FINAL

ENVIRONMENTAL ASSESSMENT FOR BRAC ACTIONS FOR THE 137TH AIRLIFT WING RELOCATION, KC-135R AIRCRAFT ROBUST, AND ASSOCIATED CONSTRUCTION AT THE 507TH AIR REFUELING WING

TINKER AIR FORCE BASE, OKLAHOMA

United States Air Force
Air Force Material Command

Tinker Air Force Base, Oklahoma

October 2007

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
OCT 2007		**00-00-2007 to 00-00-2007**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Final Environmental Assessment for BRAC Actions for the 137th Airlift Wing Relocation, KC-135R Aircraft Robust, and Associated Construction at the 507th Air Refueling Wing Tinker Air Force Base, Oklahoma	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **AMEC Earth and Environmental, Inc,104 W Anapamu St Ste 204a,San Barbara,CA,93101**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

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

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**179**	

FINAL
FINDING OF NO SIGNIFICANT IMPACT: BASE REALIGNMENT AND CLOSURE (BRAC) ACTIONS FOR THE 137TH AIRLIFT WING RELOCATION, KC-135R AIRCRAFT ROBUST, AND ASSOCIATED CONSTRUCTION AT THE 507TH AIR REFUELING WING TINKER AIR FORCE BASE OKLAHOMA CITY, OKLAHOMA

Introduction

Military assets at Tinker Air Force Base (AFB), Will Rogers World Airport Air Guard Station (AGS), and Portland International Airport (IAP) AGS were among those recommended for realignment by the 2005 BRAC Commission as directed by the United States (US) Department of Defense (DoD). The *2005 Defense Base Closure and Realignment Commission Report,* released 8 September 2005, was developed in accordance with the Defense Base Closure and Realignment Act of 1990 and details recommendations for affected military installations. The overarching purpose of BRAC is to maximize the effective use of DoD resources by streamlining management and operations of DoD installations and associated weapons ranges. This streamlining process is intended to save money while enhancing the effectiveness of US military forces.

In 2002, the DoD issued its United Facilities Criteria (UFC) system, including *DoD Minimum Antiterrorism Standards for Buildings,* in order to minimize the possibility of mass casualties in buildings or portions of buildings owned, leased, privatized, or otherwise occupied, managed, or controlled by or for the DoD. The standards provide appropriate, feasible, and enforceable measures to establish a level of protection against terrorist attacks. The intent of these standards can be achieved through prudent master planning, real estate acquisition, and design and construction practices. Though established in 2002, these standards apply to existing facilities starting with the Fiscal Year 2004 (FY 04) program and are mandated when any facility is proposed to undergo major investments, conversion of use, building additions, or glazing replacement. At Tinker AFB, proposed facility construction and demolition are intended to comply with these standards.

Pursuant to Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of the National Environmental Policy Act (NEPA) (40 Code of Federal Regulations [CFR] 1500 1508), DoD Directive 6050.1 and Air Force Instruction 32 CFR Part 989, Tinker AFB has prepared an Environmental Assessment (EA) that evaluates the potential environmental and socioeconomic impacts associated with the BRAC-related actions for the 137th Airlift Wing (137 AW) relocation, KC-135R aircraft robust, and associated construction at the 507th Air Refueling Wing (507 ARW) at Tinker AFB. This EA is incorporated by reference into this finding.

Description of Proposed Action

The Proposed Action is intended to fully implement the BRAC 2005 recommendations affecting the 507 ARW at Tinker AFB. The components of the Proposed Action are summarized below.

The BRAC 2005 recommendations that affect Tinker AFB include three principal activities:

1) the relocation of operations and maintenance personnel associated with the 137 AW of the Oklahoma Air National Guard (ANG) from Will Rogers AGS to Tinker AFB, where the 137 AW would become an associate wing, operating with the 507 ARW of the Air Force Reserve Command (AFRC);
2) the robust (i.e., transfer) of four KC-135R aircraft from the 939 ARW from Portland IAP AGS, Oregon to Tinker AFB; and
3) the demolition and construction of facilities to support the additional personnel and aircraft.

The following demolition and construction actions are proposed at Tinker AFB to fully implement the BRAC 2005 recommendations:

- construction of AFRC and ANG squadron operations, operations support squadron, life support storage, and life support work area;
- construction of a new hangar with hangar access and associated demolition of Buildings 1037 and 1041, which would also correct a current deficiency at Tinker AFB; and
- renovation of Building 1048.

Alternatives

Alternative 1: Hangar Repositioning. Alternative locations for the construction of the new hangar were evaluated. To maximize its operational effectiveness, the hangar should be located near the 507 ARW's apron, near the existing hangar. This alternative would implement all BRAC 2005 recommendations affecting the 507 ARW; the four additional KC-135R aircraft would be transferred to Tinker AFB and the 137 AW would be relocated to Tinker AFB to associate with the 507 ARW. The construction of a new hangar, renovation of Building 1048, and the construction of the Squadron Operations Building would be required to accommodate the additional aircraft and the 137 AW and to support the aerial refueling mission. The existing ramp would be expanded to provide hangar access. This alternative would not involve the demolition of any existing buildings. One feasible alternative location for the hangar was identified. The alternative location was north of the existing hangar in the floodplain to Crutcho Creek. A significant amount of fill and special foundations would be required to construct the hangar in this location.

Alternative 2: Transfer of 137 AW Only. Alternative 2 would implement the transfer of the 137 AW only. To provide adequate support facilities, this alternative would still require the construction of the Squadron Operations Building and the renovation of Building 1048. The four KC-135R aircraft would not be transferred from Portland IAP AGS under this alternative. However, the construction of the hangar would still be required to correct current operational deficiencies, and the existing ramp would be expanded to provide hangar access. Due to the limited availability of feasible hangar locations, this alternative would also require the demolition of Buildings 1037 and 1041 to accommodate the proposed hangar. This alternative would not be viable because it would not implement the BRAC 2005 recommendation of transferring the four KC-135R aircraft to Tinker AFB to create adequately sized squadrons and improve the overall operational effectiveness of the DoD's KC-135 fleet.

Alternative 3: No-Action Alternative. Under the No-Action Alternative, Tinker AFB would not implement the Proposed Action, and BRAC 2005 recommendations would not be implemented as directed. The 137 AW would remain at Will Rogers AGS; no aircraft would be transferred from Portland IAP AGS; and no construction, demolition, or renovation to provide support facilities for the aerial refueling mission would occur. Current inadequacies in hangar facilities would remain. The CEQ's regulations for the implementation of the NEPA stipulate that the No-Action Alternative must be considered to assess environmental consequences that may occur if the Proposed Action is not implemented. This alternative has been carried forward in the EA, as required by the CEQ.

Anticipated Environmental Effects

	Under Implementation of the Proposed Action:
Airspace and Airfield Operations	A 50-percent increase in the number of hours flown and the number of KC-135R aircraft maintained by the 507 ARW would occur; however, this increase would only account for a 5.4-percent increase in total aircraft operations at Tinker AFB. The increase in KC-135R operations would not surpass the air traffic capacity of Tinker AFB and no significant impacts to runway usage would occur under the Proposed Action. No change to the configuration (i.e., size, shape, or location) of the Air Traffic Control Assigned Area (ATCAA) or Military Operations Area (MOA) airspace areas are proposed or would be required to support the implementation of the proposed aircraft robust. In addition, no modification of the air traffic control (ATC) system at Tinker AFB would be required.
Air Quality	Implementation of the Proposed Action would result in the generation of dust (i.e., particulate matter less than 10 microns in diameter [PM_{10}]) during construction activities including grading and demolition. Because the majority of these activities would take place on already disturbed and paved sites, PM_{10} emissions are expected to be low. Any adverse short-term impacts resulting from proposed construction activities would be further mitigated through standard dust minimization practices; therefore, emissions from this source would not be significant. Long-term operational emissions associated with the Proposed Action would be emissions from the addition of four KC-135 aircraft and their operations. These emissions, when compared to the overall county-wide annual emissions, would be negligible and would not represent a significant impact. In addition, approximately 125 full-time personnel and 300 Traditional Guardsmen would be transferred to Tinker AFB and would result in an increase of combustion emissions associated with increased vehicular traffic in the vicinity of Tinker AFB. However, these vehicle trips are already occurring in the Oklahoma City region; therefore, emissions would be negligible and not result in significant impact

	Under Implementation of the Proposed Action:
Noise	Implementation of the Proposed Action would result in a 5.4-percent increase in the total number of annual aircraft operations at Tinker AFB; however, the off-base area affected by noise levels of 65 L_{dn} or greater would increase negligibly. No areas off base would be newly exposed to the 65+ L_{dn} noise contour. Further, implementation of the Proposed Action would not result in any sensitive receptors (e.g., residences, schools, etc.) currently within the baseline 65+ L_{dn} contour to experience a significant increase in noise levels. Implementation of the Proposed Action would have minor, temporary effects on the noise environment in the vicinity of proposed construction and demolition sites. However, noise generation would be typical of construction activities, short-term, and associated impacts could be reduced through the use of equipment sound mufflers and restriction of construction activity to normal working hours. Therefore, noise generated by construction and demolition activities would not significantly impact sensitive receptors on or in the vicinity of Tinker AFB.
Land Use	All project components have been designed and sited to be compatible with existing base land use and airfield safety guidelines and to be inherently consistent with Tinker AFB planning policies. In addition, the BRAC-required construction projects are necessary to comply with the 2005 BRAC Recommendations and to accommodate the aircraft robust and additional personnel. Construction components of the Proposed Action have been sited in accordance with established land use development guidelines addressing safety, functionality, and environmental protection zones. No adverse impacts to land use on Tinker AFB would occur. With regard to off-site land use, no new types of land use activities would be introduced onto Tinker AFB as a result of the implementation of the Proposed Action. However, the proposed aircraft robust would increase the flight activity at the base, resulting in increased risk of accidents in all clear zones (CZs) and accident potential zones (APZs). The size and location of the CZs and APZs would be unchanged and existing land use in these areas would be unaffected; further, current land use within the noise zones would remain unchanged and no land use areas would be newly introduced to the 65+ L_{dn} noise contour.
Geological Resources	Potential geologic impacts associated with the Proposed Action at the 507 ARW Complex would be limited to ground-disturbing activities. Minor impacts would result from proposed construction activities; however, all construction activities would occur on previously disturbed land and on soils that are capable of supporting such development. Proposed construction would not have significant impacts on sensitive or regional geologic or physiographic features. Best-management practices (BMPs) and standard erosion control measures would be incorporated to reduce any potential impacts related to geology and soils to less than significant levels. Therefore, impacts to soil, soil productivity, and geological resources would not be significant.
Water Resources	With regard to surface water, construction would have localized and temporary effects on nearby hydrology and water quality; however, BMPs would be incorporated during construction to minimize erosion, runoff, and sedimentation. No additional impermeable surface areas would be created; therefore no impacts would occur with regard to groundwater hydrology. Stormwater runoff would be captured by the on-base storm water retention pond and creek systems. None of the proposed facilities or improvements comprises a significant water user or wastewater generator. Further, construction activities and staging areas would not be sited in or near identified wetlands on base. In addition, the proposed construction areas are not within the 100- or 500-year floodplains; therefore, implementation of the Proposed Action would not impact water resources at Tinker AFB.
Biological Resources	Construction associated with the Proposed Action would require almost no vegetation removal and, based on the lack of sensitive or native plants species on the 507 ARW Complex, proposed construction would not have significant impacts on vegetation or the habitat it may provide. Areas where construction would occur have been previously disturbed and are primarily paved or otherwise developed and contain no known critical habitats. The Texas Horned Lizard, a Federal species of concern, is known to be present in the South Forty District; however, the sites proposed for facilities construction are not located in known distribution areas for this species. No other sensitive species are known to occur in or near areas that would be affected by implementation of the Proposed Action. Therefore, there would be no impact to sensitive species.

	Under Implementation of the Proposed Action:
Transportation and Circulation	Implementation of the Proposed Action would result in the addition of 125 full-time personnel and 300 part-time Traditional Guardsmen to staff and support the associate squadron. The increase in personnel would result in a direct increase in the number of vehicles on base; however, Traditional Guardsmen would only be on base during drill weekends and would therefore not impact base circulation. Once on base, the vehicles for the additional full-time personnel would be driven to parking areas and most would remain on site for the duration of the workday; therefore, the additional vehicles would not significantly impact on-base circulation. Regionally, the increase in personnel levels at Tinker AFB would be offset by the corresponding decrease in the number of commuters currently traveling to and from Will Rogers World Airport. With regard to parking, the addition of 125 vehicles during the work week would not exceed the capacity on base or USAF standards regarding parking ratios. Parking space availability on drill weekends is already below the USAF standards and the addition of 425 vehicles would exacerbate the situation. However, drill weekends would be appropriately staggered to alleviate the parking constraints.
Visual Resources	Facilities construction projects and increased aircraft operations associated with the Proposed Action would be visually consistent with existing structures and activities at Tinker AFB. Further, the visual environment of Tinker AFB does not constitute a unique or sensitive viewshed; therefore, no significant impact to regional visual resources would occur upon implementation of the Proposed Action.
Cultural Resources	Buildings 1041 and 1037 are proposed for demolition under the Proposed Action. Both buildings are less than 50 years old and neither is recognized as a facility of historical importance; further, neither of these facilities is known to have military or architectural significance. All construction projects associated with the Proposed Action have been sited in previously developed areas on the base. No archaeological resources listed or eligible for inclusion on the National Register of Historic Places (NRHP) have been identified at the 507 ARW Complex. There are no known federally recognized Native American lands or resources at Tinker AFB. Tinker AFB has initiated consultations with three Native American tribes (i.e., the Seminole Nation, Osage Nation, and Muskogee Nation). Each of these tribes has verbally commented that they have no Native American Graves Protection and Repatriation Act (NAGPRA) or American Indian Religious Freedom Act (AIRFA) concerns with regard to the Proposed Action. Therefore, impacts to cultural resources would be less than significant.
Socioeconomics	The Proposed Action includes the transfer of 125 full-time and 300 part-time Traditional Guardsmen from the 137 AW to Tinker AFB. The 137 AW is located at the Will Rogers World Airport in southwest Oklahoma City, and the employees that would transfer to Tinker AFB currently reside in or near Oklahoma City. Economic activity associated with proposed construction activities, such as hiring of temporary laborers and purchasing of materials, would provide short-term economic benefits to the local economy. However, beneficial impacts resulting from construction payrolls and materials purchased would be negligible on a regional scale. Therefore, the Proposed Action would have beneficial but less than significant impacts on local socioeconomic characteristics
Environmental Justice and Protection of Children	In general, residents in communities near the base may be considered both minority and low-income. However, communities near the base do not comprise dense concentrations of minority populations. Tinker AFB is in the process of developing an Air Installation Compatible Use Zone (AICUZ) Study that will determine the anticipated change in noise contours associated with implementation of the Proposed Action and the resulting increased flying operations. However, as described in Section 3.3, impacts with regard to noise off-base and minority and low-income populations would be less than significant. Housing and facilities for children are present on Tinker AFB; however, children would not have access to construction sites. Therefore, impacts with regard to protection of children would be less than significant.
Hazardous Materials and Wastes	Implementation of the Proposed Action could have a temporary increase in the storage of hazardous materials and waste throughout construction of and modifications to facilities; however, the increase in construction-related hazardous materials and wastes would be temporary and would not comprise a significant impact. Additionally, the 507 ARW would continue to operate the KC-135R, but would increase its inventory from 8 to 12 aircraft. Because 507 ARW operations comprise only a small portion of overall aircraft operations at the base, the aircraft robust is anticipated to minimally increase the storage and use of hazardous materials at Tinker AFB. Further, the storage and use of these materials would continue to be accomplished in accordance with applicable laws, regulations, and base policies; and the slight increase in volume would be accommodated within the framework of existing management, handling, and disposal processes. Therefore, impacts with regard to hazardous materials and waste would be less than significant.

	Under Implementation of the Proposed Action:
Safety	Implementation of the Proposed Action would result in changes to the frequency of aircraft operations performed by the 507 ARW. Bird-aircraft strikes present a potential threat to 507 ARW aircraft and aircrew safety due to resident bird species as well as the base's proximity to Lake Stanley Draper and the Central Flyway. Tinker AFB implemented a BASH Plan in 2006 which established preventative measures to reduce bird-aircraft strikes and has contracted with the US Department of Agriculture (USDA) to conduct live bird control on base. With the implementation of these new measures, impacts with regard to mishaps and bird-strikes would be less than significant. All proposed construction activities have been designed and sited to comply with all airfield safety criteria and are consistent with guidelines established in the base's Master Plan. No facilities development is proposed within airfield CZs or APZs; therefore, minimal impacts to airfield safety would result from implementation of the Proposed Action.

Public Notice

NEPA, 40 CFR 1500-1508, and 32 CFR 989 require public review of the EA before approval of the Finding of No Significant Impact (FONSI) and implementation of the Proposed Action. A Notice of Availability for public review of the Draft EA was published in *The Oklahoman* on 6 July 2006. The Draft EA was available for public review at the Midwest City Public Library. The public review period lasted for 30 days, and no public comments were received; therefore, no such comments were incorporated as part of the Final EA.

Finding of No Significant Impact

After careful review of the potential impacts of this Proposed Action, I have concluded that the action's implementation would not have a significant impact on the quality of the human or natural environment or generate significant controversy. Accordingly, the requirements of NEPA and CEQ regulations and 32 CFR 989, et seq. have been fulfilled, and an Environmental Impact Statement (EIS) is not necessary and will not be prepared.

MARK A. CORRELL, Colonel, USAF
Commander

26 Dec 07
DATE

FINAL

ENVIRONMENTAL ASSESSMENT FOR BRAC ACTIONS FOR THE 137TH AIRLIFT WING RELOCATION, KC-135R AIRCRAFT ROBUST, AND ASSOCIATED CONSTRUCTION AT THE 507TH AIR REFUELING WING

TINKER AIR FORCE BASE, OKLAHOMA

Printed on 30% recycled paper

FINAL
FINDING OF NO SIGNIFICANT IMPACT:
BASE REALIGNMENT AND CLOSURE (BRAC) ACTIONS FOR THE 137TH AIRLIFT WING RELOCATION, KC-135R AIRCRAFT ROBUST,
AND ASSOCIATED CONSTRUCTION AT THE 507TH AIR REFUELING WING
TINKER AIR FORCE BASE
OKLAHOMA CITY, OKLAHOMA

Introduction

Military assets at Tinker Air Force Base (AFB), Will Rogers World Airport Air Guard Station (AGS), and Portland International Airport (IAP) AGS were among those recommended for realignment by the 2005 BRAC Commission as directed by the United States (US) Department of Defense (DoD). The *2005 Defense Base Closure and Realignment Commission Report*, released 8 September 2005, was developed in accordance with the Defense Base Closure and Realignment Act of 1990 and details recommendations for affected military installations. The overarching purpose of BRAC is to maximize the effective use of DoD resources by streamlining management and operations of DoD installations and associated weapons ranges. This streamlining process is intended to save money while enhancing the effectiveness of US military forces.

In 2002, the DoD issued its United Facilities Criteria (UFC) system, including *DoD Minimum Antiterrorism Standards for Buildings*, in order to minimize the possibility of mass casualties in buildings or portions of buildings owned, leased, privatized, or otherwise occupied, managed, or controlled by or for the DoD. The standards provide appropriate, feasible, and enforceable measures to establish a level of protection against terrorist attacks. The intent of these standards can be achieved through prudent master planning, real estate acquisition, and design and construction practices. Though established in 2002, these standards apply to existing facilities starting with the Fiscal Year 2004 (FY 04) program and are mandated when any facility is proposed to undergo major investments, conversion of use, building additions, or glazing replacement. At Tinker AFB, proposed facility construction and demolition are intended to comply with these standards.

Pursuant to Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of the National Environmental Policy Act (NEPA) (40 Code of Federal Regulations [CFR] 1500 1508), DoD Directive 6050.1 and Air Force Instruction 32 CFR Part 989, Tinker AFB has prepared an Environmental Assessment (EA) that evaluates the potential environmental and socioeconomic impacts associated with the BRAC-related actions for the 137th Airlift Wing (137 AW) relocation, KC-135R aircraft robust, and associated construction at the 507th Air Refueling Wing (507 ARW) at Tinker AFB. This EA is incorporated by reference into this finding.

Description of Proposed Action

The Proposed Action is intended to fully implement the BRAC 2005 recommendations affecting the 507 ARW at Tinker AFB. The components of the Proposed Action are summarized below.

The BRAC 2005 recommendations that affect Tinker AFB include three principal activities:

1) the relocation of operations and maintenance personnel associated with the 137 AW of the Oklahoma Air National Guard (ANG) from Will Rogers AGS to Tinker AFB, where the 137 AW would become an associate wing, operating with the 507 ARW of the Air Force Reserve Command (AFRC);
2) the robust (i.e., transfer) of four KC-135R aircraft from the 939 ARW from Portland IAP AGS, Oregon to Tinker AFB; and
3) the demolition and construction of facilities to support the additional personnel and aircraft.

The following demolition and construction actions are proposed at Tinker AFB to fully implement the BRAC 2005 recommendations:

- construction of AFRC and ANG squadron operations, operations support squadron, life support storage, and life support work area;
- construction of a new hangar with hangar access and associated demolition of Buildings 1037 and 1041, which would also correct a current deficiency at Tinker AFB; and
- renovation of Building 1048.

Alternatives

Alternative 1: Hangar Repositioning. Alternative locations for the construction of the new hangar were evaluated. To maximize its operational effectiveness, the hangar should be located near the 507 ARW's apron, near the existing hangar. This alternative would implement all BRAC 2005 recommendations affecting the 507 ARW; the four additional KC-135R aircraft would be transferred to Tinker AFB and the 137 AW would be relocated to Tinker AFB to associate with the 507 ARW. The construction of a new hangar, renovation of Building 1048, and the construction of the Squadron Operations Building would be required to accommodate the additional aircraft and the 137 AW and to support the aerial refueling mission. The existing ramp would be expanded to provide hangar access. This alternative would not involve the demolition of any existing buildings. One feasible alternative location for the hangar was identified. The alternative location was north of the existing hangar in the floodplain to Crutcho Creek. A significant amount of fill and special foundations would be required to construct the hangar in this location.

