-purpose center during Tandem Thrust 95, because of the billeting of military personnel, forced rescheduling of some youth programs and suspended afternoon basketball pick-up games.

Engineering and construction of a community improvement is apparently becoming a tradition of Tinian military exercises. In conjunction with Tandem Thrust 95, a scenic jogging/walking path was constructed along the water's edge in San Jose Village connecting the public beaches.

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This gift was warmly received and appreciated by the people of Tinian. For locals and tourists alike, it is a welcome enhancement of the most popular leisure area on the island.

VII - Conclusions and Mitigation Recommendations

In general, military exercises on Tinian, though disruptive at times, are accepted by residents as a part of the local modern-day culture. There is some economic benefit to the island though it would be properly measured marginally against lost revenues in the tourism and hospitality sectors. The temporary nature of the exercises along with military mitigation attempts have resulted in a noticeable acquiescence in the community.

If large scale casino resort development activities commence, the military training exercises could have an adverse impact by restricting air and water traffic. However, this situation could be mitigated with advance notice to the civilian population and government agencies.

Most complaints and unresolved problems seem to involve poor communication between military authorities and affected civilians. The fault for this may lie with military planners or within the local information dissemination system on Tinian. Regardless, better communication with those actually affected by military exercises would resolve the bulk of complaints. With that in mind and to summarize other findings, the following actions are recommended to help mitigate the socioeconomic impact of future military exercises on Tinian.

Recommended Socioeconomic Impact Mitigation Measures

1. When military exercises are scheduled for Tinian, provide a courtesy fax or telephone notification of dates and expected civilian impact directly to certain local entities in addition to the normal notification channel through the Mayor's office. As much advance notice as possible should be given especially if the exercise involves restricting access to the Military Area. Tour operators would like notice one month in advance when possible. At a minimum, the following should be directly notified:

   Mr. Carlos Shoda, Executive Director
   Commonwealth Ports Authority
   P.O. Box 1055
   Saipan, MP 96950
   Phone: (670) 664-3534
   Fax: (670) 234-5962

Ms. Ellen Ikehara, Field Operations Supervisor
Marianas Visitors Bureau Tinian Field Office
Phone: (670) 433-9365
Fax: (670) 433-0653

2. Consider excluding the busier and busier West Tinian Airport from future military exercises, especially during daylight hours. If a need for unexpected use of the airport or runway should arise, immediately directly notify the airport manager, Mr. Sylvestre Palacios at (670) 433-9296.

3. Restrict the area immediately surrounding West Tinian Airport from ground exercises to prevent military personnel from encroaching on the operating runway.

4. To prevent what some believe to be an inevitable tragic accident, strengthen the coordination of all landings, takeoffs and parachute drops anywhere on Tinian with the new civil air traffic control in Saipan.

5. Designate a finance officer to whom reimbursement billings should be submitted by local agencies. Document the procedures to be followed in obtaining military reimbursement of costs associated with exercises and disseminate that information through the Tinian Mayor's office.

6. Continue or even expand the practice of community service projects during military exercises.

7. In scheduling military exercises on Tinian, take into consideration the following annual events which normally bring substantial numbers of visitors to the island:

Cliff Fishing Derby	3rd weekend in February
San Jose Fiesta	1st weekend in May
San Isidro Fiesta	4th weekend in May
Agri-Food Fair	1st weekend in June
MVB 10K Fun Run	4th Saturday in September

8. Reevaluate socioeconomic impact to incorporate new data if a hotel/casino resort is constructed on Tinian.

9. Continue the sensitivity to the island of Tinian and it's residents exhibited in the excellent briefing instructions provided to personnel of the Tandem Thrust 95 exercise under the heading TINIAN TRAINING AREA: THINGS YOU NEED TO KNOW (Exhibit VII-A).

ESTIMATED ADJUSTMENTS TO TINIAN DEMOGRAPHICS

POPULATION

Published Population 1992 *	Estimated Increase From Exhibit IV-A Extrapolations	Estimated Population Dec. 1995
2,553	1,165	3,718

POPULATION DENSITY

	Population 1992 *	Sq Miles *	Persons per SM *
Tinian	2,553	39	65.5
Rota	2,561	32	80.0
Saipan	47,786	45	1,061.9

1995 Pragmatic Estimate		
Tinian Population	Sq Miles **	Persons/ SM
3,718	13.0	286.3

* - SOURCE: 1993 Commonwealth of the Northern Mariana Islands Statistical Yearbook: Department of Commerce and Labor, CNMI government