Alternative 2: Transfer of 137 AW Only. Alternative 2 would implement the transfer of the 137 AW only. To provide adequate support facilities, this alternative would still require the construction of the Squadron Operations Building and the renovation of Building 1048. The four KC-135R aircraft would not be transferred from Portland IAP AGS under this alternative. However, the construction of the hangar would still be required to correct current operational deficiencies, and the existing ramp would be expanded to provide hangar access. Due to the limited availability of feasible hangar locations, this alternative would also require the demolition of Buildings 1037 and 1041 to accommodate the proposed hangar. This alternative would not be viable because it would not implement the BRAC 2005 recommendation of transferring the four KC-135R aircraft to Tinker AFB to create adequately sized squadrons and improve the overall operational effectiveness of the DoD's KC-135 fleet.

Alternative 3: No-Action Alternative. Under the No-Action Alternative, Tinker AFB would not implement the Proposed Action, and BRAC 2005 recommendations would not be implemented as directed. The 137 AW would remain at Will Rogers AGS; no aircraft would be transferred from Portland IAP AGS; and no construction, demolition, or renovation to provide support facilities for the aerial refueling mission would occur. Current inadequacies in hangar facilities would remain. The CEQ's regulations for the implementation of the NEPA stipulate that the No-Action Alternative must be considered to assess environmental consequences that may occur if the Proposed Action is not implemented. This alternative has been carried forward in the EA, as required by the CEQ.

Anticipated Environmental Effects

	Under Implementation of the Proposed Action:
Airspace and Airfield Operations	A 50-percent increase in the number of hours flown and the number of KC-135R aircraft maintained by the 507 ARW would occur; however, this increase would only account for a 5.4-percent increase in total aircraft operations at Tinker AFB. The increase in KC-135R operations would not surpass the air traffic capacity of Tinker AFB and no significant impacts to runway usage would occur under the Proposed Action. No change to the configuration (i.e., size, shape, or location) of the Air Traffic Control Assigned Area (ATCAA) or Military Operations Area (MOA) airspace areas are proposed or would be required to support the implementation of the proposed aircraft robust. In addition, no modification of the air traffic control (ATC) system at Tinker AFB would be required.
Air Quality	Implementation of the Proposed Action would result in the generation of dust (i.e., particulate matter less than 10 microns in diameter [PM_{10}]) during construction activities including grading and demolition. Because the majority of these activities would take place on already disturbed and paved sites, PM_{10} emissions are expected to be low. Any adverse short-term impacts resulting from proposed construction activities would be further mitigated through standard dust minimization practices; therefore, emissions from this source would not be significant. Long-term operational emissions associated with the Proposed Action would be emissions from the addition of four KC-135 aircraft and their operations. These emissions, when compared to the overall county-wide annual emissions, would be negligible and would not represent a significant impact. In addition, approximately 125 full-time personnel and 300 Traditional Guardsmen would be transferred to Tinker AFB and would result in an increase of combustion emissions associated with increased vehicular traffic in the vicinity of Tinker AFB. However, these vehicle trips are already occurring in the Oklahoma City region; therefore, emissions would be negligible and not result in significant impact

	Under Implementation of the Proposed Action:
Noise	Implementation of the Proposed Action would result in a 5.4-percent increase in the total number of annual aircraft operations at Tinker AFB; however, the off-base area affected by noise levels of 65 L_{dn} or greater would increase negligibly. No areas off base would be newly exposed to the 65+ L_{dn} noise contour. Further, implementation of the Proposed Action would not result in any sensitive receptors (e.g., residences, schools, etc.) currently within the baseline 65+ L_{dn} contour to experience a significant increase in noise levels. Implementation of the Proposed Action would have minor, temporary effects on the noise environment in the vicinity of proposed construction and demolition sites. However, noise generation would be typical of construction activities, short-term, and associated impacts could be reduced through the use of equipment sound mufflers and restriction of construction activity to normal working hours. Therefore, noise generated by construction and demolition activities would not significantly impact sensitive receptors on or in the vicinity of Tinker AFB.
Land Use	All project components have been designed and sited to be compatible with existing base land use and airfield safety guidelines and to be inherently consistent with Tinker AFB planning policies. In addition, the BRAC-required construction projects are necessary to comply with the 2005 BRAC Recommendations and to accommodate the aircraft robust and additional personnel. Construction components of the Proposed Action have been sited in accordance with established land use development guidelines addressing safety, functionality, and environmental protection zones. No adverse impacts to land use on Tinker AFB would occur. With regard to off-site land use, no new types of land use activities would be introduced onto Tinker AFB as a result of the implementation of the Proposed Action. However, the proposed aircraft robust would increase the flight activity at the base, resulting in increased risk of accidents in all clear zones (CZs) and accident potential zones (APZs). The size and location of the CZs and APZs would be unchanged and existing land use in these areas would be unaffected; further, current land use within the noise zones would remain unchanged and no land use areas would be newly introduced to the 65+ L_{dn} noise contour.
Geological Resources	Potential geologic impacts associated with the Proposed Action at the 507 ARW Complex would be limited to ground-disturbing activities. Minor impacts would result from proposed construction activities; however, all construction activities would occur on previously disturbed land and on soils that are capable of supporting such development. Proposed construction would not have significant impacts on sensitive or regional geologic or physiographic features. Best-management practices (BMPs) and standard erosion control measures would be incorporated to reduce any potential impacts related to geology and soils to less than significant levels. Therefore, impacts to soil, soil productivity, and geological resources would not be significant.
Water Resources	With regard to surface water, construction would have localized and temporary effects on nearby hydrology and water quality; however, BMPs would be incorporated during construction to minimize erosion, runoff, and sedimentation. No additional impermeable surface areas would be created; therefore no impacts would occur with regard to groundwater hydrology. Stormwater runoff would be captured by the on-base storm water retention pond and creek systems. None of the proposed facilities or improvements comprises a significant water user or wastewater generator. Further, construction activities and staging areas would not be sited in or near identified wetlands on base. In addition, the proposed construction areas are not within the 100- or 500-year floodplains; therefore, implementation of the Proposed Action would not impact water resources at Tinker AFB.
Biological Resources	Construction associated with the Proposed Action would require almost no vegetation removal and, based on the lack of sensitive or native plants species on the 507 ARW Complex, proposed construction would not have significant impacts on vegetation or the habitat it may provide. Areas where construction would occur have been previously disturbed and are primarily paved or otherwise developed and contain no known critical habitats. The Texas Horned Lizard, a Federal species of concern, is known to be present in the South Forty District; however, the sites proposed for facilities construction are not located in known distribution areas for this species. No other sensitive species are known to occur in or near areas that would be affected by implementation of the Proposed Action. Therefore, there would be no impact to sensitive species.

	Under Implementation of the Proposed Action:
Transportation and Circulation	Implementation of the Proposed Action would result in the addition of 125 full-time personnel and 300 part-time Traditional Guardsmen to staff and support the associate squadron. The increase in personnel would result in a direct increase in the number of vehicles on base; however, Traditional Guardsmen would only be on base during drill weekends and would therefore not impact base circulation. Once on base, the vehicles for the additional full-time personnel would be driven to parking areas and most would remain on site for the duration of the workday; therefore, the additional vehicles would not significantly impact on-base circulation. Regionally, the increase in personnel levels at Tinker AFB would be offset by the corresponding decrease in the number of commuters currently traveling to and from Will Rogers World Airport. With regard to parking, the addition of 125 vehicles during the work week would not exceed the capacity on base or USAF standards regarding parking ratios. Parking space availability on drill weekends is already below the USAF standards and the addition of 425 vehicles would exacerbate the situation. However, drill weekends would be appropriately staggered to alleviate the parking constraints.
Visual Resources	Facilities construction projects and increased aircraft operations associated with the Proposed Action would be visually consistent with existing structures and activities at Tinker AFB. Further, the visual environment of Tinker AFB does not constitute a unique or sensitive viewshed; therefore, no significant impact to regional visual resources would occur upon implementation of the Proposed Action.
Cultural Resources	Buildings 1041 and 1037 are proposed for demolition under the Proposed Action. Both buildings are less than 50 years old and neither is recognized as a facility of historical importance; further, neither of these facilities is known to have military or architectural significance. All construction projects associated with the Proposed Action have been sited in previously developed areas on the base. No archaeological resources listed or eligible for inclusion on the National Register of Historic Places (NRHP) have been identified at the 507 ARW Complex. There are no known federally recognized Native American lands or resources at Tinker AFB. Tinker AFB has initiated consultations with three Native American tribes (i.e., the Seminole Nation, Osage Nation, and Muskogee Nation). Each of these tribes has verbally commented that they have no Native American Graves Protection and Repatriation Act (NAGPRA) or American Indian Religious Freedom Act (AIRFA) concerns with regard to the Proposed Action. Therefore, impacts to cultural resources would be less than significant.
Socioeconomics	The Proposed Action includes the transfer of 125 full-time and 300 part-time Traditional Guardsmen from the 137 AW to Tinker AFB. The 137 AW is located at the Will Rogers World Airport in southwest Oklahoma City, and the employees that would transfer to Tinker AFB currently reside in or near Oklahoma City. Economic activity associated with proposed construction activities, such as hiring of temporary laborers and purchasing of materials, would provide short-term economic benefits to the local economy. However, beneficial impacts resulting from construction payrolls and materials purchased would be negligible on a regional scale. Therefore, the Proposed Action would have beneficial but less than significant impacts on local socioeconomic characteristics
Environmental Justice and Protection of Children	In general, residents in communities near the base may be considered both minority and low-income. However, communities near the base do not comprise dense concentrations of minority populations. Tinker AFB is in the process of developing an Air Installation Compatible Use Zone (AICUZ) Study that will determine the anticipated change in noise contours associated with implementation of the Proposed Action and the resulting increased flying operations. However, as described in Section 3.3, impacts with regard to noise off-base and minority and low-income populations would be less than significant. Housing and facilities for children are present on Tinker AFB; however, children would not have access to construction sites. Therefore, impacts with regard to protection of children would be less than significant.
Hazardous Materials and Wastes	Implementation of the Proposed Action could have a temporary increase in the storage of hazardous materials and waste throughout construction of and modifications to facilities; however, the increase in construction-related hazardous materials and wastes would be temporary and would not comprise a significant impact. Additionally, the 507 ARW would continue to operate the KC-135R, but would increase its inventory from 8 to 12 aircraft. Because 507 ARW operations comprise only a small portion of overall aircraft operations at the base, the aircraft robust is anticipated to minimally increase the storage and use of hazardous materials at Tinker AFB. Further, the storage and use of these materials would continue to be accomplished in accordance with applicable laws, regulations, and base policies; and the slight increase in volume would be accommodated within the framework of existing management, handling, and disposal processes. Therefore, impacts with regard to hazardous materials and waste would be less than significant.

	Under Implementation of the Proposed Action:
Safety	Implementation of the Proposed Action would result in changes to the frequency of aircraft operations performed by the 507 ARW. Bird-aircraft strikes present a potential threat to 507 ARW aircraft and aircrew safety due to resident bird species as well as the base's proximity to Lake Stanley Draper and the Central Flyway. Tinker AFB implemented a BASH Plan in 2006 which established preventative measures to reduce bird-aircraft strikes and has contracted with the US Department of Agriculture (USDA) to conduct live bird control on base. With the implementation of these new measures, impacts with regard to mishaps and bird-strikes would be less than significant. All proposed construction activities have been designed and sited to comply with all airfield safety criteria and are consistent with guidelines established in the base's Master Plan. No facilities development is proposed within airfield CZs or APZs; therefore, minimal impacts to airfield safety would result from implementation of the Proposed Action.

Public Notice

NEPA, 40 CFR 1500-1508, and 32 CFR 989 require public review of the EA before approval of the Finding of No Significant Impact (FONSI) and implementation of the Proposed Action. A Notice of Availability for public review of the Draft EA was published in *The Oklahoman* on 6 July 2006. The Draft EA was available for public review at the Midwest City Public Library. The public review period lasted for 30 days, and no public comments were received; therefore, no such comments were incorporated as part of the Final EA.

Finding of No Significant Impact

After careful review of the potential impacts of this Proposed Action, I have concluded that the action's implementation would not have a significant impact on the quality of the human or natural environment or generate significant controversy. Accordingly, the requirements of NEPA and CEQ regulations and 32 CFR 989, et seq. have been fulfilled, and an Environmental Impact Statement (EIS) is not necessary and will not be prepared.

_____ _____

MARK A. CORRELL, Colonel, USAF DATE
Commander

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Cont.)

Page

TABLE OF CONTENTS (Cont.)

Page

TABLE OF CONTENTS (Cont.)

Page

TABLE OF CONTENTS (Cont.)

Page

TABLE OF CONTENTS (Cont.)

Page

LIST OF TABLES

TABLE OF CONTENTS (Cont.)

LIST OF TABLES (Cont.)

Page

LIST OF FIGURES

TABLE OF CONTENTS (Cont.)

LIST OF FIGURES (Cont.)

Page

LIST OF APPENDICES

LIST OF ACRONYMS

°F	degrees Fahrenheit
1,2 DCA	1,2 dichloroethane
3 CCG	3rd Combat Communications Group
38 EIG	38th Engineering Installation Group
72 ABW	72ndAir Base Wing
137 AW	137th Airlift Wing
507 ARW	507th Air Refueling Wing
552 ACW	552nd Air Control Wing
931 ARG	931st Air Refueling Group
ACHP	Advisory Council on Historic Preservation
AFB	Air Force Base
AFI	Air Force Instruction
AFRC	Air Force Reserve Command
AGS	Air Guard Station
AGE	aerospace ground equipment
AGL	above ground level
AIRFA	American Indian Religious Freedom Act
ANG	Air National Guard
APs	Accumulation Point
APZ	Accident Potential Zone
AST	aboveground storage tank
AT/FP	Anti-Terrorism Force Protection
ATC	air traffic control
ATCAA	Air Traffic Control Assigned Airspace
ARW	Air Refueling Wing
AW	Airlift Wing
AWAC	Airborne Warning and Control
BASH	Bird-Aircraft Strike Hazard
BEA	US Bureau of Economic Analysis
bgs	below ground surface
BMP	best management practice
BRAC	Base Realignment and Closure
CAA	Clean Air Act
CAAA	Clean Air Act Amendment
CDC	child development center
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Controlled Firing Area
CFR	Code of Federal Regulations
cis-1,2-DCE	cis 1,2-dichloroethene
CMS	corrective measure studies
CNG	Compressed Natural Gas
CO	carbon monoxide
CP	Collection Point
CSCW-1	US Navy Command Strategic Communications Wing One
CWA	Clean Water Act
CZ	Clear Zone
D-C-P	Dale-Canadian-Port
D-S	Darnell-Stephenville
dB	decibel
dBA	A-weighted decibel
DERP	Defense Environmental Restoration Program
DNL	Day-night sound level
DoD	US Department of Defense
DOT	US Department of Transportation
DRMO	Defense Reutilization and Marketing Office
EA	Environmental Assessment
ECAMP	Environmental Compliance Assessment and Management Program
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
ERP	Environmental Restoration Program
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FEMA	Federal Emergency Management Agency
FICON	Federal Interagency Committee on Noise
FONSI	Finding of No Significant Impact
FY	Fiscal Year
GOCP	Greater Oklahoma City Partnership
GWMU	Groundwater Management Unit
GWTP	Ground Water Treatment Plant
HAP	hazardous air pollutant
HMMP	Hazardous Materials Management Program
HMMS	Hazardous Material Management System
HUD	US Department of Housing and Urban Development
I-	Interstate
Portland IAP	Portland International Airport
IAS	Initial Accumulation Sites
IFR	Instrument Flight Rules
IICEP	Interagency and Intergovernmental Coordination for Environmental Planning
INM	Integrated Noise Model
IR	instrument route
IRP	Installation Restoration Program
IWTP	Industrial Wastewater Treatment Plant
JP-	jet fuel
LLSZ	Lower-Lower Saturated Zone
LQG	Large Quantity Generator
LSZ	Lower Saturated Zone
LUC	land use control
MCL	maximum contaminant level
mg/L	milligram per liter
MLRA	major land resource area
MOA	Military Operations Area
MSDS	Material Safety Data Sheets
MSL	mean sea level
MTR	Military Training Route
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NATO	US Military and North Atlantic Treaty Organization
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NM	Nautical Mile
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPL	National Priorities List
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
O_3	ozone
OC-ALC	Oklahoma City Air Logistics Center

LIST OF ACRONYMS

OCARTS	Oklahoma City Area Regional Transportation Study
OCC	Oklahoma Corporation Commission
OCCVB	Oklahoma City Convention and Visitors Bureau
ODEQ	Oklahoma Department of Environmental Quality
ODWC	Oklahoma Department of Wildlife Conservation
OKC Plan	Oklahoma City Plan 2000-2020
ONHI	Oklahoma Natural Heritage Inventory
ORBCA Program	Oklahoma Risk-Based Corrective Action Program
OU	Oklahoma University
OWRB	Oklahoma Water Resources Board
OWS	oil/water separator
PA	preliminary assessment
PAA	Primary Authorized Aircraft
Pb	lead
PCA	Positive Control Area
PD-680	Petroleum Distillate 680
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
POL	petroleum, oil, and lubricants
POV	privately owned vehicle
PZ	Production Zone
R-V-B	Renthin-Vernon-Bethany
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigations
RI/FS	remedial investigations/feasibility studies
SEL	Sound Exposure Level
sf	square foot/feet
SHPO	State Historic Preservation Office
SIOP	Single Integrated Operational Plan
SIP	State Implementation Plan
SO_2	sulfur dioxide
STP	Sanitary Treatment Plant
SWPPP	Storm Water Pollution Prevention Plan
T&G	touch and go
TCE	trichloroethene
TDS	total dissolved solids
tpy	tons per year
TSDF	Treatment, Storage and Disposal Facility
UFC	Unified Facilities Criteria
USZ	Upper Saturated Zone
US	United States
USACE	US Army Corps of Engineers
USAF	US Air Force
USC	US Code
USDA	US Department of Agriculture
USDOT	US Department of Transportation
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
USSTRATCOM	US Strategic Command
UST	underground storage tank
VFR	Visual Flight Rules
VOC	volatile organic compound
VQ	Fleet Air Reconnaissance Squadrons
VR	visual route
VTOL	vertical takeoff/landing
WMA	wildlife management area
WSA	Waste Staging Area
WWII	World War II

SECTION 1
OVERVIEW

1.1 Introduction

Military assets at Tinker Air Force Base (AFB), Will Rogers World Airport Air Guard Station (AGS), and Portland International Airport (IAP) AGS were among those recommended for realignment by the 2005 Base Realignment and Closure (BRAC) as directed by the United States (US) Department of Defense (DoD). The *2005 Defense Base Closure and Realignment Commission Report*, released on 8 September 2005, was developed in accordance with the Defense Base Closure and Realignment Act of 1990 and details recommendations for affected military installations. The overarching purpose of BRAC is to maximize the effective use of DoD resources by streamlining management and operations of DoD installations and associated weapons ranges. This streamlining process is intended to save money while enhancing the effectiveness of the US military forces.

Development and execution of the BRAC process involved the President of the US, the DoD, US Congress, an independent commission (i.e., the BRAC Commission), and local communities. Eight criteria were developed by the DoD for use in the BRAC analytical process. The criteria were reviewed by Congress and the public, and the final criteria were published by the Secretary of Defense on 12 February 2004. The criteria were later amended by Congress and codified in the National Defense Authorization Act for fiscal year 2004.

Final BRAC 2005 Selection Criteria gave highest priority to military value (criteria 1-4) and then to other considerations (criteria 5-8). As indicated in the DoD *Base Closure and Realignment Report* issued in May 2005, the criteria included:

"Military Value

1) The current and future mission capabilities and the impact on operational readiness of the total force of the Department of Defense, including the impact on joint warfighting, training, and readiness.
2) The availability and condition of land, facilities, and associated airspace (including training areas suitable for maneuver by ground, naval, or air forces throughout a diversity of climate and terrain areas and staging areas for the use of the Armed Forces in homeland defense missions) at both existing and potential receiving locations.
3) The ability to accommodate contingency, mobilization, surge, and future total force requirements at both existing and potential receiving locations to support operations and training.
4) The cost of operations and the manpower implications.

Other Considerations

5) The extent and timing of potential costs and savings, including the number of years, beginning with the date of completion of the closure or realignment, for the savings to exceed the costs.

6) The economic impact on existing communities in the vicinity of military installations.

7) The ability of the infrastructure of both the existing and potential receiving communities to support forces, missions, and personnel.

8) The environmental impact, including the impact of costs related to potential including the impact of costs related to potential environmental restoration, waste management, and environmental compliance activities" (DoD 2005).

The DoD developed its base realignment and closure recommendations based on these criteria and submitted them to the Defense Base Closure and Realignment Commission for review. The Commission developed its recommendations and submitted them to the President on 8 September 2005. On 15 September 2005, the President reported his approval of the recommendations to Congress. The final vote by the 109th Congress was held on 27 October 2005 and resulted in the passage of the BRAC recommendations.

Other BRAC "rounds" occurred in 1988, 1991, 1993, and 1995; however, the BRAC 2005 recommendations include factors that were not considered in previous rounds. Among the most notable changes are basing the recommendations on probable threats to national security for a 20-year period (2005-2024) and consolidating and collocating joint-service missions and operations.

The BRAC 2005 recommendations that affect Tinker AFB include three principal activities:

1) The relocation of operations and maintenance personnel associated with the 137th Airlift Wing (137 AW) of the Air National Guard (ANG) from Will Rogers AGS to Tinker AFB, where the 137 AW will become an associate wing, operating with the 507th Air Refueling Wing (507 ARW) of the Air Force Reserve Command (AFRC); although the 137 AW currently operates eight C-130 cargo aircraft, those aircraft will not follow the 137 AW to Tinker AFB but rather will be relocated to Pittsburgh, Air Force Reserve, 911 AW, Pennsylvania;

2) The robust of four KC-135R aircraft from the 939 ARW from Portland IAP AGS, Oregon to Tinker AFB; and

3) The demolition and construction of facilities to support the additional personnel and aircraft.

The following demolition and construction actions are proposed for Tinker AFB to implement the BRAC 2005 recommendations:

- construction of AFRC and ANG squadron operations, operations support squadron, life support storage, and life support work area,
- construction of a new hangar with hangar access and associated demolition of Buildings 1037 and 1041, which would also correct a current deficiency at Tinker AFB, and
- renovation of Building 1048.

In 2002, the DoD issued its United Facilities Criteria (UFC) system, including *DoD Minimum Antiterrorism Standards for Buildings*, in order to minimize the possibility of mass casualties in buildings or portions of buildings owned, leased, privatized, or otherwise occupied, managed, or controlled by or for the DoD (DoD 2003). The standards provide appropriate, implementable, and enforceable measures to establish a level of protection against terrorist attacks. The intent of these standards can be achieved through prudent master planning, real estate acquisition, and design and construction practices. Though established in 2002, these standards apply to existing facilities starting with the Fiscal Year 2004 (FY 04) program and are mandated when any facility is proposed to undergo major investments, conversion of use, building additions, or glazing replacement. At Tinker AFB, proposed facility construction and demolition are intended to comply with these standards.

This Environmental Assessment (EA) addresses the potential impacts of the proposed action on the human and natural environment as required by the National Environmental Policy Act (NEPA) of 1969, as amended (42 US Code §§ 4321-4347), and in accordance with the Council on Environmental Quality (CEQ) regulations implementing the procedural provisions of the NEPA (40 Code of Federal Regulations [CFR] §§ 1500-1508), and Air Force Instruction (AFI) 32-7061 entitled *Environmental Impact Analysis Process* (32 CFR Part 989).

1.2 Purpose and Need

The purpose of the proposed project is to implement the BRAC 2005 recommendations affecting Tinker AFB. Tinker AFB, Will Rogers AGS, and Portland IAP AGS were among DoD facilities selected to fulfill the objectives of BRAC 2005. One need identified in the interrelated recommendations for these facilities is the consolidation and streamlining of the aerial refueling mission at Tinker AFB.

The DoD recommended relocating the 137 AW of the ANG from Will Rogers AGS to Tinker AFB and associating the 137 AW with the 507 ARW of the AFRC. Tinker AFB was chosen for realignment due to its high "military value," as defined by criteria 1-4 of the *Base Closure and Realignment Report of 2005*. Although no 137 AW C-130 aircraft would relocate to Tinker AFB, relocated personnel would train to operate and support KC-135R aircraft and would increase available resources and improve the overall effectiveness of the KC-135R fleet at Tinker AFB.

Another BRAC recommendation included the realignment of the 939 ARW at Portland IAP AGS and the redistribution of that unit's KC-135R aircraft. Four of these aircraft would be distributed to the 507 ARW at Tinker AFB while the remaining aircraft would be reallocated to other installations. This action would also increase the AFRC squadron size at Tinker AFB. The relocation of these aircraft coupled with increased personnel (from the 137 AW) to support associated operations is being conducted as part of a larger Air Force effort to create more effective squadrons of desired size.

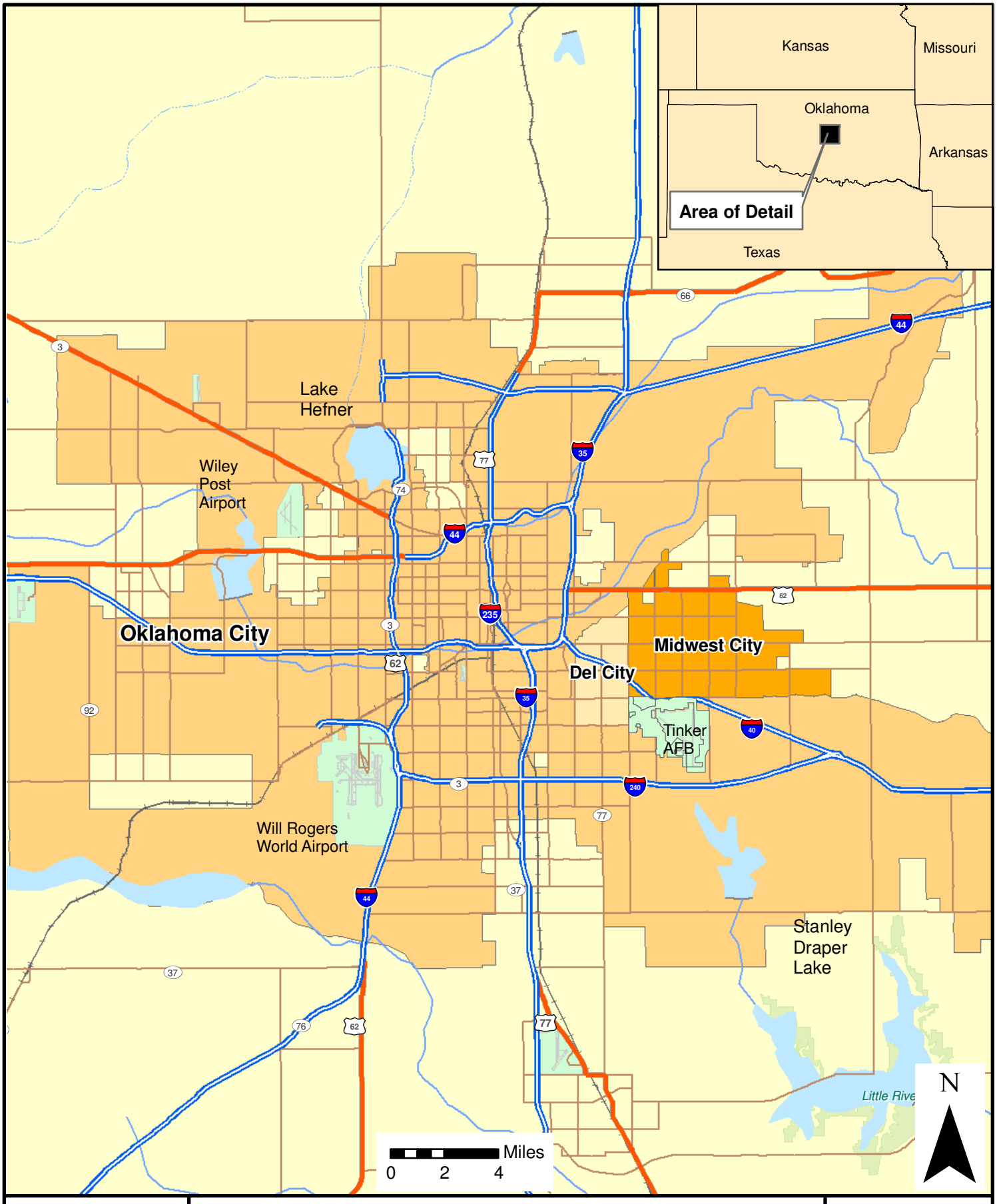
1.3 Location and History

Tinker AFB is located within the city limits of Oklahoma City, Oklahoma (Figure 1-1). This facility is bordered to the north by Interstate 40 and SE 29th Street, to the east by Douglas Boulevard, to the south by SE 74th Street, and to the west by Sooner Road. Midwest City and Del City are located north and northwest of Tinker AFB, respectively.

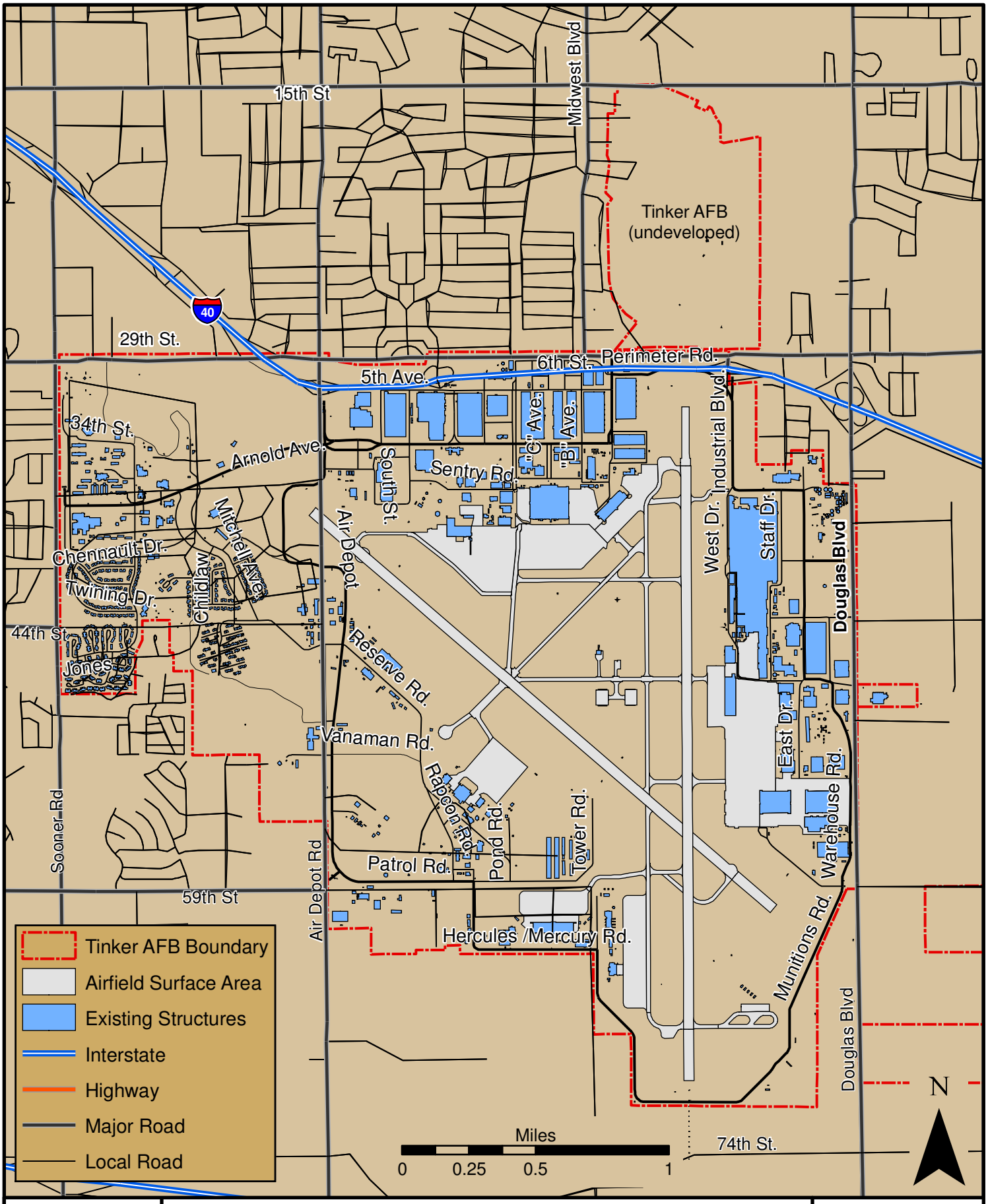
Since its establishment as the Oklahoma Air Depot in 1941, Tinker AFB has expanded its real property assets from approximately 1,500 acres to more than 5,033 acres. The west side of the installation was named Tinker Field in 1942 to honor Major General Clarence L. Tinker, an Oklahoman who died leading bombers on a strike against the Japanese at Wake Island in World War II (WWII). After WWII, the base was expanded to include the Douglas Cargo Aircraft Plant, which was located on the east side of the installation. A management systems overhaul occurred at the base in the 1950s to accommodate the B-52 Bomber and the KC-135 tanker (Tinker AFB 2005a).

In the 1960s, 1970s, and 1980s, the base acquired maintenance responsibilities for additional aircraft, engines, and equipment; the additional associate organizations and responsibilities resulted in an increase in both civilian and military personnel. In the 1970s, the base took over management of new weapons including the A-7D Corsair, the E-3A Airborne Warning and Control (AWAC) aircraft, the E-4 Airborne Command Post aircraft, and the air- and ground-launched missiles. In 1974, the depot was renamed the Oklahoma City Air Logistics Center (OC-ALC).

Currently, Tinker AFB is located on more than 5,033 acres of federal land, containing 716 buildings (15.9 million square feet), an airfield, and other facilities that support various associate units at the base (Figure 1-2). Tinker AFB is divided into seven districts. The southwestern portion of the base is known as the South Forty District and includes the 3rd Combat Communications Group (3 CCG), the 507 ARW, and the Navy US Navy Command Strategic Communications Wing One (CSCW-1) (Tinker AFB 2005a).



EA	**Regional Location** **Construction of Consolidated Fuel Overhaul and Repair Facility** **Tinker Air Force Base**	FIGURE 1-1



EA	**Current Tinker Air Force Base Infrastructure Location Map**	FIGURE 1-2

The airfield at Tinker AFB comprises two Class B runways and 12 taxiways which support the base's assigned aircraft, transient aircraft, and aircraft bound for the OC-ALC. Currently, 50 aircraft – distributed among three wings – are assigned to the base. These wings comprise the following:

- The 552nd Air Control Wing (552 ACW) is assigned 28 E-3 aircraft.
- The 507 ARW is assigned eight KC-135R aircraft.
- The US Navy CSCW-1 includes various Fleet Air Reconnaissance Squadrons (VQs) and comprises one of the wings; the VQ-3 is assigned six E-6B aircraft, the VQ-4 is assigned seven E-6B aircraft, and the VQ-7 is assigned one Boeing 737-600 trainer aircraft.

Implementation of the BRAC 2005 recommendations would increase the 507 ARW assigned aircraft from eight to 12 KC-135R aircraft and would affect property currently supporting the 507 ARW at Tinker AFB. Buildings 1037, 1041, and 1048, which are all located within the South Forty District, would be affected by the proposed project. The location and history of the 507 ARW and the 137 AW are discussed in the following sections.

1.3.1 Location and History of the 507 ARW

The 507 ARW is located in the southwestern portion of Tinker AFB in the South Forty District. Buildings 1037 and 1041, which currently house 507 ARW support facilities, are located on the north side of Reserve Road, immediately south of an existing KC-135R hangar. Building 1048 is located southeast of Buildings 1037 and 1041, on the south side of Reserve Road. Building 1048 is the current Squadron Operations facility; it houses the 465th Air Refueling Squadron command section, training, intelligence, and life support.

The 507th Fighter Group was first activated in 1972, and then later converted to the 507 ARW at Tinker AFB. The unit was responsible for flying the F-105D "Thunderchief." Subsequently, the unit was converted to perform other missions. The unit's mission was converted to flying the F-4D "Phantom" in 1980, to the F-16A "Falcon" in 1990, and finally to its current KC-135R "Stratotanker" aerial refueling mission in 1994. In 1995, the 507 ARW combined with the 513th Air Control Group (513 ACG), an Air Force Reserve Airborne Warning and Control Systems (Tinker AFB 2005a).

1.3.2 Location and History of the 137 AW

The 137 AW is located at the Will Rogers World Airport in southwest Oklahoma City, approximately 11 miles west of Tinker AFB (Figure 1-1). Primary access to the airport is provided by Meridian Avenue, accessed directly from Interstate 40 or via Airport Road from Interstate 44. As with the 507 ARW, the 137 AW has undergone various mission changes since its inception.

The 137th Fighter Group was formed in November 1946 in Norman, Oklahoma and obtained federal recognition in December 1947. In September 1949, the 137th completed the move to its current location at Will Rogers World Airport after its base in Norman sustained significant tornado damage (Oklahoma ANG 2006).

The 137 AW first began flying the P-51 Mustang. Subsequently, the wing was assigned other aircraft including the F-80 Shooting Star, the F-86 Sabre Jet, the C-97 Stratocruiser, the C-124 Globemaster, and the C-130 Hercules (C-130H) (Oklahoma ANG 2006).

1.4 Current Missions and Operations

Currently, Tinker AFB provides specialized logistics support, management, maintenance and distribution to defense weapons systems worldwide. The 72nd Air Base Wing (72 ABW) is the host organization for Tinker AFB and provides critical base-wide functions including security, medical services, civil engineering, fire protection, supply, communications and airfield operations. However, various associate units are located at the base, including the OC-ALC, the 552 ACW, the 507 ARW, the US Navy CSCW-1, the 3 CCG, and the 38th Engineering Installation Group (38 EIG). The proposed project would affect the operations and facilities associated with the 507 ARW and the 137 AW. The current missions and operations of these wings are discussed in the following sections.

1.4.1 507 ARW Current Missions and Operations

The 507 ARW consists of five subordinate groups and 15 squadrons, and employs approximately 1,100 people at Tinker AFB. The five subordinate units include: the 931st Air Refueling Group (931 ARG), the 507th Operations Group, the 507th Maintenance Group, the 507th Mission Support Group, and the 507th Medical Squadron. Approximately 184 members of the 507 ARW are Air Reserve Technicians who serve as a full-time support cadre along with 20 traditional civilian employees. The 931 ARG is hosted at McConnell AFB in Kansas and is comprised of approximately 350 reservists who do not participate in activities at Tinker AFB (Tinker AFB 2006a).

The 507 ARW currently operates eight KC-135R air refueling aircraft and flies two to three missions per day, resulting in approximately 3,000 flight hours annually. The wing provides worldwide aerial refueling to US Military and North Atlantic Treaty Organization (NATO) aircraft in support of Air Mobility Command and US Strategic Command national war orders (Tinker AFB 2005b).

1.4.2 137 AW Current Missions and Operations

The 137 AW is currently comprised of 300 Guardsmen who utilize eight C-130H aircraft to provide airlift support in support of various headquarters-directed missions around the world, to provide counter-drug support for the Oklahoma Bureau of Narcotics and Dangerous Drugs, and to conduct other missions as required (Oklahoma ANG 2006). The C-130H aircraft is designed to support the transport of troops and equipment into hostile environments in less than optimal airstrip conditions (USAF 2006).

1.5 Summary of Environmental Study Requirements

The Environmental Impact Analysis Process (EIAP) is the process by which federal agencies facilitate compliance with environmental regulations. The NEPA is the primary legislation affecting these agencies' decision-making process. This act and other facets of the EIAP are described below.

1.5.1 National Environmental Policy Act

The NEPA requires that federal agencies consider potential environmental consequences of proposed actions. The law's intent is to protect, restore, or enhance the environment through well-informed federal decisions. The CEQ was established under the NEPA for the purpose of implementing and overseeing federal policies as they relate to this process. In 1978, the CEQ issued *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR §§1500-1508 [CEQ 1978]). The Air Force developed its own procedural regulations for implementing the NEPA entitled *Environmental Impact Analysis Process* (AFI 32-7061, codified at 32 CFR Part 989). The CEQ regulations specify that an EA be prepared to:

- briefly provide sufficient analysis and evidence for determining whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI);
- aid in an agency's compliance with the NEPA when no EIS is necessary; and
- facilitate preparation of an EIS when one is necessary.

Further, to comply with other relevant environmental requirements (e.g., the Safe Drinking Water Act, Endangered Species Act [ESA], and National Historic Preservation Act [NHPA]), and to assess potential environmental impacts, the EIAP and decision-making process for the proposed action involves a thorough examination of all environmental issues pertinent to the actions proposed for the 507 ARW and 137 AW. The decision-making process includes a study of environmental issues related to the proposed construction, demolition, aircraft robust (i.e., inventory increase), and increased personnel levels at Tinker AFB.

1.5.2 Interagency and Intergovernmental Coordination for Environmental Planning

Public involvement is a useful component of the EA process; it includes both agencies and members of the public. Public involvement occurs primarily during the public comment period.

Interagency and Intergovernmental Coordination for Environmental Planning (IICEP) is a mandated process for informing and coordinating with other governmental agencies regarding actions proposed by federal entities. As detailed in 40 CFR § 1501.4(b), CEQ regulations require intergovernmental notifications prior to making any detailed statement of environmental impacts. Through the IICEP process, the Air Force notifies relevant federal, state, and local agencies and allows them sufficient time to make known their environmental concerns specific to a proposed action. Comments and concerns submitted by these agencies during the IICEP process are subsequently addressed and incorporated into the analysis of potential environmental impacts conducted as part of the EA.

A draft EA was issued and that document was sent directly to identified agencies; a notice of availability was published in *The Oklahoman*, and copies of the draft EA were placed at the Midwest City Public Library on 6 July 2007. Upon publication of the notice of availability and placement of the EA in the public library, the 30-day public comment period began. During the public comment period, all interested individuals were able to request and view a copy of the draft EA at the library and were invited to submit written comments. No public or agency comments were received; therefore, no such comments have been incorporated as part of the Final EA.

SECTION 2
DESCRIPTION OF PROPOSED ACTIONS AND ALTERNATIVES

2.1 Introduction

The BRAC 2005 recommendations include implementation of the following three elements at Tinker AFB: 1) the realignment of the 137 AW from Will Rogers AGS; 2) the robust of four KC-135R aircraft from Portland IAP AGS; and 3) renovation, construction, and demolition projects within the 507 ARW Complex in the South Forty District of Tinker AFB necessary to provide support facilities for their aerial refueling mission. As required by the NEPA, the potential impacts of the Proposed Action on the human and natural environment must be evaluated, and reasonable alternatives to the Proposed Action must be considered.

2.2 Proposed Action

The Proposed Action is intended to fully implement the BRAC 2005 recommendations affecting the 507 ARW at Tinker AFB. The components of the Proposed Action are discussed below.