** - allows for 66% of Tinian island included in Military Area and habitatually unavailable to local population

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Exhibit IV-A

PASSENGER COUNT
WEST TINIAN AIRPORT
1992-1995

Year/ Month	Enplane-ments	Deplane-ments	Total Passengers	Gain
1995			1995	
Jan	3,398	3,482	6,880	84
Feb	3,464	4,010	7,474	546
Mar	3,149	2,944	6,093	-205
Apr	3,711	3,753	7,464	42
May	5,787	6,178	11,965	391
Jun	4,773	4,412	9,185	-361
Jul	4,455	4,420	8,875	-35
Aug	4,727	4,716	9,443	-11
Sep	3,550	3,532	7,082	-18
Oct	3,230	3,286	6,516	56
Nov	3,646	3,756	7,402	110
Dec	4,100	4,124	8,224	24
Total	47,990	48,613	96,603	623
1993			1993	
Jan	2,546	2,760	5,306	214
Feb	2,155	2,153	4,308	-2
Mar	2,682	2,590	5,272	-92
Apr	2,575	2,854	5,429	279
May	3,439	3,135	6,574	-304
Jun	3,025	3,156	6,181	131
Jul	2,915	2,929	5,844	14
Aug	2,717	2,840	5,557	123
Sep	1,959	2,049	4,008	90
Oct	2,360	2,381	4,741	21
Nov	2,310	2,391	4,701	81
Dec	3,317	3,292	6,609	-25
Total	32,000	32,530	64,530	530

Year/ Month	Enplane-ments	Deplane-ments	Total Passengers	Gain
1994			1994	
Jan	3,130	3,309	6,439	179
Feb	2,697	2,697	5,394	0
Mar	2,523	2,493	5,016	-30
Apr	2,832	3,343	6,175	511
May	4,075	3,442	7,517	-633
Jun	3,866	3,669	7,535	-197
Jul	3,414	3,541	6,955	127
Aug	3,390	3,489	6,879	99
Sep	3,109	3,026	6,135	-83
Oct	2,707	2,780	5,487	73
Nov	2,663	2,769	5,432	106
Dec	3,008	2,868	5,876	-140
Total	37,414	37,426	74,840	12
1992			1992	
Jan	2,336	2,348	4,684	12
Feb	2,268	2,319	4,587	51
Mar	2,475	2,523	4,998	48
Apr	2,584	2,903	5,487	319
May	2,979	3,243	6,222	264
Jun	2,914	2,297	5,211	-617
Jul	2,427	2,510	4,937	83
Aug	2,468	2,473	4,941	5
Sep	2,206	2,152	4,358	-54
Oct	2,300	2,505	4,805	205
Nov	2,239	2,406	4,645	167
Dec	2,740	2,881	5,621	141
Total	29,936	30,560	60,496	624

SOURCE: CNMI Government
Commonwealth Ports Authority

Extrapolated Data

Average Per Day:

	Enplane-ments	Deplane-ments	Total Passengers
1995	131.5	133.2	264.7
1994	102.5	102.5	205.0
1993	87.7	89.1	176.8
1992	81.8	83.5	165.3

Four Year Population Gain	1,789
Population Gain 1993-1995	1,165

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Exhibit IV-B

Total Passenger Traffic - West Timian Airport
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
1995
1994
1993
1992