2.2.1 Transfer of the 137 AW

The BRAC 2005 recommendations include the transfer of the ANG's 137 AW to Tinker AFB to associate with the AFRC's 507 ARW. The association of these units would accomplish the BRAC objective of consolidating and streamlining Air Force reserve component operations in Oklahoma City at Tinker AFB. Of the total 300 Guardsmen, 130 full-time personnel and 170 Traditional Guardsmen of the 137 AW would be relocated to Tinker AFB. Each member of the 137 AW would be retrained from their current mission of providing airlift support – operating and maintaining C-130H aircraft – to the KC-135R aircraft and associated aerial refueling mission. These staff will temporarily work in existing buildings located at Tinker AFB until a new Squadron Operations Building is constructed (see Section 2.2.3). No major equipment would be transferred with the 137 AW. Additional emergency response and life support facilities would be created at Tinker AFB to accommodate the extra personnel. Further, to accommodate anticipated peaks in additional personnel and vehicles generated by the transfer through Unit Training Assembly (UTA) weekends, such training would be staggered to the extent practicable.

2.2.2 Aircraft Robust

Among the multiple aircraft assigned to Tinker AFB, the 507 ARW currently maintains a Primary Authorized Aircraft (PAA) inventory of eight KC-135R aircraft. The BRAC 2005 recommendations include the realignment of the workload at Tinker AFB by adding four KC-135R aircraft; these aircraft would be relocated from the Portland IAP AGS. This element of the proposed action would consolidate the aerial refueling mission at a base of high "military value." The addition of these aircraft would not only increase the PAA inventory at Tinker AFB from eight to 12 KC-135R, but would also result in an estimated 50-percent increase in operations associated with the KC-135R inventory.

Data validated in January 2006 indicate that aircraft based at Tinker AFB are flown on more than 44,000 operations annually; additional operations are associated with depot maintenance and transient aircraft activity at the base (Tinker AFB 2006b). The evaluation of operations is based on an "average busy-day" concept in which annual operations for an aircraft type are averaged over the number of flying days per year. Projected average busy-day operations for 2006 – which includes all aircraft operations – are summarized in Table 2-1. An aircraft operation is defined as one takeoff/departure, one approach/landing, or half of a closed pattern. A closed pattern consists of two operations: a takeoff/departure or an approach/landing. For the purposes of forecasting the average busy-day, flying activity at Tinker AFB for based and depot maintenance aircraft is assumed to occur 260 days per year. Due to their inherently unpredictable scheduling, transient aircraft operations are based on activity occurring 365 days per year. Using these criteria, a total of 75,029 operations are projected for Tinker AFB in 2006.

Table 2-1. Average Busy-Day Aircraft Operations for 2006

Category/ Tinker AFB Unit	Aircraft Type	Number Aircraft Assigned	Daily Arrival/ Departure Operations	Daily Closed Pattern Operations	Total Daily Operations	Annual Operations
Tinker AFB Assigned Aircraft						
552 ACW	E-3	28	14.8	49.17	63.97	16,632.2
507 ARW	KC-135R	8	6.17*	24.94*	31.11*	8,088.6
VQ-3 & VQ-4	E-6B	13	10.00	60.80	70.80	18,408.0
VQ-7	Boeing 737	1	2.00	4.00	6.0	1,561.0
Subtotal		50	32.97	138.91	171.88	44,689.8
Depot Maintenance Aircraft						
N/A	C/KC-135	N/A	0.67	2.68	3.35	871.0
N/A	E-3	N/A	0.12	0.95	1.07	278.2
N/A	B-52	N/A	0.42	0.77	1.19	309.4
N/A	B-1	N/A	0.25	0.15	0.40	104
Subtotal			1.46	4.55	6.01	1,562.6
Transient Aircraft						
N/A	22 types	N/A	27.92	50.92	78.84	28,776.6
TOTAL		**50**	**62.35**	**194.38**	**256.73**	**75,029.0**

Source: Tinker AFB 2006b.
Notes: N/A= Not Applicable; * = extrapolated from data in Tinker AFB 2006b.

The addition of four KC-135R aircraft resulting from the proposed robust for the 507 ARW would result in the authorization of an estimated 4,050 flying hours, or approximately 4.62 sorties per day (i.e., 1,157.14 sorties per year) and 45 deployment sorties per year for a total of 1,202.14 total sorties per year (Table 2-2). A sortie is a single military aircraft flight from the initial takeoff through final landing. The robust of four KC-135R aircraft would result in an additional 15.55 operations per day, which represents approximately 6 percent of the overall number of daily operations.

Table 2-2. Baseline and Proposed 507 ARW KC-135R Aircraft Operations

	Number of Aircraft	Flight Hours	Total Sorties/Day	Total Sorties/Year	Total Daily Operations
Baseline	8	2,700*	3.14*	846.43*	31.11*
Proposed	12	4,050	4.62	1,202.14	46.66

Source: Tinker AFB 2006b.
Notes: * = Extrapolated from data in Tinker AFB 2006b

2.2.3 Renovation, Construction, and Demolition Activities

The completion of renovation, demolition, and construction projects would be necessary to accommodate the association of the 137 AW with the 507 ARW and the additional four KC-135R aircraft that are required by the BRAC 2005 recommendations. The proposed projects are depicted in Figure 2-1 and described in Table 2-3. The renovation, demolition, and construction projects would provide adequately sized and functionally configured facilities to support the aerial refueling mission. These projects also include measures to specifically minimize the possibility of mass casualties in the buildings by applying appropriate measures compliant with Anti-Terrorism Force Protection protocols (as identified in *DoD Minimum Antiterrorism Standards for Buildings*) that establish a level of protection against terrorist attacks.

2.3 Alternatives

Three alternatives to the Proposed Action were identified. Each alternative's adequacy for implementing the project's objectives was evaluated.

2.3.1 Alternative 1: Hangar Repositioning

Alternative locations for the construction of the new hangar were evaluated. To maximize its operational effectiveness, the hangar should be located near the 507 ARW's apron, near the existing hangar. This alternative would implement all BRAC 2005 recommendations affecting the 507 ARW; the four additional KC-135R aircraft would be transferred to Tinker AFB and the 137 AW would be relocated Tinker AFB to associate with the 507 ARW. The construction of a new hangar, renovation of Building 1048, and the construction of the Squadron Operations Building would be required to accommodate the additional aircraft and the 137 AW and to support the aerial refueling mission. The existing ramp would be expanded to provide hangar access. This alternative would not involve the demolition of any existing buildings.

One feasible alternative location for the hangar was identified. The alternative location was north of the existing hangar in the floodplain to Crutcho Creek (Figure 2-2). A significant amount of fill and special foundations would be required to construct the hangar in this location.

EA	**Proposed Action** **Tinker Air Force Base**	FIGURE 2-1

EA

Alternative 1: Hangar Repositioning
Tinker Air Force Base

FIGURE
2-2

Table 2-3. Proposed Renovation, Construction, and Demolition Projects

Project	Project Number	Description/Purpose
Construct New Hangar/Demolish Buildings 1041 and 1037	WWYK079000	Current hangar facilities are not adequate for the existing mission and would be significantly undersized if an additional four aircraft were assigned to the unit. The new hangar would be a 2,624-square meter (SM) one-bay hangar that would be utilized for scheduled maintenance. The existing ramp would be expanded to provide hangar access. Buildings 1041 and 1037 currently house 507 ARW support facilities. These buildings would be demolished to allow for the construction of the new hangar near the apron.
Construct New Building (Squadron Operations Building)	WWYK079003	A new 2,801-SM building would be constructed to satisfy squadron operations for AFRC and ANG requirements including operations support squadron, life support storage, and life support work area. No facilities are currently available at Tinker AFB to accommodate the required functions.
Renovate Building 1048		In addition to the construction of the Squadron Operations Building, Building 1048 would be renovated to provide additional space for the support of the joint operations of the ANG due to the relocated 137 AW and the 507 ARW.

Source: AFRC 2006.

2.3.2 Alternative 2: Transfer of 137 AW Only

Alternative 2 would implement the transfer of the 137 AW only. To provide adequate support facilities, this alternative would require the construction of the Squadron Operations Building and the renovation of Building 1048 (Figure 2-3). The four KC-135R aircraft would not be transferred from Portland IAP AGS under this alternative. However, the construction of the hangar would still be required to correct current operational deficiencies, and the existing ramp would be expanded to provide hangar access. Due to the limited availability of feasible hangar locations, this alternative would also require the demolition of Buildings 1037 and 1041 to accommodate the proposed hangar.

This alternative would not be viable because it does not implement the BRAC 2005 recommendation of transferring the four KC-135R aircraft to Tinker AFB. The purpose of transferring the aircraft to Tinker AFB is to create adequately sized squadrons which would improve the overall operational effectiveness of the KC-135 fleet.

EA	**Alternative 2: Transfer of 137 AW Only** **Tinker Air Force Base**	FIGURE 2-3

2.3.3 Alternative 3: No-Action Alternative

Under the No-Action Alternative, Tinker AFB would not implement the Proposed Action, and the BRAC recommendations would not be implemented as directed. The 137 AW would remain at Will Rogers AGS; no aircraft would be transferred from Portland IAP AGS; and no construction, demolition, or renovation to provide support facilities for the aerial refueling mission would occur. Current inadequacies in hangar facilities would remain.

The CEQ's regulations for the implementation of the NEPA stipulate that the No Action Alternative must be considered to assess environmental consequences that may occur if the Proposed Action is not implemented. This alternative will be carried forward as required by the CEQ.

SECTION 3
AFFECTED ENVIRONMENT

This section describes existing environmental conditions for resources potentially affected by the Proposed Action and identified alternatives. In compliance with the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations, Unified Facilities Criteria (UFC) 3-260-01, and 32 Code of Federal Regulations (CFR) 989, the description of the affected environment focuses on those resources potentially subject to impacts.

In the case of the Proposed Action for this EA, the affected environment description is limited primarily to Tinker Air Force Base (AFB) and Oklahoma County. Resource descriptions focus on the following areas: airspace management, air quality, noise, land use, geological resources, water resources, biological resources, transportation and circulation, visual resources, cultural resources, socioeconomics, environmental justice, hazardous materials and wastes, and safety.

3.1 Airspace Management

3.1.1 Definition of Resource

Airspace management is defined by Air Force Instruction (AFI) 13-201, *Air Force Airspace Management*, as the coordination, integration, and regulation of the use of airspace of defined dimensions. The objective is to meet military training requirements through the safe and efficient use of available navigable airspace in a peacetime environment while minimizing the impact on other aviation users and the public. There are two categories of airspace and airspace areas: regulatory and non-regulatory. Within these two categories, further classifications include controlled, uncontrolled, special use, and other airspace. Categories and types of airspace are dictated by: (1) the complexity and density of aircraft movements; (2) the nature of the operations conducted within the airspace; (3) the level of safety required; and (4) national and public interest in the airspace.

Airspace management is an important issue when considering potential environmental and safety effects of a proposed aircraft robust since it dictates the types of aircraft activities that occur at different locations and altitudes. The Federal Aviation Administration (FAA) has overall responsibility for managing airspace through a system of flight rules and regulations, airspace management actions, and air traffic control (ATC) procedures. The FAA accomplishes this through close coordination with state aviation and airport planners, military airspace managers, and other entities to determine how airspace can be used most effectively to serve all interests. All military and civilian aircraft are subject to Federal Aviation Regulations (FARs), which are developed and enforced by the FAA. Elements of airspace management relevant to safety and environmental resources include aircraft types, speeds, altitudes, and frequency of operations. These elements, in turn, influence the types and severity of effects that can occur on biological resources, cultural resources, air quality, safety, land use, socioeconomics, and visual resources.

3.1.1.1 Controlled Airspace

Controlled airspace is a generic term that encompasses different classifications of airspace (Class A, B, C, D, and E airspace shown in Figure 3-1) and defines dimensions within which ATC service is provided to Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) operations (US Department of Transportation [DOT] 1994). All military and civilian aircraft operating in controlled airspace are subject to FARs.

3.1.1.2 Uncontrolled Airspace

Uncontrolled airspace (Class G) is not subject to restrictions that apply to controlled airspace. Limits of uncontrolled airspace typically extend from the ground surface to 700 feet (ft) above ground level (AGL) in urban areas and from the ground surface to 1,200 ft AGL in rural areas. Uncontrolled airspace can extend above these altitudes to as high as 14,500 ft mean sea level (MSL) if no other types of controlled airspace have been assigned. ATC does not have authority to exercise control over aircraft operations within uncontrolled airspace. Primary users of uncontrolled airspace are general aviation aircraft operating in accordance with VFR.

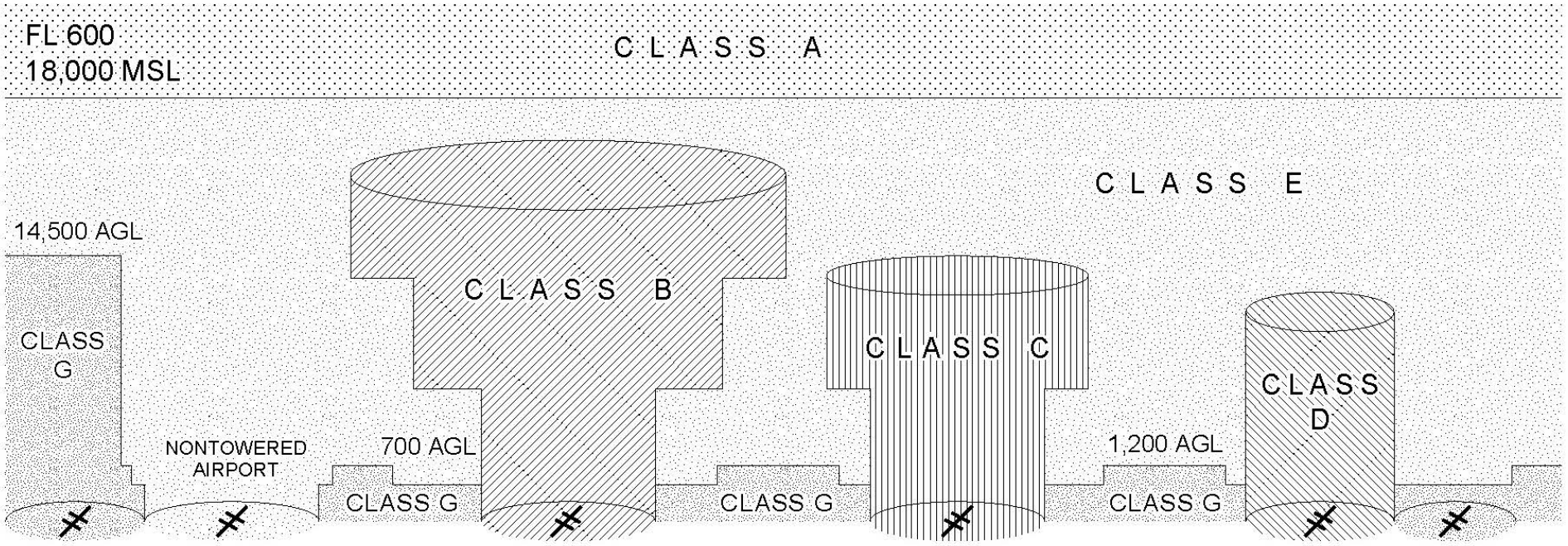
3.1.1.3 Special Use Airspace

Special use airspace consists of airspace within which specific activities must be confined, or wherein limitations are imposed on aircraft not participating in those activities. With the exception of Controlled Firing Areas (CFAs), special use airspace is depicted on aeronautical charts, including hours of operation, altitudes, and the agency controlling the airspace. All special use airspace descriptions are contained in FAA Order 7400.8.

3.1.1.4 Military Training Routes

Military Training Routes (MTRs) are flight paths that provide a corridor for low-altitude navigation and training, which is important because aircrews may be required to fly at low altitudes for tens or hundreds of miles to avoid detection in combat conditions. To train realistically, the military and the FAA have developed a system of MTRs that allows the military to train for low-altitude navigation at air speeds in excess of 250 knots. There are two types of MTRs, instrument routes (IRs) and visual routes (VRs).

Air Traffic Control Assigned Airspace (ATCAA) is airspace above 18,000 ft MSL designed to accommodate non-hazardous high-altitude military flight training activities; this airspace remains in the control of the FAA and, when not in use by military aircraft, may be used to support civil aviation activities. ATCAA permits military aircraft to conduct high-altitude air-to-air combat training, practice evasive maneuvers, perform air refueling, and initiate or egress from attacks on targets within a range. ATC routes IFR traffic around this airspace when activated; ATCAA does not appear on any sectional or enroute charts. Currently, by agreement with the FAA, no ATCAA is authorized over any of the existing airspace in the vicinity of Tinker AFB.



AGL – above ground level
FL – flight level
MSL – mean sea level

NOTE: Altitudes not to scale.
SOURCE: FAA 1993.

EA	**FAA Airspace Classification**	FIGURE 3-1

3.1.2 Existing Conditions

3.1.2.1 Mission

The 507th Air Refueling Wing (507 ARW) provides worldwide aerial refueling to bomber, fighter, cargo, and reconnaissance forces. In addition to refueling, the 507 ARW also supports Air Mobility Command's airlift requirements (cargo carrier and troop deployment), US Strategic Command's (USSTRATCOM) Single Integrated Operational Plan (SIOP) requirements, including overseas deployment, in times of peace, war, and national emergency as well as FAA flight inspection requirements.

3.1.2.2 Aircraft Inventory and Operations

The 507 ARW currently maintains and operates a Primary Aircraft Inventory (PAI) of eight KC-135R Stratotanker aircraft, providing air refueling capabilities within 1,000 nautical miles of Tinker AFB. The KC-135R Stratotanker is an aerial-refueling aircraft that can also transport troops (up to 80 passengers) and cargo. This aircraft is powered by four CFM International F-108-CF-100 high-bypass turbofans, each of which can generate 22,224 pounds of thrust. The KC-135R has an operational ceiling of 50,000 ft MSL and a ferry range of more than 9,732 nautical miles with 120,000 pounds of transfer fuel.

3.1.2.3 Tinker AFB Runways and 507 ARW Sorties

Two concrete landing surfaces but four designated runways are currently utilized at Tinker AFB; Runways 12/30, heading to the southeast and northwest, and Runways 17/35, heading to the south and north. Runways 17/35 are the primary ones used for 507 ARW operations. According to the Tinker AFB 2006 Air Installation Compatible Use Zone (AICUZ) study, total aircraft operations at Tinker AFB by runway were distributed as follows: Runway 12, 4 percent; Runway 17, 54 percent; Runway 30, 3 percent; and, Runway 35, 39 percent (Tinker AFB 2006b).

The 507 ARW currently flies approximately 5 days per week and conducts a total of approximately 846 KC-135R sorties per year (which includes both local and deployment sorties). A sortie is defined as a series of single events (i.e., operations) which includes landings, takeoffs, and individual climb-out and descent portions of a closed pattern. Approximately 70 percent of 507 ARW annual sorties depart Tinker AFB via Runway 17 with 30 percent departing Runway 35. While all arrivals (both VFR and IFR) and IFR closed patterns also occur on Runway 17/35, approximately 8 percent of VFR closed patterns take place on Runway 12/30. About 10 percent of 507 ARW flight operations involve sorties from which aircrews return to Tinker AFB after 10:00 PM. In addition to the 507 ARW operations at Tinker AFB, the unit also conducts minimal airfield operations at the following airfields: Will Rogers World Airport, Amarillo International Airport, Clinton-Sherman Airport, and Altus AFB (Tinker AFB 2006b).

3.1.2.4 Airspace Use and Flight Procedures

Typically, all flight operations associated with the 507 ARW take place in ATCAA located at flight levels between 19,000 and 28,000 ft MSL and within MOAs above 15,000 ft MSL. Of all operations that occur in MOAs, approximately 80 percent of 507 ARW operations occur in Hog and Rivers MOAs located above Arkansas and the Brownwood MOA located above Texas. Remaining MOA operations occur in MOAs located within a 1,000 nautical mile radius of Tinker AFB (Tinker AFB 2006c).

Flight plans and schedules for the 507 ARW are filed monthly with Fort Worth Center, the controlling agency of the region. Prior to initiating a training mission, 507 ARW pilots file a flight plan with Forth Worth Center and receive takeoff clearance from ATC at Tinker AFB. Pilots fly in accordance with IFR and remain under ATC until passed off to a FAA Regional Center; at that point, clear of conflicting aircraft, 507 ARW aircraft are cleared to enter the ATCAA or MOA to conduct air refueling operations. Upon returning to Tinker AFB, 507 ARW pilots maintain the same coordination with Forth Worth Center and Tinker AFB ATC, entering ATC at a fixed point and remaining under that control until landing (Tinker AFB 2006c).

3.2 Air Quality

3.2.1 Definition of Resource

Air quality in a given location is determined by the concentration of various pollutants in the atmosphere. National Ambient Air Quality Standards (NAAQS) are established by the US Environmental Protection Agency (USEPA) under the Clean Air Act (CAA) for criteria pollutants, including: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter equal to or less than ten microns in diameter (PM_{10}) and 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). NAAQS represent maximum levels of background pollution that are considered safe, with an adequate margin of safety, to protect public health and welfare.

3.2.1.1 Criteria Pollutants

Air quality is affected by stationary sources (e.g., industrial development) and mobile sources (e.g., motor vehicles). Air quality at a given location is a function of several factors, including the quantity and type of pollutants emitted locally and regionally, and the dispersion rates of pollutants in the region. Primary factors affecting pollutant dispersion are wind speed and direction, atmospheric stability, temperature, the presence or absence of inversions, and topography.

Ozone. The majority of ground-level (terrestrial) O_3 is formed as a result of complex photochemical reactions in the atmosphere involving volatile organic compounds (VOCs), nitrogen oxides (NO_x), and oxygen. O_3 is a highly reactive gas that damages lung tissue, reduces lung function, and sensitizes the lung to other irritants. Although stratospheric O_3 shields the earth from damaging ultraviolet radiation, terrestrial O_3 is a highly damaging air pollutant and is the primary source of smog. As of June 2004, the USEPA issued the final rule for 8-hour O_3, revising the 1-hour O_3 NAAQS standard. The 8-hour standard is more protective of public health and more stringent than the 1-hour standard, and non-attainment areas for 8-hour O_3 are now designated.

Carbon Monoxide. CO is a colorless, odorless, poisonous gas produced by incomplete burning of carbon in fuel. The health threat from CO is most serious for those who suffer from cardiovascular disease, particularly those with angina and peripheral vascular disease.

Nitrogen Dioxide. NO_2 is a highly reactive gas that can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections. Repeated exposure to high concentrations of NO_2 may cause acute respiratory disease in children. Because NO_2 is an important precursor in the formation of O_3 or smog, control of NO_2 emissions is an important component of overall pollution reduction strategies. The two primary sources of NO_2 in the US are fuel combustion and transportation.

Sulfur Dioxide. SO_2 is emitted primarily from stationary source coal and oil combustion, steel mills, refineries, pulp and paper mills, and from non-ferrous smelters. High concentrations of SO_2 may aggravate existing respiratory and cardiovascular disease; asthmatics and those with emphysema or bronchitis are the most sensitive to SO_2 exposure. SO_2 also contributes to acid rain, which can damage trees and lead to the acidification of lakes and streams.

Particulate Matter (PM_{10} and $PM_{2.5}$). PM is a mixture of tiny particles that vary greatly in shape, size, and chemical composition, and can be comprised of metals, soot, soil, and dust. PM_{10} includes larger, coarse particles, whereas $PM_{2.5}$ includes smaller, fine particles. Sources of coarse particles include crushing or grinding operations, and dust from paved or unpaved roads. Sources of fine particles include all types of combustion activities (e.g., motor vehicles, power plants, wood burning) and certain industrial processes. Exposure to PM_{10} and $PM_{2.5}$ levels exceeding current standards can result in increased lung- and heart-related respiratory illness. The USEPA has concluded that finer particles are more likely to contribute to health problems than those greater than 10 microns in diameter.

Airborne Lead. Airborne lead can be inhaled directly or ingested indirectly by consuming lead-contaminated food, water, or non-food materials such as dust or soil; fetuses, infants, and children are most sensitive to Pb exposure, which has been identified as a factor in high blood pressure and heart disease. Exposure to Pb has declined dramatically in the last 10 years as a result of the reduction of Pb in gasoline and paint, and the elimination of Pb from soldered cans.

3.2.1.2 Clean Air Act Amendments

The Clean Air Act Amendments (CAAA) of 1990 place most of the responsibility to achieve compliance with NAAQS on individual states. To this end, USEPA requires each state to prepare a State Implementation Plan (SIP). A SIP is a compilation of goals, strategies, schedules, and enforcement actions that will lead the state into compliance with all NAAQS. Areas not in compliance with a standard can be declared nonattainment areas by USEPA or the appropriate state or local agency. In order to reach attainment, NAAQS may not be exceeded more than once per year. A nonattainment area can reach attainment when NAAQS have been met for a period of ten consecutive years. During this time period the area is in transitional attainment, also termed maintenance.

3.2.2 Existing Conditions

3.2.2.1 Climate

The annual daily average temperature in Oklahoma County during winter is 38.6 degrees Fahrenheit (°F) with an average daily minimum temperature in Oklahoma County of 27.8°F. In summer the average temperature is 80°F and the average daily maximum temperature is 91.1°F. The normal annual precipitation is 33.35 inches. The majority of precipitation occurs in April through October. The average seasonal snowfall is 9.1 inches. Prevailing winds blow from the south with the average speed of 7 miles per hour year round, with higher averages of 14 miles per hour in March and April (US Department of Agriculture [USDA] 2003).

3.2.2.2 Local Air Quality

Oklahoma County is currently designated by the USEPA as an attainment area for CO, SO_2, NO_2, PM_{10} and $PM_{2.5}$. Oklahoma has entered into an Early Action Compact Agreement with the USEPA for the 8-hour ozone standard and has deferred attainment classification. Seven air quality monitoring stations are located within Oklahoma County which monitor CO, PM_{10}, $PM_{2.5}$, SO_2, O_3, and NO_2. According to USEPA AirData, concentrations of PM_{10}, $PM_{2.5}$, NO_2, and CO have not exceeded the primary NAAQS in the past 10 years (USEPA 2006a). In contrast, concentrations of ozone have exceeded the 8-hour NAAQS in nine of the past 10 years (USEPA 2006a). Table 3-1 summarizes emissions for criteria pollutants within Oklahoma County in 2006.

Table 3-1. National Ambient Air Quality Standards and Measured Emission Levels (2006) Oklahoma County, Oklahoma

Pollutant	Averaging Time	Measured Levels in Oklahoma County	National Standards (Primary)
O_3	8 hour	0.091 ppm	0.08 ppm (156 µg/m^3)
	1 hour	0.107 ppm	0.12 ppm (235 µg/m^3)
CO	8 hour	2.1 ppm	9.0 ppm (10 mg/m^3)
	1 hour	3.1 ppm	35 ppm (40 mg/m^3)
NO_2	Annual Arithmetic Mean	0.010 ppm	0.053 ppm (100 µg/m^3)
SO_2	Annual Average	0.001 ppm	0.03 ppm (80 µg/m^3)
	24 hour	0.004 ppm	0.14 ppm (365 µg/m^3)
PM_{10}	Annual Arithmetic Mean	25 µg/m^3	50 µg/m^3
	24 hour	87 µg/m^3	150 µg/m^3
$PM_{2.5}$	Annual Arithmetic Mean	9.4 µg/m^3	15 µg/m^3
	24 hour	26 µg/m^3	65 µg/m^3
Pb	Calendar Quarter	N/A	1.5 µg/m^3

Source: USEPA 2006.

Notes: µg/m^3 – micrograms per cubic meter
mg/m^3 – milligrams per cubic meter
ppm – parts per million
N/A – not measured in Oklahoma County, Wyoming

3.2.2.3 Tinker AFB Conditions

Tinker AFB falls under the jurisdiction of the Oklahoma Department of Environmental Quality (ODEQ), which publishes regulations for air quality and permitting for all counties in Oklahoma. Under the CAAA, the Title V Operating Permit Program imposes requirements for air quality permitting on air emission sources. Tinker AFB is categorized as a major source under the Title V program since its potential emissions from stationary sources exceed 100 tons per year (tpy) of any of the criteria pollutants; or 10 or 25 tpy of any single or combination of Hazardous Air Pollutants (HAPs), respectively. Also under the CAAA, the Aerospace National Emission Standards for Hazardous Air Pollutants (NESHAP) program specifies various provisions for regulated sources, including limits on HAP emissions, compliance demonstrations and performance testing, monitoring, record keeping, and reporting. The NESHAP program does apply to Tinker AFB since potential emissions of any single HAP equals or exceeds 10 tpy and a combination of HAPs equals or exceeds 25 tpy. Tinker AFB maintains a Title V Air Permit, most recently modified on April 11, 2007. Primary on-site emission sources at the Tinker AFB include:

- stationary combustion sources (boilers, water heaters, furnaces, gasoline and diesel-fuel generators, arresting barrier engines, engine test cells);
- operational sources (chemical usage, paints, degreasers, woodworking, abrasive blasting, welding operations, fuel cell maintenance, wastewater treatment, small arms firing range);
- fuel-storage/transfer operations (horizontal tanks, internal floating roof tanks, fuel transfer losses); and
- mobile sources (vehicle operations, aircraft operations, trim and power checks, aerospace ground equipment [AGE].

Further, emissions associated with aircraft operations at Tinker AFB have been quantified through an air emissions inventory process, most recently completed and documented in an *Estimation of Emissions from Aircraft Operations Technical Report* (Tinker AFB 2001). Results of this inventory are presented in Table 3-2.

Table 3-2. Estimated Emissions from Aircraft Operations, Tinker AFB (2001)

Type of Operation	Count (Operations)	Actual Emissions (Tons/yr)				
		CO	VOC	NOx	SO_2	PM
Landings and Takeoffs	15,865	1,345	1,168	216	47.6	112
"Touch & Go"	3,196	7.80	0.55	56.5	6.33	6.57
Low Approaches	1,316	2.83	0.20	17.7	2.09	2.09
Trim and Power Checks	647	235	229	148	27.9	56.2
Total Emissions		1,616	1,400	615	104	197

Source: Tinker AFB 2001

3.3 Noise

3.3.1 Definition of Resource

Noise is defined as unwanted sound or, more specifically, as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise annoying (Federal Interagency Committee on Noise [FICON] 1992). Human response to noise can vary according to the type and characteristics of the noise source, the distance between the noise source and the receptor, the sensitivity of the receptor, and time of day.

Due to the wide range in sound levels, sound is expressed in decibels (dB), a unit of measure based on a logarithmic scale. A 10-dB increase in noise level corresponds to a 100 percent increase (or doubling) in perceived loudness. As a general rule, a 3-dB change is necessary for noise increases to be noticeable to humans (Bies and Hansen 1988). Sound measurement is further refined by using an A-weighted decibel scale that emphasizes the range of sound frequencies that are most audible to the human ear (i.e., between 1,000 and 8,000 cycles per second). Unless otherwise noted, all decibel measurements presented in the following noise analysis are A-weighted (dBA).

The day-night average sound level system (L_{dn}) is a noise metric that averages A-weighted sound levels over a 24-hour period, with an additional 10-dB penalty added to noise events occurring between 10:00 PM and 7:00 AM. This penalty is intended to compensate for generally lower background noise levels at night and the additional annoyance of nighttime noise events. L_{dn} is the preferred noise metric of the US Department of Housing and Urban Development (HUD), the US Department of Transportation (USDOT), FAA, USEPA, Veterans' Administration, and DoD.

3.3.1.1 Noise in the Airfield Environment

Aircraft Operations. Analyses of aircraft noise exposure and compatible land use around DoD facilities are normally accomplished using a group of computer-based programs, collectively called NOISEMAP (USAF 1992). NOISEMAP, through its program BASEOPS, allows entry of runway coordinates, airfield information, flight tracks, flight profiles (e.g., engine thrust settings, altitudes, and speeds) along each flight track for each aircraft, numbers of flight operations, run-up coordinates, run-up profiles, and run-up operations. The model's output comprises a regularly spaced "grid" file containing L_{dn} values. The NMPLOT program uses the grid file to plot contours of equal L_{dn}, which can then be overlaid onto maps to depict current noise exposure levels in the Tinker AFB airfield environment. The 65 dBA through 85 dBA L_{dn} contours were generated for the scenarios described herein. In airport noise analyses, noise contours are used to help determine compatibility of aircraft operations and local land use.

Noise levels from flight operations exceeding ambient background noise typically occur beneath main approach and departure corridors, near local air traffic patterns around the airfield, and in areas immediately adjacent to parking ramps and aircraft staging areas. As aircraft take off and gain altitude, their noise contribution drops.

Other Airfield Noise. Although noise resulting from aircraft flight operations represents the greatest contribution to the overall noise environment near the airfield, other noise sources (e.g., highway traffic) may also influence total ambient noise levels. Other activities that may generate substantial amounts of noise at an airport include preflight engine run-ups and aircraft maintenance activities, industrial operations, and construction activities. Although aircraft maintenance actions and industrial operations may generate large amounts of noise, they are typically confined to the airfield and industrial areas. Construction activities, on the other hand, may occur anywhere on the site and result in disturbance to on-site personnel or off-site noise-sensitive receptors (e.g., housing areas and schools). However, construction noise tends to be localized and temporary and may be reduced through use of special equipment or scheduling restrictions.

3.3.2 Existing Conditions

3.3.2.1 Regional Setting

The noise environment of communities surrounding Tinker AFB is characteristic of a moderately dense developed urban area, with some areas of undeveloped land south of the base. The urban developed setting typically experiences noise associated with vehicles on highways, railways,

aircraft, or industrial activities. Undeveloped areas typically experience noise associated with local highways, aircraft, or light industrial activities. According to FICON, the following communities have the indicated typical ranges of outdoor L_{dn} noise levels: *Rural*, 40 to 48 L_{dn}; *Small Town and Quiet Suburban*, 45 to 55 L_{dn}; *Urban Residential*, 58 to 62 L_{dn}; *Suburban and Low Density Urban*, 52 to 60 L_{dn}; and *Noisy Urban Residential* 63 to 67 L_{dn} (FICON 1992). Civilian areas adjacent to the airfield support residential, commercial, public/quasi-public and open/agricultural/low density. Much of the area surrounding the base to the north, east, and west contains moderately dense residential, while areas to the south are sparsely populated with noise levels of correspondingly low magnitude. Tinker AFB aircraft activity is the dominant noise producer in the region with residences and an elementary school present within the 65+ L_{dn} contour.

Table 3-3 identifies noise levels associated with some common indoor and outdoor activities and settings and indicates the subjective human judgments of noise levels, specifically the perception of noise levels doubling or being halved. For reference purposes, a baseline noise level of 70 dB is described as moderately loud. As can be seen in the table illustrating the logarithmic dB scale, humans perceive an increase of 10 dB as a doubling of loudness, while an increase of 30 dB corresponds with an eight-fold increase in perceived loudness.

3.3.2.2 Tinker AFB

Current noise levels associated with aircraft operations at Tinker AFB were generated during the preparation of the *Tinker AFB Air Installation Compatible Use Zone (AICUZ) Study* (Tinker AFB 2006b) and are depicted in Figure 3-2. Baseline 65 to 80 L_{dn} noise contours associated with aircraft operations extend beyond the boundary of Tinker AFB to the north and south. Noise contours are concentrated around Runway 17/35, the primary runway at the base. Runway 17/35 is aligned in a north-south direction, which allows aircraft to takeoff and land over relatively unpopulated areas to the south such that higher noise levels occur over areas which do not support sensitive noise receptors or noise-sensitive land use. Off the ends of Runway 17/35, the 65 L_{dn} noise contour extends approximately 4.3 miles south and 4.2 miles north beyond the base boundary. The entire 85+ L_{dn} noise contour is contained within the base boundary. Acreage impacted by aircraft operations at Tinker AFB is summarized in Table 3-4 (Tinker AFB 2006b).

Table 3-3. Sound Levels of Typical Noise Sources and Noise Environments

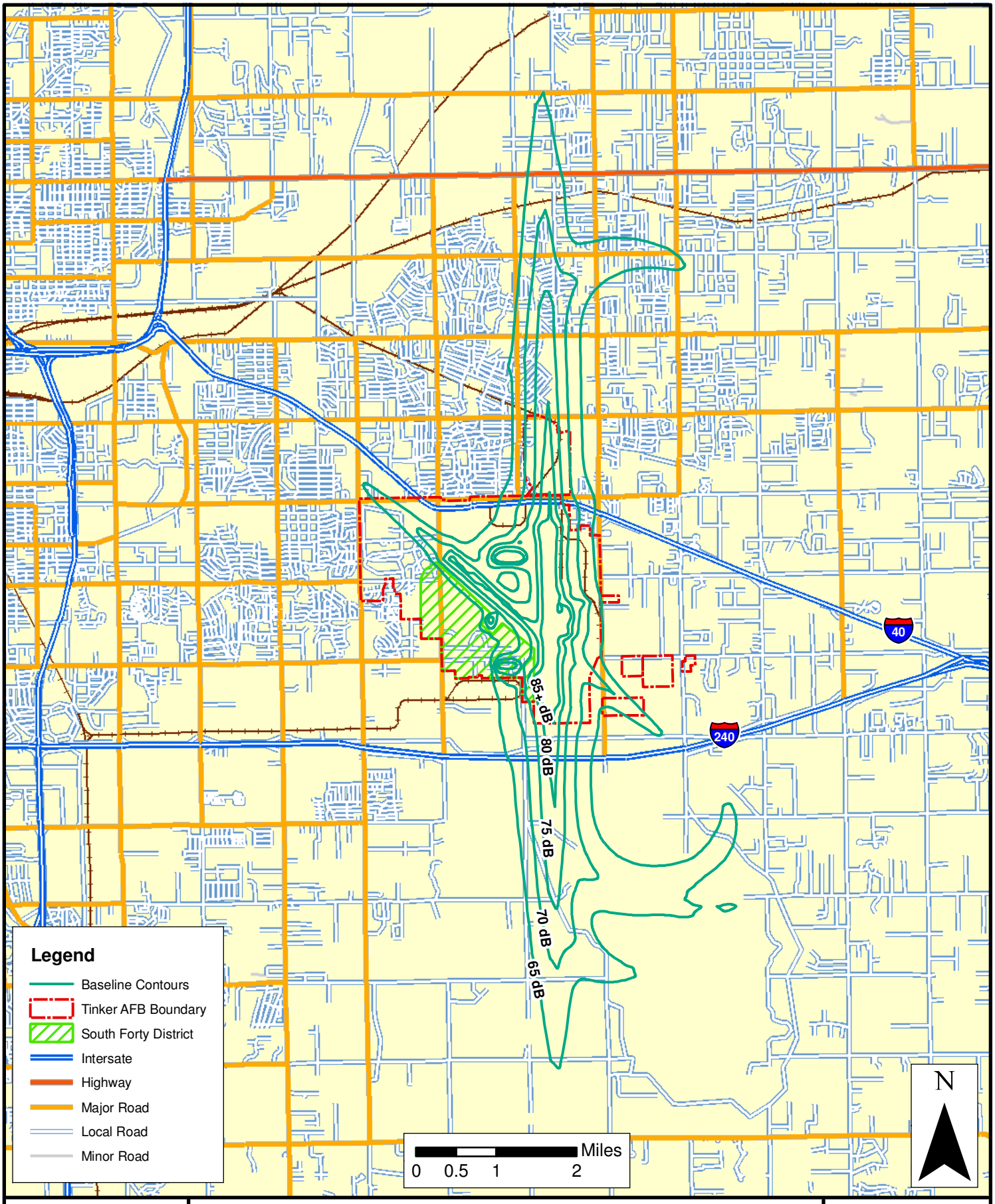
Noise Source (at a given distance)	A-Weighted Sound Level Scale (dBA)	Noise Environment	Human Judgment of Noise Loudness[1]
Military Jet Takeoff with Afterburner (50 ft)	140		
Civil Defense Siren (100 ft)	130	Carrier Flight Deck	
Commercial Jet Takeoff (200 ft)	120		Threshold of Pain
Pile Driver (50 ft)	110	Rock Music Concert	32 times as loud
			16 times as loud
Ambulance Siren (100 ft)	100		Very Loud
Newspaper Press (5 ft)			8 times as loud
Power Lawn Mower (3 ft)			
Motorcycle (25 ft)	90	Boiler Room	4 times as loud
Prop. Plane Flyover (1,000 ft)		Printing Press Plant	
Diesel Truck, 40 mph (50 ft)			
Garbage Disposal (3 ft)	80	High Urban Ambient Sound	2 times as loud
Passenger Car, 65 mph (25 ft)			Moderately Loud
Living Room Stereo (15 ft)	70		
Vacuum Cleaner (3 ft)			
Electronic Typewriter (10 ft)			
Normal Conversation (5 ft)	60	Data Processing Center	1/2 as loud
Air Conditioning Unit (100 ft)		Department Store	
Light Traffic (100 ft)	50	Private Business Office	1/4 as loud
Bird Calls (distant)	40	Lower Limit of Urban	Quiet
		Ambient Sound	1/8 as loud
Soft Whisper (5 ft)	30	Quiet Bedroom	
	20	Recording Studio	Just Audible
	10		Threshold of Hearing

[1]Relative to a reference loudness of 70 dBA.
Source: FICON 1992.

Table 3-4. Noise Exposure Acreage from Aircraft Operations at Tinker Air Force Base

Noise Level	Acreage Beyond Base Boundary	Total Acreage
65-69	3,691	4,371
70-74	1,232	1,968
75-79	547	1,198
80-84	74	471
85+	0	369
Total > 65	**5,544**	**8,377**

Source: Tinker AFB 2006b.



EA

Baseline Noise Level Contours
Tinker Air Force Base

FIGURE
3-2

3.3.2.3 Remote Airspace

For remote flight operations, the 507 ARW primarily uses MOAs and ATCAA areas at altitudes above 15,000 ft MSL and 19,000 ft MSL, respectively. Further, no low-level proficiency operations occur along MTRs. Given that all 507 ARW operations typically occur above 15,000 ft MSL, assessment of noise associated with KC-135R remote operations was not carried forward.

3.3.2.4 Sound Exposure Level (SEL)

The SEL measurement provides a means of describing an individual noise event (e.g., an aircraft overflight) which comprises:

- a period of time when an aircraft is approaching and noise levels are increasing,
- an instant when the aircraft is directly overhead and the highest noise level is experienced, and
- the period of time when the aircraft moves away from the noise receptor while noise levels decrease.

Although such an event may last several seconds, the SEL metric represents a one-second noise level describing the overflight. SEL values for KC-135R aircraft at varying slant distances and power settings is presented in Table 3-5. Since the SEL value represents a composite of noise levels over an extended period of time normalized to one second, SEL values are typically 5 to 10 dB greater than the actual greatest noise level experienced by a noise receptor.

Table 3-5. SEL Values Associated with KC-135R Aircraft Operations

	Configuration (Power)			
	Approach	**Traffic Pattern**	**Intermediate**	**Maximum Rated Thrust**
Power Setting (NF)	66.5%	70.5%	80.3%	89.6%
Speed (Knots)	150	225	240	300
Slant Distance (feet)				
100	106.8	103.9	106.7	107.9
200	102.3	99.4	102.2	103.4
500	96.0	93.1	95.8	97.2
1,000	90.8	88.0	90.6	92.2
2,000	85.0	82.3	84.9	86.7
4,000	78.4	75.8	78.5	80.5

Source: Tinker AFB 2002a.