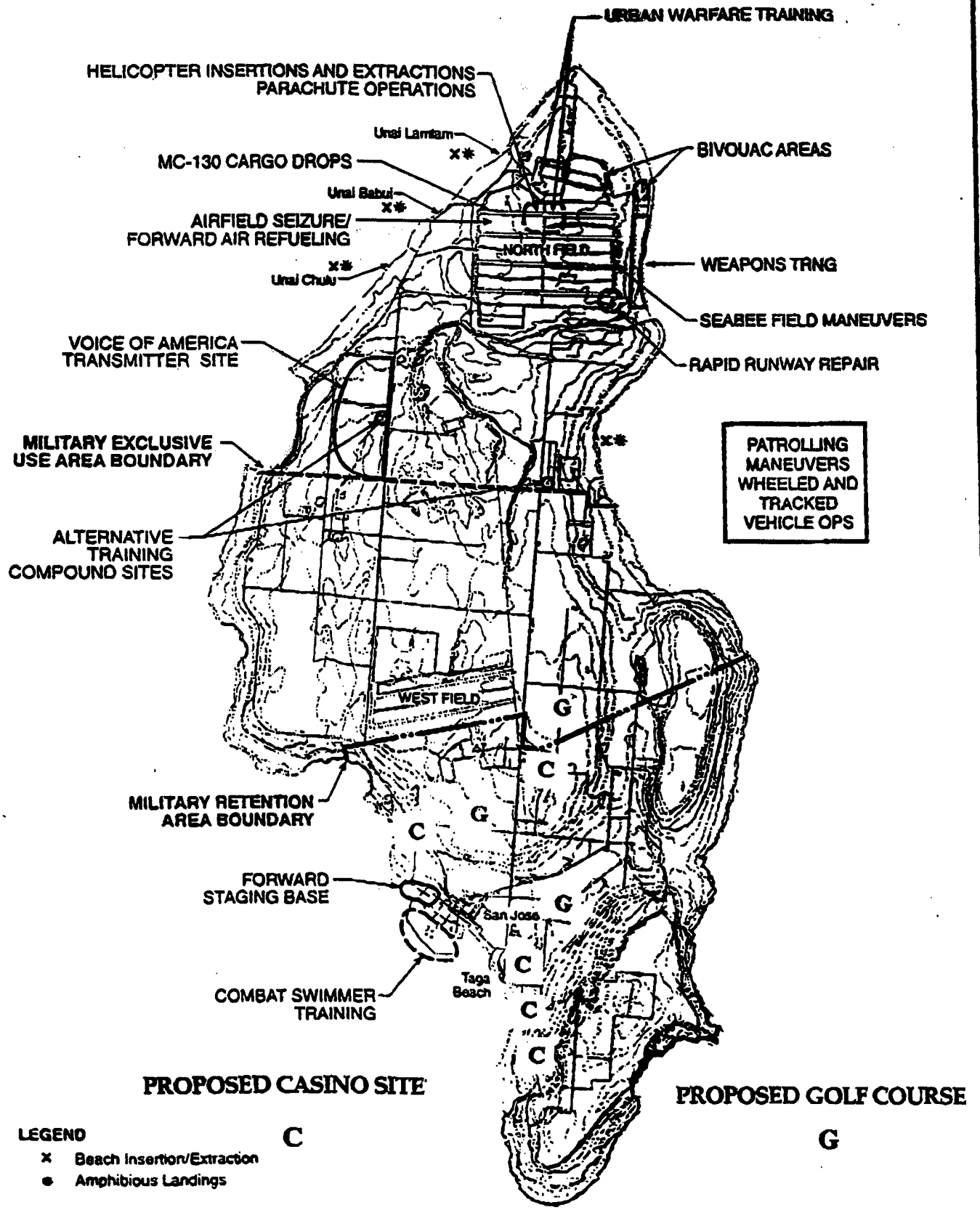


Figure 7
TINIAN TRAINING

Draft EIS: Military Training in the Marianas
Belt Collins Hawaii, 1995

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Exhibit V-B

PROJECTED AIR TRAFFIC WITH OPERATING CASINOS
WEST TINIAN AIRPORT
(General Estimates Only)

Tinian Hotel/ Casinos	Total Hotel Rooms	Avg Daily Guests	Turnover Per Day	Estimated Day-Trips Per Day	International Flights Per Day	Commuter Flights Per Day	Total Passengers Per Day	Total Passengers Per Month
1	400	540	216	500	1.1	17	1,432	42,960
2	800	1,080	432	750	2.2	25	2,364	70,920
3	1,200	1,620	648	1,000	3.2	33	3,296	98,880
5	2,000	2,700	1,080	1,500	5.4	50	5,160	154,800

Projected passenger traffic estimates would be in addition to existing Tinian airport traffic in Exhibit IV-A.

GENERAL ASSUMPTIONS

Avg Rooms per Hotel	400	Avg Passengers per International Flight	200
Avg Occupancy Rate	75%	Avg Passengers per Commuter Flight	30
Avg Persons per Room	1.8		
Avg Length of Stay	2.5		

ACTUAL RESULTS WILL VARY FROM PROJECTIONS AND THOSE VARIANCES MAY BE MATERIAL.