3.3.2.5 Noise Abatement Procedures

Avoidance of noise-sensitive areas is emphasized and takeoff patterns are routed to avoid these locations as much as possible. For example, the majority of departures and approaches occur on Runway 17/35 to avoid populated areas. Also, efforts are made to control and schedule missions to keep noise levels low, especially at night. Twelve noise complaints were registered in 2005

and 8 noise complaints were registered as of 4 December 2006 at Tinker AFB; however, these complaints cannot be exclusively attributed to aircraft operations associated with the 507 ARW as other based aircraft and transient military aircraft also utilize Tinker AFB's airfield (Tinker AFB 2006d).

3.4 Land Use

3.4.1 Definition of Resource

Land use comprises natural conditions or human activities occurring at a particular location. Human-modified land use categories include residential, commercial, industrial, transportation, communications and utilities, agricultural, institutional, recreational, and other developed use areas. Management plans and zoning regulations determine the type and extents of land uses allowed in specific areas and are often intended to protect specially designated or environmentally sensitive areas.

Several siting criteria have been established specific to land development and use at commercial and military airfields. To maintain safety, the USAF has established siting criteria in AFI 32-1026, *Planning and Design of Airfields*, and Air Force Manual 32-1013, *Airfield and Heliport Planning Criteria*, for land development of USAF military installations. These criteria include clear zones, obstruction zones relative to runways, and quantity-distance criteria relative to the storage of munitions. While these criteria are related to safety, they are used to assist decision-makers and planners with appropriate siting of facilities on USAF installations. FAA airfield criteria are used at commercial airports and are generally the same as the USAF criteria. In addition, several regulations address security requirements for military bases and have implications on physical layout and design of installations.

3.4.2 Existing Conditions

3.4.2.1 Regional Land Use

Tinker AFB is located in Oklahoma City, Oklahoma, southeast of the center of the city. Oklahoma City is centrally located in Oklahoma County and lies on a level plain on both sides of the North Canadian River. Tulsa is approximately 100 miles northeast of Oklahoma City, Lawton/Fort Sill is approximately 90 miles southwest, and Enid is approximately 93 miles north. Midwest City is located approximately 3 miles north of the base, and Del City is located approximately 6 miles northwest of the base.

Oklahoma City

Oklahoma City includes approximately 621 square miles of residential, industrial, recreational, and retail areas and is the financial, medical, retail, and business hub of central Oklahoma, providing services to over one million people within a 100-mile radius of the city. The city is also the principal market for the state's livestock and agricultural industries and is the major wholesaling center for the area (Greater Oklahoma City Partnership [GOCP] 2006). A railroad yard, the former General Motors Assembly Plant (approximately 400 acres), and other industrial

uses are located between the base and I-240, which runs east-to-west adjacent to the Runway 35 Clear Zone (CZ). Areas of open space are interspersed within the corridor between the base and I-240, and residential subdivisions are being developed to the south of I-240, southwest of the former General Motors Assembly Plant. Lake Stanley Draper is located farther south of I-240 and contains nearly 3,000 acres surrounded by undeveloped land. The lake is in an Environmental Conservation District and is owned by the Oklahoma City Water Trust. Minimal commercial development is located along Douglas Boulevard outside the eastern boundary of the base. Sporadic residential development has occurred farther east of the base (Tinker AFB 2006b).

The Oklahoma City Plan 2000-2020 (OKC Plan) was adopted by the Oklahoma Planning Commission on 28 September 2006 and was last amended on 10 August 2006. Review of the Land Use Plan within the OKC Plan indicates the following land uses planned for areas encompassing or adjacent to Tinker AFB:

- The land containing Tinker AFB is classified as Transportation, Communication, and Utilities.
- Property designated as Industrial Reserve is located immediately east of the base.
- The area adjoining the southern border of the base and surrounding Lake Stanley Draper is designated as Major Open Space and Environmental Conservation.
- The area between Southeast 74th Street and Southeast 59th Street on the southwestern boundary of the base is designated as Standard Industrial.
- The area between Southeast 59th Street and Southeast 44th Street on the western boundary of the base is designated as Urban Development.

The OKC Plan also indicates the projected development of properties in Oklahoma City. The land immediately surrounding and west of Tinker AFB is designated for "Urban Growth," the land to the south and southeast surrounding Lake Stanley Draper is designated as "Environmental Conservation," and land to the east is designated as "Rural." The Urban Growth Areas contain more recent and on-going development that are served by public water, sewage treatment, and fire protection services, or areas where these services will be made available by 2020. Predominant uses include single-family homes, apartments of moderate densities, regional and community shopping centers, low-rise office buildings, and industrial development in selected areas. Residential densities in these areas usually exceed one dwelling per acre.

Zoning in Oklahoma City is enforced through a zoning ordinance. The Oklahoma City Airports Zoning Ordinance establishes height restriction zones around airports and airport environs zones created by the existing and future potential noise impact. The city also restricts incompatible uses within noise zones above day-night sound level 65 L_{dn}. In 2002, Oklahoma County purchased and dedicated 53 acres between I-40 and Tinker AFB to support base security and aircraft safety and noise. All homes in this area were removed.

Midwest City

Midwest City is located directly north of the base and, as identified in the OCARTS, is predominantly residential with commercial land uses located along major road corridors. These commercial corridors are primarily SE 15th Street, SE 29th Street, I-40, Air Depot Boulevard, and Midwest Boulevard. Public and institutional uses are scattered throughout Midwest City, including City Hall, a public library, the post office, several schools, and the John Conrad Regional Golf Course. The Glenwood Subdivision is located between the base and Midwest City. Due to encroachment and safety concerns, Oklahoma County purchased 343 acres of the subdivision in 1973, and leased it to Tinker AFB. The land located north of Runway 17, across I-40, was subsequently cleared of structures and remains undeveloped (Tinker AFB 2006b).

Land use planning in this area is currently based on the Midwest City Comprehensive Plan, developed in 1985 and currently being updated to reflect land use changes in the city and to direct future land uses. Midwest City enforces the "Tinker Air Force Base Zoning Ordinance," which regulates development within Accident Potential Zone (APZ) I (Tinker AFB 2006b).

Del City

Del City is located northwest of the base and is primarily a developed, moderately dense, mixed-use community. As identified in the OCARTS, the predominant land use in Del City in the vicinity of Tinker AFB is residential, with commercial corridors along SE 15th Street, SE 29th Street, and I-40. Limited areas of industrial uses are located in Del City between I-40 and the North Canadian River (Tinker AFB 2006b).

Del City maintains and enforces a conventional zoning ordinance. The ordinance includes a section entitled "Airport Zoning" that controls development within the APZ I (Tinker AFB 2006b).

3.4.2.2 Local Land Use

Tinker AFB is bordered to the north by I-40 and 29th Street, to the east by Douglas Boulevard, to the south by 74th Street, and to the west by Sooner Road. The majority of the land in the vicinity of Tinker AFB can be characterized as moderate-density urban developed, with areas of undeveloped land to the south (Tinker AFB 2006b). The Association of Central Oklahoma Governments developed the 2000-2030 Oklahoma City Area Regional Transportation Study (OCARTS) which identified land uses in the Oklahoma City metropolitan area.

With regard to Tinker AFB off-site land use, airspace obstructions, construction in the APZs, residential development, and the construction of other noise-sensitive uses near the base are of great concern to Tinker AFB. Current incompatible land use associated with accident potential zones and noise zones is presented in Table 3-6. Tinker AFB's and the USAF's objectives are to minimize increases in incompatible land use and to encourage voluntary conversion of incompatible land use to compatible, while fulfilling the base's mission. Historically, Tinker AFB has worked with local governments and communities, including the cities of Oklahoma City, Del City, Midwest City, Choctaw, Nicoma Park, and Spencer, in an attempt to achieve

these objectives. The Tinker AFB Civil Engineer and Public Affairs Offices have worked together to facilitate public meetings and informational workshops to provide information about base operations, forecasts, plans, and mitigation strategies. The Public Affairs Office also works to address complaints and concerns expressed by off-airfield neighbors (Tinker AFB 2006a).

Table 3-6. Incompatible Land Uses in the Vicinity of Tinker AFB (2006)

Location	Incompatible Use(s)
Runway 17 APZ I (North of Airfield)	A bank Two bars A community club
Runway 17 APZ II (North of Airfield)	Residential development — more than two dwellings per acre An elementary school A library A post office A nursing home City hall Medical center complexes
Runway 12 APZ I (Northwest of the Airfield)	Tinker Business and Industrial Park A bar A Sam's Club Seven car dealerships An auto repair shop Single-family residences A portion of an apartment complex
Runway 12 APZ II (Northwest of Airfield)	Residential uses at a density greater than two dwelling units per acre A middle school A high school A library A community center
65-69 L_{dn} Noise Zone	Residential uses, north of 29th Street, Midwest City
70-74 L_{dn} Noise Zone	Residential uses, north of the base
75-79 L_{dn} Noise Zone	Steed Elementary School between 15th Street and Reno Avenue

Source: Tinker AFB 2006a

On 16 January 2007, the Association of Central Oklahoma Governments (ACOG) met with representatives of Tinker AFB and with representatives of member cities affected by base operations to discuss implications of the 2006 AICUZ Study. These member cities are working with Tinker AFB to limit future incompatible land use as a result of Tinker AFB aircraft operations. The ACOG will sponsor the preparation of a Joint Land Use Study (JLUS) to address land use planning issues for entities affected by base operations. The JLUS would be funded primarily by the DoD and is anticipated to be complete by the end of 2007.

A public meeting was held on 22 January 2007 at the Del City Community Center to discuss the *2006 AICUZ Study*. Participants each received a Citizen's Brochure containing the 2006 AICUZ Map, identification of compatible land uses, and answers to basic questions about the AICUZ process. No negative comments were received from members of the public.

3.4.2.3 Tinker AFB

Tinker AFB consists of approximately 5,033 acres of federal land located southeast of downtown Oklahoma City. Land use patterns on the base have been influenced by the base's missions since WWII. Future short- and long-range development of Tinker AFB is outlined in the *Tinker AFB General Plan* (2005). The purpose of the *General Plan* is to determine existing and future needs and facilitate orderly future development by examining the physical composition of the base, determining existing and future space and facility needs in relation to current and future missions, and analyzing and validating development constraints and opportunities as they relate to those needs. The *General Plan* identified 13 land use categories at Tinker AFB. The land use categories with estimated acreage are depicted in Table 3-7.

Table 3-7. Existing Land Use Summary

Land Use Category	Acres
Administrative	109
Aircraft Operations and Maintenance	563
Airfield	1,021
Airfield Pavements	520
Community (Commercial)	80
Community (Services)	23
Housing (Accompanied)	182
Housing (Unaccompanied)	60
Industrial	464
Medical	27
Open Space	996
Outdoor Recreation	368
Water	17
Subtotal	4,430
Undesignated	603
TOTAL	**5,033**

Source: Tinker AFB 2005a.

In 2005, Tinker AFB maintained a total of 716 non-housing buildings containing approximately 15.9 million square feet, in addition to 12 dorms, and 730 family housing units (Tinker AFB 2005a). The base also contains two Class B runways and 12 taxiways.

A total of 520 acres of parking apron space is available at the base. Airfield aprons are located at each of the major flying wings and at the Oklahoma City Air Logistics Center (OC-ALC). The runways at Tinker AFB and the airfield clearance criteria have separated the base into functional land use areas, resulting in seven Architectural Planning Districts. Each district has distinct land uses and includes:

- Northside Industrial District – contains several warehouse facilities, the majority of administrative, command and control, 552nd Air Control Wing (552 ACW), and personnel services, and is located between Arnold Street and the northern base boundary. This is the largest industrial area on the base.

- Eastside Depot Maintenance District – contains the OC-ALC and associated activities and is located on the east side of the base.
- The 38th EIG District – consists of a satellite facility, located immediately east of the base.
- Southeastside Munitions District – contains munitions storage areas and is located in the southeast corner of the base.
- South Forty District – contains support facilities for the 3rd Combat Communications Group (3 CCG), the 507 ARW, and the US Navy Command Strategic Communications Wing One (CSCW-1) and is located on the southwestern portion of the base. This district contains a variety of uses including Industrial, Aircraft Operations and Maintenance, Airfield (Runway/Taxiway/Apron), Community (Commercial), Administrative, Open Space, Water, and Outdoor Recreation.
- Westside Community District – contains base housing and communities facilities and is located in the northwestern portion of the base.
- Airfield District – this district supports all aircraft operations and maintenance activities and is composed of two runways and 12 taxiways. This district is located at the center of the base and occupies the majority of base acreage.

3.5 Geological Resources

3.5.1 Definition of Resource

Geological resources consist of surface and subsurface materials and their properties. Principal geologic factors affecting the ability to support structural development are seismic properties (i.e., potential for subsurface shifting, faulting, or crustal disturbance), soil stability, and topography.

The term soil, in general, refers to unconsolidated materials overlying bedrock or other parent material. Soil structure, elasticity, strength, shrink-swell potential, and erodibility all determine the ability for the ground to support man-made structures. Soils typically are described in terms of their complex type, slope, physical characteristics, and relative compatibility or constraining properties with regard to particular construction activities and types of land use.

Topography is the change in elevation over the surface of a land area. An area's topography is influenced by many factors, including human activity, underlying geologic material, seismic activity, climatic conditions, and erosion. A discussion of topography typically encompasses a description of surface elevations, slope, and distinct physiographic features (e.g., mountains) and their influence on human activities.

3.5.2 Existing Conditions

3.5.2.1 Regional Setting

The underlying geology of the central Oklahoma area is characterized by sedimentary rocks of Permian age (245-290 million years). Surficial geology in Oklahoma County is dominated by

the Garber Sandstone stratum with relatively smaller stratigraphic units of the Hennessey Group (siltstones and shale), and soil deposits consisting of terrace deposits and alluvium (USDA 2003).These sedimentary units overlie a basement of granite and other metamorphic or igneous rocks (Tinker AFB 2001).

The Oklahoma City area is located within the Southern Plains region of the Midwest. Oklahoma County elevations range from approximately 850 feet above MSL to the southeast to 1,300 feet above MSL in the northwest.

Tinker AFB

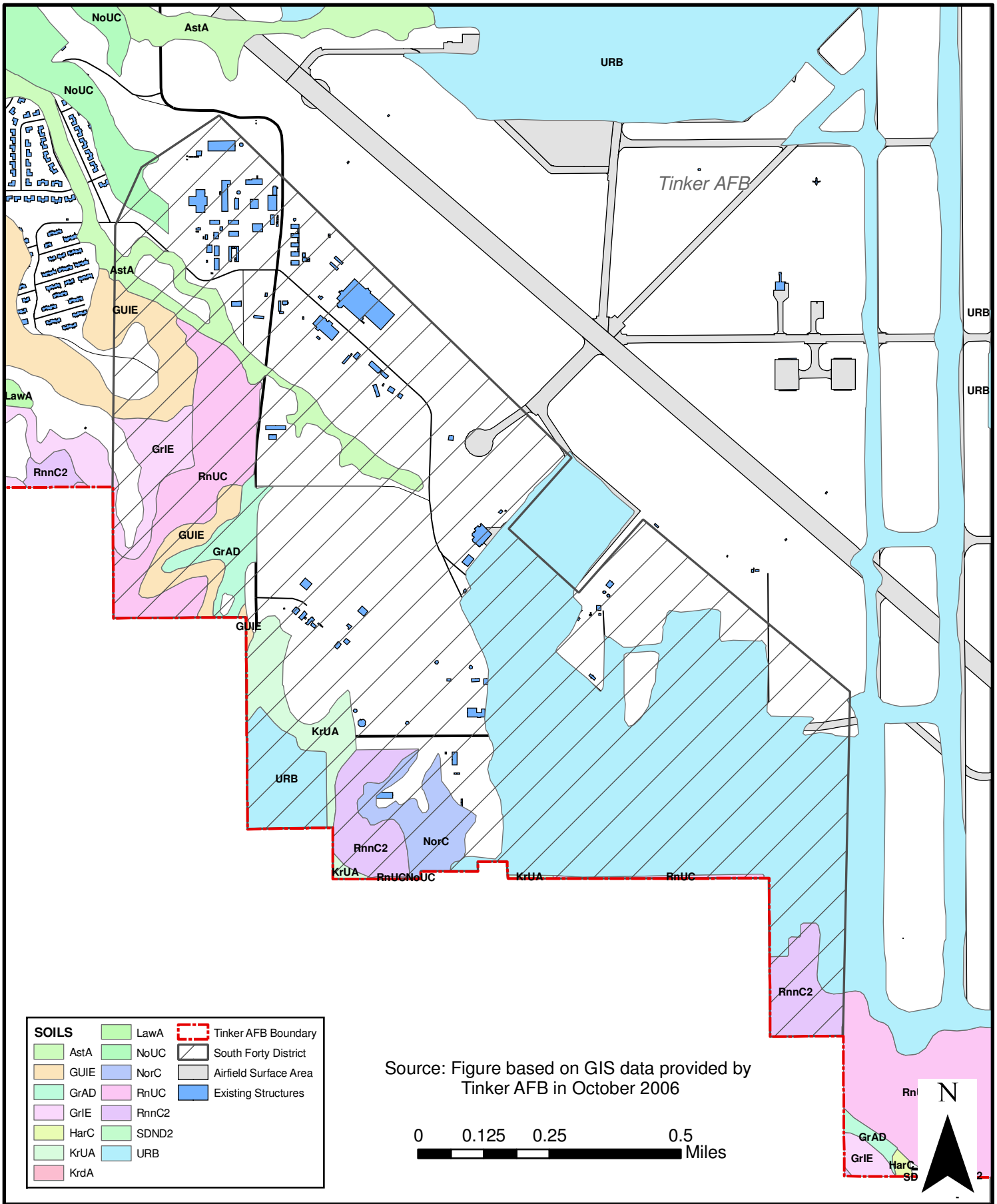
Recent drilling and construction of cross-sections confirm that the erosional edge of the Hennessy Group (Kingman Siltstone and Fairmont Shale) extends from the northwest corner of the base southeastward to the Engineering Installation Group area. Over 75 percent of the base surface geology is Hennessey Group, and most of the remaining surface geology is Garber Sandstone with some alluvium along streams (Tinker AFB 2001). Recent work shows that the Hennessey at the surface is underlain by Garber Sandstone, which in-turn is underlain by the Wellington Formation. In summary, Tinker AFB's surficial geology is composed primarily of sandstone and shale.

Soils

Soils at Tinker AFB are comprised of three major associations, which were derived from the in-situ weathering of shale and sandstone, with some Aeolian sorting and modification. These include: 1) Darnell-Stephenville (D-S), 2) Renthin-Vernon-Bethany (R-V-B), and 3) Dale-Canadian-Port (D-C-P) (Tinker AFB 2001) (NRCS 1969). Soil associations are illustrated on Figure 3-3.

The D-S association is characterized by shallow to deep, light-colored sandy upland soils with reddish subsoils; areas are gently to moderately sloped with some areas strongly sloped. Prior to historic land clearing, the D-S soils typically supported oak-hickory forest (i.e., cross timbers) with prairie openings (i.e., savannahs).

The R-V-B association consists of shallow to deep, dark, loamy upland soils with clayey subsoils formerly favoring prairie conditions; sloping varies from nearly level to moderately steep. The sites for the proposed facilities within the South Forty Development Area lie within the RVB Association (USACE 2002). The D-C-P association consists of deep, loamy alluvial soils located in bottomlands along watercourses.



EA

Soils Map
South Forty District
Tinker Air Force Base

FIGURE
3-3

Tinker AFB's soil survey was completed in 1983 and updated in 1991 by the NRCS. A total of 42 soil types were identified within base boundaries. Approximately 89 acres were classified as prime farmland. However, at the time Tinker AFB was surveyed, much of the land (approximately 300 acres), which would have been designated prime farmland, had long since been urbanized and therefore no longer met prime farmland criteria.

Soil properties on Tinker AFB have been heavily altered by human activities and topsoil has been removed at some locations and not replaced. Soil compaction is common as the result of off-road training exercises, military construction projects, historical aircraft parking, and related activities. Other places have been subject to extensive filling.

Topography and Physiography

Tinker AFB is located in the Central Red Bed Plains section of the Central Lowland Physiographic Province, which is characterized by level to gently rolling hills, broad flat plains, and bottomlands bisected by small- to medium-sized water courses.

Elevations at the base range from approximately 1,200 feet above MSL (at Crutcho Creek in the northwestern portion of base) to 1,310 feet above MSL (in the southeast portion of base). The airfield elevation is approximately 1,291 feet above MSL. The South Forty District is comprised of relatively flat lands, most of which are heavily maintained. Individual project sites are generally level and paved.

3.6 Water Resources

3.6.1 Definition of Resource

Water resources analyzed in this EA include surface and groundwater resources, including the quality and availability of surface and groundwater, wetlands, and the potential for flooding. Surface water resources comprise lakes, rivers, and streams and are important for a variety of reasons including economic, ecological, recreational, and human health. Groundwater comprises the subsurface hydrologic resources of the physical environment and is an essential resource in many areas; groundwater is commonly used for potable water consumption, agricultural irrigation, and industrial applications. Groundwater properties are often described in terms of depth to aquifer, aquifer or well capacity, water quality, and surrounding geologic composition.

Wetlands are defined by the USACE and USEPA as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. As defined in 1984, wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3[b]). Wetlands provide a variety of functions including groundwater recharge and discharge; floodflow alteration; sediment stabilization; sediment and toxicant retention; nutrient removal and transformation; aquatic and terrestrial diversity and abundance; and uniqueness. Three criteria are necessary to define wetlands: vegetation (hydrophytes), soils (hydric), and hydrology (frequency of flooding or soil saturation). Hydrophytic vegetation is classified by the estimated probability of occurrence in wetland versus

upland (non-wetland) areas throughout its distribution. Hydric soils are those that are saturated, flooded, or ponded for sufficient periods during the growing season and that develop anaerobic conditions in their upper horizons (i.e., layers). Wetland hydrology is determined by the frequency and duration of inundation and soil saturation; permanent or periodic water inundation or soil saturation is considered a significant force in wetland establishment and proliferation. Jurisdictional wetlands are those subject to regulatory authority under Section 404 of the Clean Water Act (CWA) and Executive Order 11990, Protection of Wetlands.

Other issues relevant to water resources include watershed areas affected by existing and potential runoff and hazards associated with 100-year floodplains. Floodplains are belts of low, level ground present on one or both sides of a stream channel and are subject to either periodic or infrequent inundation by flood water. Inundation dangers associated with floodplains have prompted federal, state, and local legislation that limits development in these areas largely to recreation and preservation activities.

3.6.2 Existing Conditions

3.6.2.1 Regional Setting

Surface Water

Oklahoma County's landforms drain into the North Canadian River: the northern portion of the county drains into the Crutcho Creek Drainage Basin and into the North Canadian River, and the southern portion drains into the Elm Creek and Hog Creek Drainage Basins and into the South Canadian River, both of which are headwaters for the Arkansas-Mississippi River Basin. The North Canadian River trend west to east through Oklahoma County. The entire county is part of the Arkansas River Basin (USFWS 2006a).

Groundwater

Aquifers which underlie Oklahoma County include both ephemeral and perennial aquifers. The most significant aquifer beneath the county is the perennial Garber-Wellington aquifer; however, the primary source of potable water for the county and several surrounding communities is provided by surface water. This aquifer is recharged primarily by infiltration of rainfall or surface water through thin fractures in the Hennessey Group and directly into the Garber Sandstone (OWRB 2006).

Most water from the Garber-Wellington aquifer is of sufficient quality to be used for most industrial, agricultural, and domestic purposes. However, some contaminated groundwater plumes do exist, typically at a depth of 175 feet or shallower. This does not pose health concerns at this time since the producing zone (i.e., depth at which water from supply wells is obtained) is 200 feet or deeper. Also, there appears to be an aquitard at approximately 200 feet which hydraulically separates the producing zone from shallower groundwater in the aquifer (Tinker AFB 2007b).

Industrial operations, individual homes, farm irrigation, and small communities not served by a municipal distribution system also depend on the Garber Wellington Aquifer. Communities presently depending on surface supplies, such as Oklahoma City, Midwest City, and Del City, maintain wells tapping the Garber-Wellington Aquifer as a backup water supply in the event of drought.

Wetlands

Wetlands represent approximately 2 percent of the land area in Oklahoma (USEPA 2006b). Several wetlands are located in Oklahoma County; National Wetland Inventory (NWI) maps for the area indicate that these wetlands are primarily freshwater emergent, freshwater forested/shrub, freshwater pond, and riverine (USFWS 2006a).

Floodplains

Flood hazard areas of Oklahoma County are subject to periodic inundation which results in loss of life and property, health and safety hazards, disruption of commerce and governmental services, and extraordinary public expenditures for flood protection and relief, all of which adversely affect public health, safety, and general welfare. The bulk of Federal Emergency Management Agency (FEMA) designated 100-year floodplains for Oklahoma County exist along the North Canadian River and its major tributaries. However, no FEMA-designated floodplains exist along the smaller, intermittent streams (OWRB 2006).

3.6.2.2 Tinker AFB

Surface Water

Tinker AFB's surface drainage occurs in three primary drainage basins: 1) Crutcho Creek Drainage Basin, 2) Elm Creek Drainage Basin, and 3) Hog Creek Drainage Basin. These are further divided into 10 sub-basins or watersheds. The majority of land associated with Tinker AFB is drained by the Crutcho Creek Drainage Basin which flows to the north into the North Canadian River. East Crutcho Creek flows through a culvert under the 507 ARW aircraft parking apron. Eventually, the North Canadian River joins the Arkansas River and Mississippi Rivers, ultimately discharging into the Gulf of Mexico. The Elm Creek and Hog Creek Drainage Basins flow to the south of the base into the Little River which forms confluences with the South Canadian River, Arkansas River, Mississippi River, and discharges into the Gulf of Mexico (Tinker AFB 2007b).

On-base, open-flowing waters comprise a total of about eight linear miles. The first- and second-order segments are typically ephemeral or intermittent while the third-order segment is perennial. All base creek flows are the result of stormwater runoff (Tinker AFB 2007b). Stormwater runoff is collected by various diversion structures and discharged to surface streams. Approximately 5 miles of stream channels within Tinker AFB lie within 100-year floodplains. East Crutcho Creek and its tributaries flow through the South Forty District and are associated with several ponds (Figure 3-4).

EA

Wetlands and Water Bodies
South Forty District
Tinker Air Force Base

FIGURE 3-4

No significant point source industrial discharges currently are made to any waterway on Tinker AFB. In 1996, the base Industrial Wastewater Treatment Plant (IWTP) and Sanitary Treatment Plant (STP) discharges were rerouted to the Oklahoma City Public Owned Treatment Works. This eliminated flows of 1.3 million gallons per day to the on-base portion of Soldier Creek (i.e., East Soldier Creek) at National Pollutant Discharge Elimination System (NPDES) Outfalls 001 and 01S (Tinker AFB 2007b).

Groundwater

The direction of groundwater flow under Tinker AFB varies. There is an apparent groundwater divide associated with Crutcho Creek that affects groundwater flow direction. Regional topographic lows draw portions of groundwater in the area southwestward, while other areas flow northward toward discharge points along Crutcho Creek (Tinker AFB 2007b). The approximate direction of groundwater flow in the Garber-Wellington aquifer is south and southwest across the southern half of the base and west to northwest across the northern half.

Throughout much of the northern half of the base, the Garber-Wellington aquifer is not protected by any confining shale. In the southern half of the base, the Hennessey Group overlies the aquifer and acts as a confining layer because it is typical clay-rich, low-permeability shale. The confining nature of the Hennessey Group causes rainfall to remain near ground surface and flow laterally until it discharges to streams. The groundwater system at Tinker AFB has been divided into five hydrogeologic zones: the Hennessey Water Bearing Zone, the Upper Saturated Zone (USZ), the Lower Saturated Zone (LSZ), the Lower-Lower Saturated Zone (LLSZ), and the Production Zone (PZ). The USZ and LSZ are regionally considered to be in the upper third of the Garber-Wellington aquifer, and generally are present at depths of less than 200 feet below ground surface (bgs). The LLSZ is considered the lower half of the LSZ. The PZ generally is considered to be greater than 200 feet bgs, and is used for water supply at Tinker AFB and off-base locations (Tinker AFB 2001). Tinker AFB is located in a recharge area for these water-bearing zones; groundwater is derived primarily from precipitation and from infiltration of surface streams.

Groundwater at Tinker AFB is found under either water table or confined conditions. The depth to water ranges from a few feet to about 70 feet bgs depending on the local topography. Across Tinker AFB, water can sometimes be found in shallow, thin, discontinuous perched zones located above the aquifer. Shallow groundwater may discharge to surface streams (gaining stream) or be recharged by streams (losing stream) (OWRB 2006). Both situations occur at Tinker AFB along Crutcho Creek and Soldier Creek. In contrast, water in the Hennessey Water Bearing Zone generally flows to the northeast toward Crutcho Creek from higher topographic areas along the south boundary of the base (Tinker AFB 2002a).

Wetlands

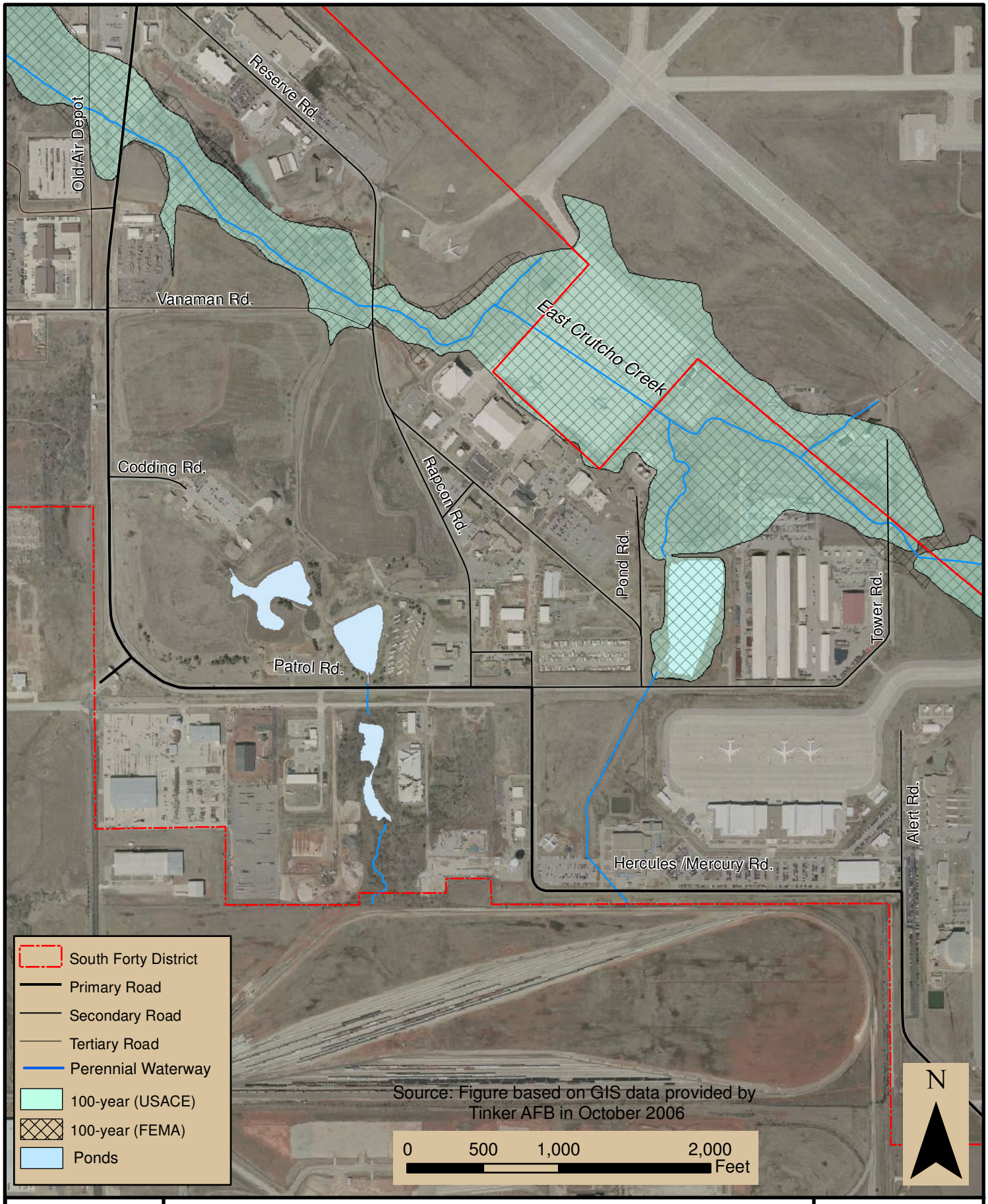
In 1995, approximately 65 acres of wetlands were identified on Tinker AFB by the US Fish and Wildlife Service (USFWS) using NWI criteria (Figure 3-4). This included creeks, ponds, drainage swales, and other wet areas. Of the 65 acres, 7.9 acres were later classified by the USACE as jurisdictional wetlands under the CWA. The 7.9 acres were divided among five wetland areas: Ground Water Treatment Plant (GWTP) wetland (0.5 acres); Fuel Control Facility wetland (0.8 acres); Greenway wetland (4.8 acres); Compressed Natural Gas (CNG) wetland (0.3 acres); and the Glenwood wetland (1.5 acres, on-base portion only). This excluded the off-base portion (8.5 acres) of the Glenwood wetland which was located immediately adjacent to and east of the base on county and private land (Tinker AFB 2005a).

In 1999, the Glenwood wetland was drained because it attracted waterfowl which presented an aircraft strike hazard. This reduced the total on-base wetland acreage to 6.4 acres. Mitigation for the Glenwood wetland removal included the construction of wetlands in the cities of Choctaw (two wetlands totaling 2.3 acres) and McCloud (3 acres), Oklahoma; Eagle Ridge Institute in Oklahoma City (3 acres); and at the Kids-We-Care site (three wetlands totaling 10 acres) south of Guthrie, Oklahoma. (Mitigation acreages are approximated [Tinker AFB 2005].)

All wetlands on Tinker AFB were man-made with the exception of the Glenwood Wetland, which was created by beaver activity. The GWTP wetland is located on a Superfund site and therefore is regulated under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) by the USEPA. The vegetation and soils of the GWTP wetland were removed in 1999 as part of a Soldier Creek remediation effort.

Floodplains

In October 2002, USACE, Southwestern Division-Tulsa District, completed a study for Tinker AFB to update the 100-year floodplains. The 100-year floodplains were reassessed for the Crutcho Creek Middle Branch, Upper Crutcho Creek (the Eastern Branch), and Upper Crutcho Creek (Western Branch) (USACE 2002). The Crutcho Creek 100-year floodplain encroaches on several portions of the South Forty District including portions of the 507 ARW Complex (Figure 3-5). Crutcho Creek, its tributaries, and Kuhlman Creek are bounded by 100-year floodplains designated by the FEMA. These floodplains affect approximately 121 acres of base land. No FEMA-designated floodplains exist along the smaller, intermittent streams that exist on the base (USACE 2002).



EA

Floodplains
South Forty District
Tinker Air Force Base

FIGURE
3-5

3.7 Biological Resources

3.7.1 Definition of Resources

Biological resources include native or naturalized plants and animals and the habitats in which they occur. Sensitive biological resources are defined as those plant and animal species listed as threatened or endangered, or proposed as such, by the USFWS. Federal and State Species of Concern are not protected by law; however, these species could become listed or protected at any time. Threatened and endangered species are federally and/or state protected plants and animals that are in danger of becoming extinct without protection. These species may be rare because of specialized habitat needs or habitat destruction. The Federal Endangered Species Act of 1973 protects listed species against killing, harming, harassment, or any action that may damage their habitat.

3.7.2 Existing Conditions

3.7.2.1 Regional Setting

Vegetation

The original vegetation cover in the central Oklahoma uplands consisted of mixed forests and woodlands interspersed with areas of open grasslands. These original plant communities have been radically altered through development, deforestation, intensive agriculture, and the introduction of invasive species (Tinker AFB 2007b). However, many smaller portions of these vegetative communities still comprise Oklahoma County's vegetation. Upland forests integrating with woodlands and prairie comprise Oklahoma County's primary vegetation community. Intermixed in this community are woodlands of oaks, upland forests of deciduous and evergreen trees, and grasslands intermixed with blue grama (*Bouteloua gracilis*), buffalo grass (*Bouteloua dactyloides*), and non-native grasses (Hoagland 1999). The county's vegetative community also includes riparian areas adjacent to streams, drainage channels, and in low-lying areas where water availability is relatively greater than the surrounding landscape (Tinker AFB 2002a).

Wildlife

Approximately 350 native vertebrate species and a much greater unknown number of invertebrates have historically occurred either in the Central Oklahoma/Texas Plains or Central Great Plains Ecoregions (Oklahoma Department of Wildlife Conservation [ODWC] 2006). Some species which probably occurred on this land during pre-settlement times include prairie dogs, bear, bison, wolves, elk, and horses. Numerous other species have been displaced by urban and industrial activities on and around Tinker AFB.

Threatened and Endangered Species

Five species are federally listed as threatened or endangered in Oklahoma County by the USFWS (Table 3-8). The State of Oklahoma has an endangered species act for plants and animals; those species listed on the Federal list correspond with those on the State list (Oklahoma Natural Heritage Inventory [ONHI] 2003).

Table 3-8. Special Status Plant and Animal Species of Oklahoma County

Scientific Name	Common Name	State Status[1]	Federal Status[1]
Birds			
Haliaeetus leucocephalus	Bald Eagle	T	T
Vireo atricapillus	Black-Capped Vireo	E	E
Sterna antillarum	Least Tern	E	E
Charadrius melodus	Piping Plover	T	T
Grus americana	Whooping Crane	E	E
Tyto alba	Barn Owl	CS, SS2	
Buteo swainsoni	Swainson's Hawk	SS2	
Athene cunicularia	Burrowing Owl	SS2	
Lanius ludovicianus migrans	Migrant Loggerhead Shrike	SS2	
Fish			
Notropis girardi	Arkansas River Shiner	T	T
Mammals			
Marmota monax	Woodchuck	SS2	
Reptiles			
Phrynosoma cornutum	Texas Horned Lizard	SS2	
Plants			
Penstemon oklahomensis	Oklahoma Penstemon	S3	

[1]Legal Status:

- E – Endangered
- T – Threatened
- CS – Statewide closed season (state ranking). It is unlawful at any time to possess or to kill individuals of these species or to remove any individuals of these species from their natural habitats.
- SS2 - Species of Special Concern (state ranking). These species have been identified by technical experts as possibly threatened of extirpation but for which additional information is needed.
- S3 - Rare and local in Oklahoma (though it may be abundant at some of its locations); in the range of 21-100 occurrences.

Sources: USFWS 2006b; Tinker AFB 2007b.

3.7.2.2 Tinker AFB

Vegetation

Just over one-half (2,620 acres) of the Tinker AFB land area has been developed for buildings, roads, pavements, railroads, and other structures. About 20 percent of the current land area

(1,036 acres) is periodically maintained grounds (i.e., semi-improved grounds) such as the airfield. Approximately 14 percent of the land (700 acres) is highly maintained grounds (i.e., improved grounds) such as lawns, athletic fields, and a golf course. The remaining 14 percent (684 acres) is not maintained (i.e., unimproved grounds), and includes areas such as the Urban Greenway and Glenwood areas (Tinker AFB 2007b).

Within the land areas that have been converted to urban and industrial use, the plant community is comprised primarily of turf grasses and ornamental trees and shrubs. The predominant turfgrass on Tinker AFB is Bermuda grass. Native buffalo grass is often found mixed with Bermuda grass. Other more rural areas are typically a mixture of exotic and native plants. Trees and shrubs are composed of native and exotic plants, and, contrary to pre-settlement plant distribution, many woody plants are found on upland as well as bottomland sites (Tinker AFB 2007b).

The Proposed Action area is dominated by previously disturbed ground with little or no natural vegetation occurring. The majority of the site is located on previously developed areas. The Proposed Actions site is relatively devoid of natural vegetation.

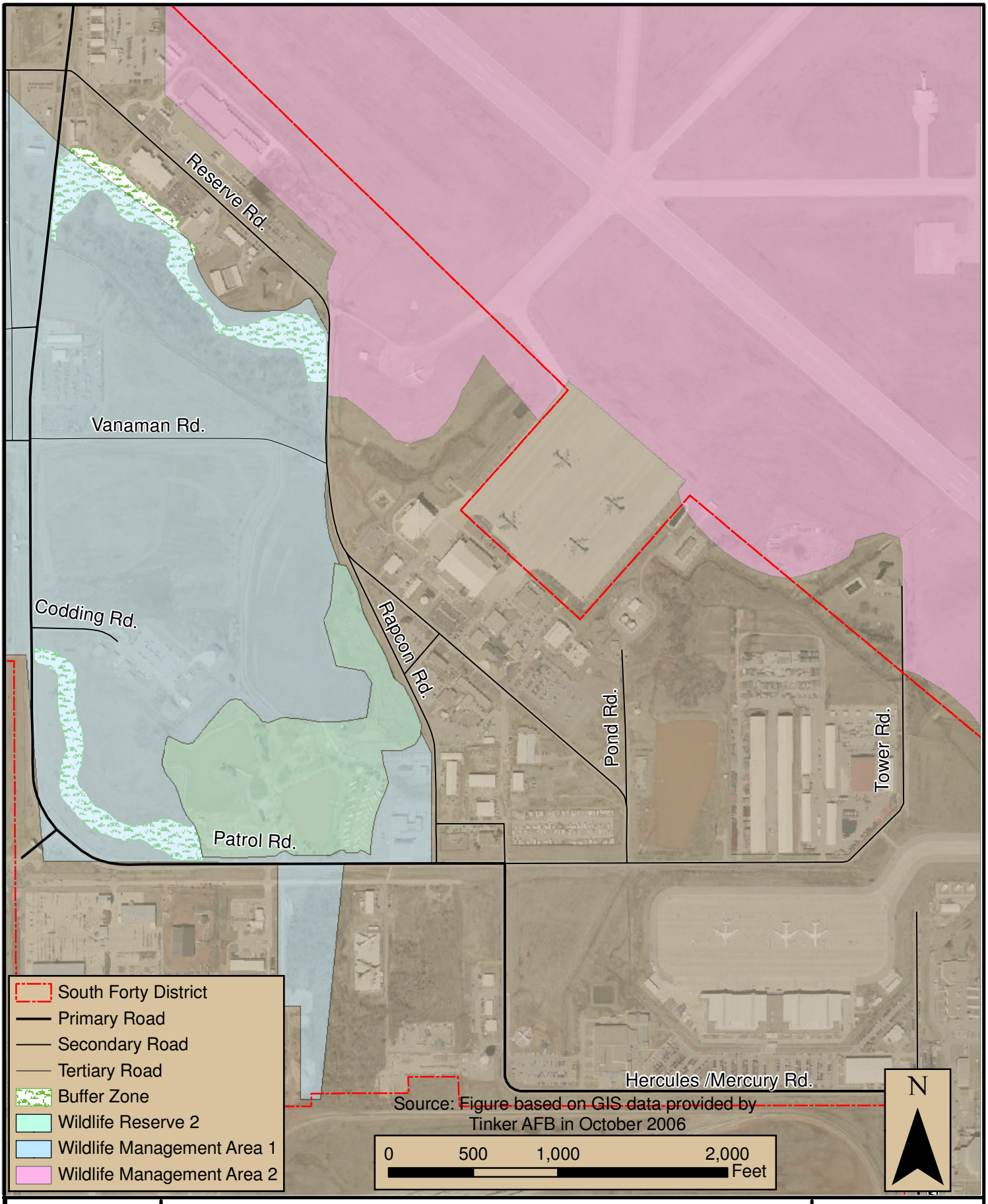
Wildlife

Wildlife at the 507 ARW Complex is limited to those species adapted to high levels of human activity and disturbance. The high level of disturbance and shortage of habitat limits wildlife utilization to areas of open space for occasional foraging (Figure 3-6). Common wildlife that may be found in the vicinity of the installation include Eastern fox squirrel (*Sciurus niger*), eastern cottontail rabbit (*Sylvilagus floridanus*), beaver (*Casto canadensis*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), mourning dove (*Zenaida macroura*), barn swallow (*Hirundo rustica*), red-winged blackbird (*Agelaius phoeniceus*), meadowlark (*Sturnella* spp.), scissor-tailed flycatcher (*Tyrannus florficatus*), bobwhite quail (*Colinus virginianus*), Texas horned lizard (*Phrynosoma cornutum*), three-toed box turtle (*Terrapene carolina*), and bullfrog (*Rana catesbeiana*) (Tinker AFB 2002a).