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Exhibit VI-A

DEPARTMENT OF FINANCE
U.S. COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

GNMI-FN Form 214-77
(Rev. 4/87)

BILL FOR COLLECTION

Bill No. TQ6-020

Make Remittance Payable To: Treasurer, CNMI (Bureau or Office)

Date DECEMBER 27,1995

Mail Payment To: Tinian Finance & Accounting, Tinian MP, 96952 (Address)

PAYER:

ANDERSEN AIR FORCE BASE
YIGO, GUAM 96929

Amount of Payment $ 840.06

Date	DESCRIPTION	Quantity	Unit Price Cost	Per	Amount
12/05/95	REYES,ROBERT S.(MILITARY FLT.C-130)	4	$ 10.89	HR	$ 43.56
12/06/95	" " " (" " ")	2	$ 10.89	HR	21.78
12/07/95	" " " (C-130 FLT. CANCELED)	2	$ 10.89	HR	21.78
12/07/95	" " " (C-130 FLT.MONITOR HEAVY DROP,LANDING)	6	$ 10.89	HR	65.34
12/08/95	" " " (" " " " " "HOL.)	7	$ 14.51	HR	101.57
12/08/95	" " " (" " " " " ")	5	$ 14.51	HR	72.55
12/09/95	" " " (C-130 FLT.MONITOR HEAVY DROP,LANDING)	3	$ 10.89	HR	32.67
12/05/95	MENDIOLA,ANICETO B.(MILITARY FLT. C-130)	4	$ 15.51	HR	62.04
12/07/95	" " " (" " ")	2	$ 15.51	HR	31.02
12/07/95	" " " (C-130 FLT.MONITOR HEAVY,DROP, LANDINGS)	6	$ 15.51	HR	93.06
12/08/95	" " " (" " " " " HOL.)	7	$ 20.68	HR	144.76
12/08/95	" " " (" " " " " HOL.)	5	$ 20.68	HR	103.40
12/09/95	" " " (C-130 FLT.MONITOR HEAVY DROP, LANDINGS)	3	$ 15.51	HR	46.53

BI-WEEKLY BILLING
PP# 25 ENDING 12/09/95

4472/9051

AMOUNT DUE THIS BILL, $ 840.06

Prepared By: ANICETO B. MENDIOLA

Concurred By: NORMAN S. PALACIOS 1/23/96

SPECIAL NOTE:

WHEN REMITTING PAYMENT, PLEASE CITE OUR BILLING NUMBER INORDER TO INSURE PROPER ACCOUNT CREDITED.

WHITE - ORIGINAL CANARY - ACCOUNTING COPY PINK - ADMINISTRATIVE OR BILLING COPY

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TINIAN TRAINING AREA: THINGS YOU NEED TO KNOW

The island of Tinian, Commonwealth of Northern Mariana Islands, is a unique historical and natural resource. In 1944, Tinian was the site of the most successful amphibious assault of World War II to that time. Subsequently, the island became the site of the world's largest operating airfield, from which were launched the two B-29 nuclear strikes that ended the war with Japan.

You are training on the site of that airfield — North Field — now largely returned to a natural state. Many historic artifacts of the dawn of the nuclear age remain on Tinian. The artifacts have global importance and must be respected. In addition there are prehistoric Chamorro cultural artifacts on the island which must also be preserved and respected. Six endangered animal species inhabit much of the training area. These animals and their habitat need your protection. The training area is also used by residents of Tinian for fishing, gathering and religious observances. There are also sight-seeing and historic tours conducted in the training area.

To ensure that the training area remains available for our use, please respect its economic, spiritual, cultural, and natural resources. Here are some guidelines for use of the Tinian training area. Please observe them:

- Don't mar or disturb any shrine or structure.
- Observe training restrictions that protect certain sensitive land areas. Adhere to the rules established for areas that are "Off Limits," "No Ground Disturbance," and "No Wildlife Disturbance." These areas are shown in your exercise orders. The rules applying to each area will be explained by your unit leader.
- Don't kill or disturb any wildlife — forest birds, water birds, bats or sea turtles (which may be nesting on sand beaches). It is a federal crime to take or harass these endangered or threatened species.
- Don't kill or take coconut crabs; they are a food animal managed by local game regulations.
- Be very careful with fire. Use pyrotechnics only in authorized areas. Fighting a brush fire in many areas of Tinian will be extremely difficult and disastrous to native vegetation.
- Do not cut or damage any fences (which include electric fences surrounding cow pastures). If any fence-line is inadvertently damaged, repair and report the incident immediately.
- Practice the "Pack It In; Pack It Out" Rule. Leave no trash. All trash will be collected for delivery to a central collection point for compacting and transport off of Tinian.
- Do not collect artifacts of any kind. Leave any World War II "souvenir" materials where you find them. Report any ordnance that may be discovered for proper disposal by EOD.

For your personal safety, be aware than many open fields are used for cattle grazing (bulls and cows). The underbrush harbors many wasps that nest on the bottom side of leaves. Tourists visiting historic sites in North Field can be expected to enter the training area during the exercise. Do not endanger them, and in turn be cautious of their driving habits. There is no traffic control system to speak of along the former runways, parking aprons and connecting street system.

The local authorities are extremely cooperative with military units that train on Tinian. Please remember that it is your cooperative spirit that will ensure Tinian's historic, cultural, and natural resources will be maintained without losing a valuable training area.

5.2 Current Status - The only casino to open on Tinian was Lone Star Casino which began operations in a converted small office building in May 1995. Questions were raised by the CNMI Governor and others as to the legality of Lone Star because of the absence of a 300-room hotel as required by the Act. Suffice it to say that Lone Star appears to have been an ill-conceived, under-capitalized and poorly managed venture which was licensed by TCGCC in an act of desperation. Lone Star Casino closed on December 17, 1995 and its gaming license was revoked on May 23, 1996. Of the original seven casino applicants, only one , Tinian Marine Resorts, Inc. has received a casino license and is in the process of obtaining the necessary financing for a $500 million, two phased casino project. This project will include 1,000 hotel rooms, a golf course, shopping center and marina. The project is located in the general beach area between Taga Beach and Tachonga Beach in the village of San Jose.

On March 12, 1996, TCGCC issued 40 year casino licenses to Hong Kong Entertainment Investments Ltd. and CNMI Touring and Entertainment Inc. These Hong Kong-based companies have each paid the full $700,000 application and licensing fees in advance. Hong Kong Entertainment Investments Ltd. is currently constructing a casino resort situated on three parcels of land (12.2 hectares) between Taga Beach and Tachonga Beach in San Jose. Its project, Tinian Palace Casino, will include a hotel with 384 rooms, 20 VIP suites and two presidential suites. It will also offer a 85,000 square foot casino, entertainment theater, night club, two restaurants, and fitness center. The company estimates that 800 employees will be employed by the resort, scheduled for opening in April 1997. These employees will be housed in a worker's village adjacent to the hotel. Two $6 million turbo-jet ferries are expected to transport the resort's guests from Saipan to Tinian via the Saipan Channel.

CNMI Touring and Entertainment Inc. is planning to construct a 300 to 500 room hotel and casino on land that has not been identified. However, negotiations are on-going with several landowners. Yoshiya Philippines Co., a subsidiary of Yoshiya Co. of Hong Kong, is currently building a $35 million luxury casino ship. On October 16, 1995, the company signed a memorandum of understanding with the CNMI governor and TCGCC chairman. It has been announced that the ship will arrive at Tinian in December 1996 and will operate out of the port area.

Initial survey work has been completed for expansion of West Tinian Airport and the Commonwealth Ports Authority has pledged that construction will be completed before the first casino opens. However, this appears doubtful given the aggressive construction schedule of the Hong Kong Entertainment venture. The expanded airport will have an 8,000 foot runway that will accommodate 747-200 wide-body aircraft. Refer to Exhibit V-B for estimated passenger traffic to be generated by operating casino resorts in Tinian.

A summary of announced casino projects, including the aforementioned projects, follows.

Active Tinian Casino Ventures

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Name	Origin	Proposed Project	Status
Tinian Marine Resorts	Taiwan & Saipan	2 phases with 500 rooms each; large casino; golf course; theme park; $500M project	Casino license issued on Nov. 1995. $500,000 fee unpaid
HK Entertainment	Hong Kong	406 rooms, casino & other attractions	License issued, site preparation underway
CNMI Touring and Entertainment, Inc.	Hong Kong	300 to 500 room hotel, casino and golf course	License issued, currently negotiating land leases
Yoshiya Philippines Co	Hong Kong	Floating luxury casino ship	Memo of understanding signed, ship is under construction
The Team Company Ltd.	Tokyo	Floating 50,000 sq. ft. casino, floating 500 room hotel	Announced by governor, no license application or fee filed.

It should be noted that inquiries have also been made by other Japanese and Macau casino developers. TCGCC is actively soliciting interest.

To date, the sites for the aforementioned projects are in the village of San Jose and are not located near the proposed military training sites. Construction and operation should not be adversely impacted by the proposed military training exercises with the possible exception of interrupted air and sea traffic while the activities are underway. This can be mitigated by close cooperation between the military, Commonwealth Ports Authority and transportation industry representatives.

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