The results of fish surveys at Tinker AFB indicate that 23 species of fish occur on base. Five species occur in ponds on the base while 18 species of fish occur in those portions of Crutcho, Kuhlman, and Soldier Creeks that are located on Tinker AFB (Tinker AFB 2002a).

Threatened and Endangered Species

No plants on Tinker AFB are classified as a state species of concern or federally listed as threatened or endangered. However, the Oklahoma penstemon (Penstemon oklahomensis), which is classified as rare under the ONHI Program, is found at numerous locations on the base (Tinker AFB 2007b). Previous studies indicate that the Oklahoma penstemon does not grow in the area of the Proposed Action (Tinker AFB 2002a).



EA

Wildlife Management Areas
South Forty District
Tinker Air Force Base

FIGURE
3-6

Two Federally listed species are known to be seasonal residents of the local area, the Bald eagle (*Halieaeetus leucocephalus*) and the Whooping Crane (*Grus americana*). The nearest known sightings of the bald eagle are around Lake Aracadia and Lake Thunderbird (approximately 9 miles and 22 miles from Tinker AFB, respectively) (Tinker AFB 2002a). Base-wide surveys for the black-capped vireo (*Vireo atricapilla*) were conducted in 1993 and 1994, and none was sighted during these surveys (Tinker AFB 2002a).

There are several federal species of concern and/or Oklahoma State species of concern found on Tinker AFB. The Texas horned lizard (*Phrynosoma cornutum*), the barn owl (*Tyto alba*), the burrowing owl (*Athene cunicularia*), Swainson's hawk (*Buteo swainsoni*), and the migrant loggerhead shrike (*Lanius ludovicianus migrans*) are listed as federal or state species of concern (Tinker AFB 2007b). The USFWS defines species of concern for the future well-being of the species, but the species does not receive any protection under the Endangered Species Act. AFI 32-7064 states that species having such a status should be considered in future planning and facility siting as well as provided protection wherever possible.

All DoD installations are required to perform a threatened and endangered species survey prior to any activities that disturb habitat that potentially supports such species. However, there are no threatened or endangered species known to occur in the immediate vicinity of the 507 ARW Complex. Further, no designated critical habitat or wilderness areas are located on or in the immediate vicinity of the base (USFWS-FR 1978 and 2005; USFWS 2006b).

3.8 Transportation and Circulation

3.8.1 Definition of Resource

Transportation and circulation refer to the movement of vehicles throughout a road and highway network. Primary roads are principal arterials, such as major interstates, designed to move traffic and not necessarily to provide access to all adjacent areas. Secondary roads are arterials such as rural routes and major surface streets which provide access to residential and commercial areas, hospitals, and schools.

3.8.2 Existing Conditions

3.8.2.1 Regional and Local Circulation

Tinker AFB is located within the city limits of Oklahoma City, approximately 5 miles southeast of downtown. Oklahoma City is served by a network of interstates and local and regional arterial roads. Four interstates, I-40, I-35, I-240, and I-44, pass through Oklahoma City. I-40 connects the east and west coasts; I-35 bisects the US from northeast of Duluth, Minnesota to Laredo, Texas; and I-44 connects St. Louis, Missouri to Wichita Falls, Texas. I-240 connects I-40 to I-44 in the southern portion of Oklahoma City.

Three arterial roads, including Sooner Road, Southeast 29th Street, and Douglas Boulevard, and two interstates, I-40 and I-240, provide access to Tinker AFB. Sooner Road is a north-south, four-lane arterial that forms part of the western border of the base. Southeast 29th Street is an

east-west arterial that forms the northern boundary of the base. Douglas Boulevard is a four-lane, north-south arterial that forms the eastern boundary of the base and provides access to the base through the Lancer Gate. I-40 runs along the northern boundary of the base and provides access to the base via Air Depot Boulevard and Tinker Gate. I-240, an east-west interstate located south of the base, provides access to the base via Sooner Road, Air Depot Boulevard, and Douglas Boulevard.

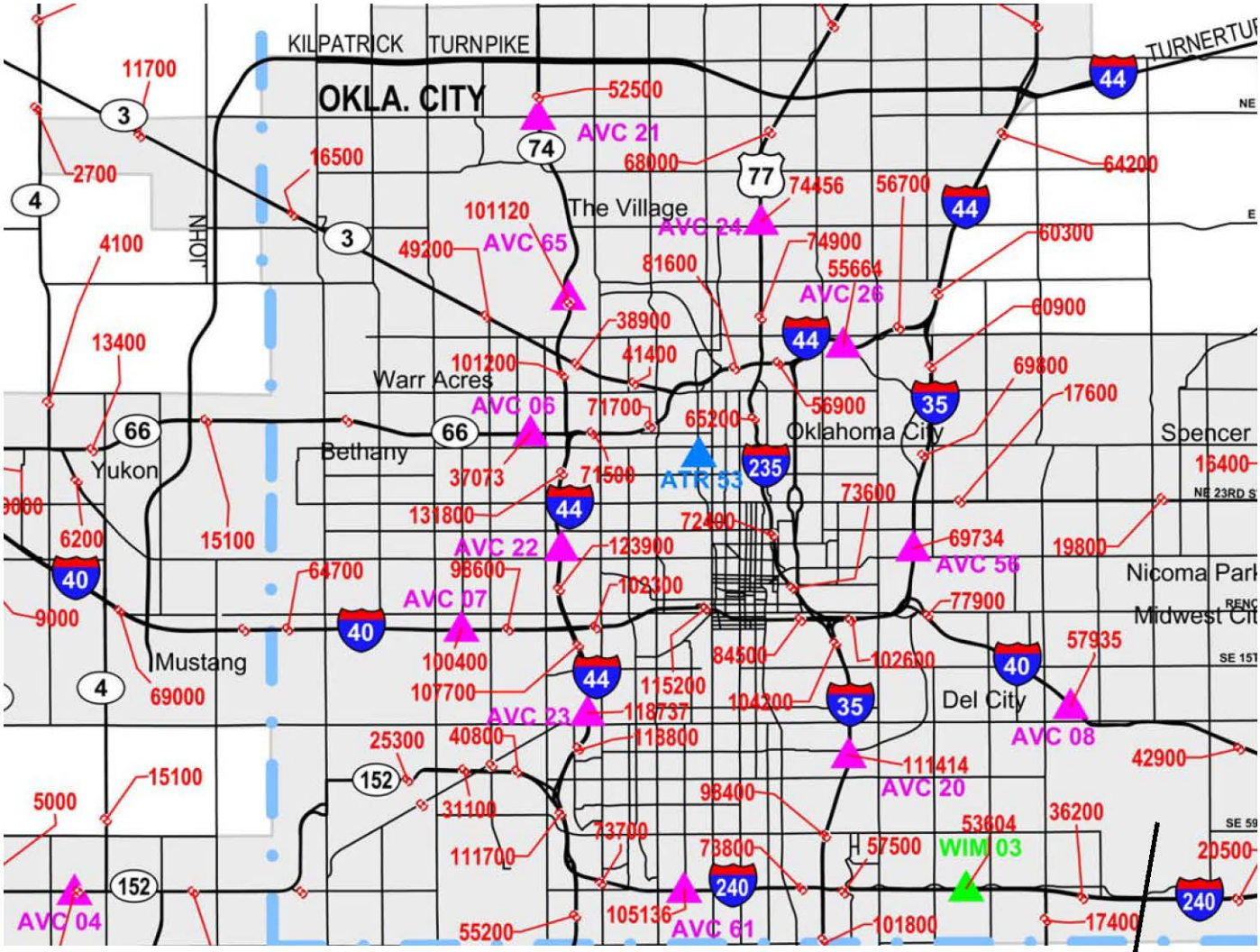
The regional transportation network and average daily traffic counts are shown in Figure 3-7. In 2005, the reported average daily traffic volume on I-40 west of Tinker Gate and west of Air Depot Boulevard, was reported to be 57,935 vehicles and east of Eaker Gate, near the Douglas Boulevard Interchange, was reported to be 42,900 vehicles (Oklahoma Department of Transportation 2006).

3.8.2.2 Tinker AFB

The roadway network on Tinker AFB is shown in Figure 3-8. Air Depot Road, East Drive, Arnold Road, and Patrol Road are the major arterial roads. A network of primarily two-lane collector roads provides access to facilities on the base and to the arterial network. McNarney Avenue, Reserve Road, and Mitchell Avenue are the primary collector roads.

Ten gates are located on the perimeter of Tinker AFB (Tinker AFB 2005a). The Tinker Gate (Gate #1) and Lancer Gate (Gate #20) are open 24 hours a day, 7 days a week. The remaining gates are open at various times to accommodate peak flow; these gates and their associated base access routes include the following:

- Eaker Gate (Gate #2), via SE 29th Street and F Avenue,
- Gott Gate (Gate #34), via Air Depot Boulevard,
- Vance Gate (Gate #40), via Sooner Road and Arnold Avenue,
- Hope Gate (38 EIG), via SE 59th Street,
- Turnbull Gate (Gate #3) at A Avenue and SE 29th Street
- Hruskocy Gate (Gate #7) at Perimeter Road and Industrial Boulevard,
- Liberator Gate (Gate #21) at Entrance Road A and Douglas Boulevard, and
- Marauder Gate (Gate #29) at SE 59th St and Douglas Boulevard.



N

Tinker AFB

OKLAHOMA DEPARTMENT OF TRANSPORTATION
PLANNING & RESEARCH DIVISION
DATA ANALYSIS SECTION
200 N.E. 21ST. STREET
OKLAHOMA CITY, OKLAHOMA 73105

LEGEND

STATE HIGHWAY SYSTEM

WIM AVC ATR

1234 (VPD)

ATR- AUTOMATIC TRAFFIC RECORDER SITE: RECORDS TRAFFIC VOLUME EACH DAY

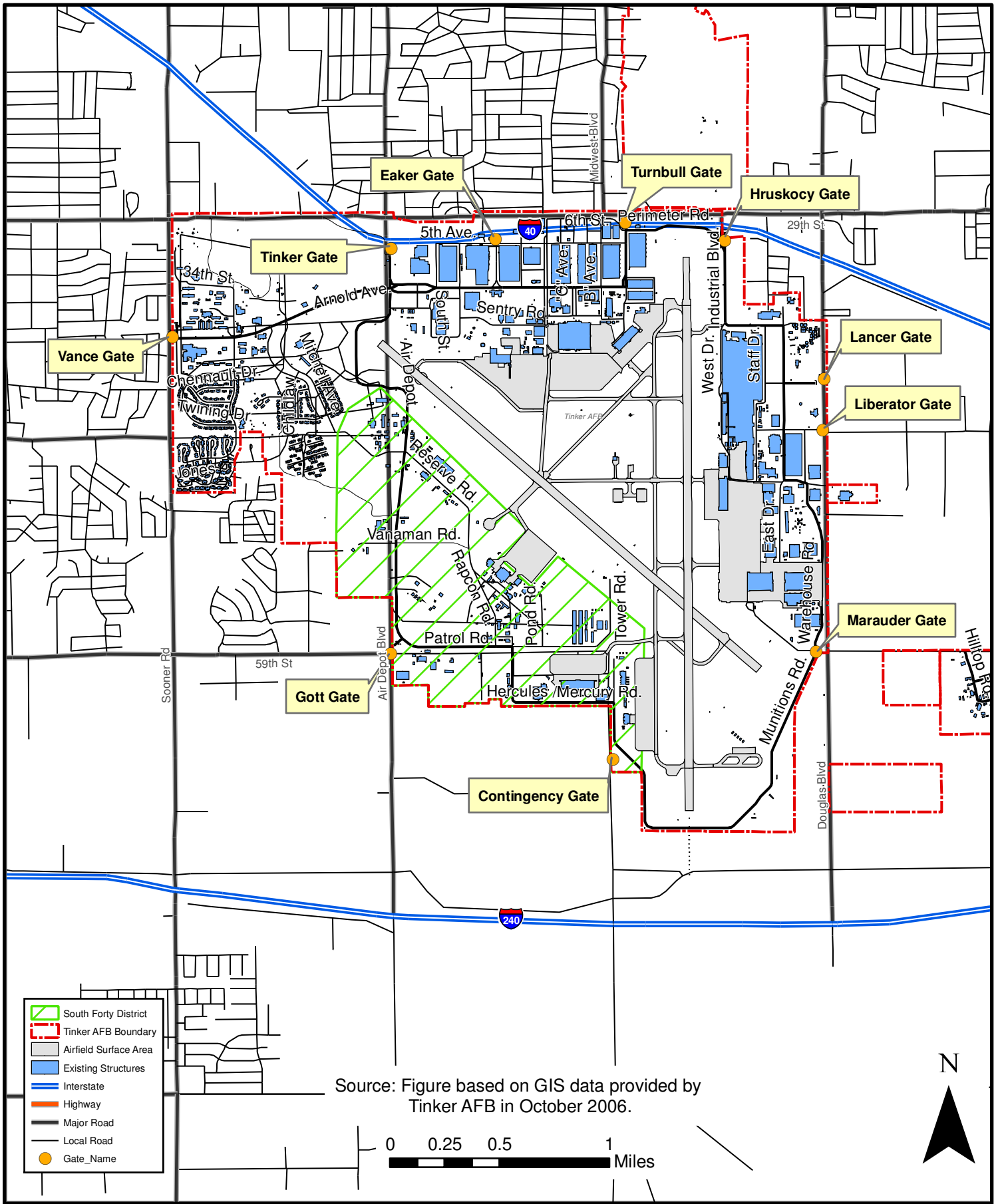
AVC- AUTOMATIC VEHICLE CLASSIFICATION SITE: RECORDS TRAFFIC VOLUME AND VEHICLE CLASSIFICATION EACH DAY

WIM- WEIGH-IN-MOTION SITE: RECORDS VEHICLE VOLUME, VEHICLE CLASSIFICATION AND APPROXIMATE AXLE WEIGHTS EACH DAY

EA

2005 Annual Average Daily Traffic
Oklahoma City

FIGURE
3-7



EA

Transportation Map
Tinker Air Force Base

FIGURE
3-8

Parking

The USAF has established guidelines intended to ensure that adequate parking is available at USAF installations; according to these standards, the ratio of available parking spaces to personnel should be no less than 0.75. Tinker AFB reports that 750 parking spaces are currently available for privately owned vehicles (POVs) of the 507 ARW. The total number of 507 ARW employees at Tinker AFB (including both full-time and part-time reservists) is approximately 1,100. Therefore, the ratio of available parking spaces to personnel on drill weekends when all employees are present is .07 less than the 0.75 USAF standard. Parking is a constraint when all 507 ARW personnel are on base; however, it is rare that all 1,100 personnel are on site at the same time. To alleviate the parking issue, the 507 ARW reservists are broken down into groups and the training weekends for the groups are staggered. Gate counts were not available at the time of this report to fully evaluate the current base-wide parking and traffic constraints.

3.9 Visual Resources

3.9.1 Definition of Resource

Visual resources are defined as the natural and manufactured features that comprise the aesthetic qualities of an area. These features form the overall impressions that an observer receives of an area or its landscape character. Landforms, water surfaces, vegetation, and manufactured features are considered characteristic of an area if they are inherent to the structure and function of a landscape.

3.9.2 Existing Conditions

3.9.2.1 Regional

The visual characters of Oklahoma City, Midwest City, and Del City are consistent with other comparable cities in the Midwest, ranging from tall buildings in the Oklahoma City downtown area to large agricultural and residential properties in more rural areas. Properties adjacent to Tinker AFB vary widely and include commercial, industrial, residential, and vacant properties.

3.9.2.2 Tinker AFB

Tinker AFB has a visual character typical of a military aviation complex with a mixture of large industrial facilities and hangars, as well as smaller structures for administrative and support functions. A network of roadways and sidewalks provide routes for vehicle and pedestrian traffic. Various outdoor recreation areas including the Urban Greenway consisting of a 110-acre wildlife and nature corridor, a golf course, athletic fields, bicycle paths, and other facilities are available for the base's population. Tinker AFB utilizes the Architectural Compatibility Guide developed in 2003 to guide the planning and design of facilities at the base to ensure building materials, design, signage, and landscape components are incorporated into new facilities and site improvements to present a cohesive and visually pleasing image (Tinker AFB 2005a).

Facilities within the seven architectural districts vary in character as a result of the land use and function. The South Forty District is generally comprised of concrete panel constructed facilities, with newer facilities being brick veneer. The landscape of Tinker AFB is primarily composed of ornamental trees, shrubs, and turf grass and varies from areas with large mature trees and shrubs to areas with little or no landscaping depending on the function of the area. Areas of the natural landscape, including such resources as wetlands, greenways, riparian corridors, have been preserved for their ecological significance as well as to enhance the attractiveness of the base.

3.10 Cultural Resources

3.10.1 Definition of Resource

Cultural resources represent and document activities, accomplishments, and traditions of previous civilizations and link current and former inhabitants of an area. Depending on their conditions and historic use, these resources may provide insight to living conditions in previous civilizations and may retain cultural and religious significance to modern groups.

Archaeological resources comprise areas where prehistoric or historic activity measurably altered the environment or deposits of physical remains (e.g., arrowheads, bottles) discovered therein. Architectural resources include standing buildings, districts, bridges, dams, and other structures of historic or aesthetic significance. Architectural resources generally must be more than 50 years old to be considered for inclusion in the National Register of Historic Places (NRHP), an inventory of culturally significant resources identified in the US; however, more recent structures, such as Cold War-era resources, may warrant protection if they have the potential to gain significance in the future. Traditional cultural resources can include archaeological resources, structures, neighborhoods, prominent topographic features, habitats, plants, animals, and minerals that Native Americans or other groups consider essential for the persistence of traditional culture.

The principal federal law addressing cultural resources is the National Historic Preservation Act (NHPA) of 1966, as amended (16 US Code [USC] Section 470), and its implementing regulations (36 CFR 800). The regulations, commonly referred to as the Section 106 process, describe the procedures for identifying and evaluating historic properties; assessing the effects of federal actions on historic properties; and consulting to avoid, reduce, or minimize adverse effects. As part of the Section 106 process, agencies are required to consult with the State Historic Preservation Office (SHPO).

The term “historic properties” refers to cultural resources that meet specific criteria for eligibility for listing on the NRHP; historic properties need not be formally listed on the NRHP. Section 106 does not require the preservation of historic properties, but ensures that the decisions of federal agencies concerning the treatment of these places result from meaningful considerations of cultural and historic values and of the options available to protect the properties.

DoD American Indian and Alaska Native Policy governs the department's interactions with federally recognized tribes. The policy outlines DoD trust obligations, communication procedures with tribes on a government-to-government basis, consultation protocols, and actions to recognize and respect the significance that tribes ascribe to certain natural resources and properties of traditional cultural or religious importance. The policy requires consultation with federally recognized tribes for proposed activities that could significantly affect tribal resources or interests.

3.10.2 Existing Conditions

3.10.2.1 Regional

Inhabited by Plains tribes and sold to the United States by France as a part of the 1803 Louisiana Purchase, much of what is now Oklahoma was subsequently designated as Native American Territory. As such, it was intended to provide a new home for tribes forced by the federal government to abandon their ancestral lands in the southeastern United States. Many of those forced to relocate in the 1830s were from what were called the Five Civilized Tribes—Cherokee, Choctaw, Chickasaw, Creek, and Seminole—who soon set up independent nations in the new territory. After the Civil War, however, the pressure of westward expansion brought railroads into the Native American Territory, where the US government began to declare some land available for settlement. Prairie land surrounding a Santa Fe railroad boxcar station was designated as a townsite when presidential proclamation opened the central portion of the Native American Territory to claimtakers on noon of April 22, 1889. Thousands crossed the borders of the "unassigned lands" when a cannon was fired initiating the official start for the event known as the Oklahoma Land Run. By sunset of that day the land run had produced a tent city of 10,000 people on the townsite, which eventually became Oklahoma City (Oklahoma City Convention and Visitors Bureau [OCCVB 2006]).

The settlement attained official status in 1890, just a few weeks after the western half of the Native American Territory was redesignated Oklahoma Territory, named for a Choctaw phrase meaning "red man." Incorporated as Oklahoma City on May 23, 1890, Oklahoma City swiftly became one of the new territory's largest cities. More railroad connections to the city helped make it a center for trade, milling, and meat packing. The Oklahoma and Native American territories merged and were admitted to the union as the state of Oklahoma in 1907. Oklahoma City became the state capital in 1910 (OCCVB 2006).

3.10.2.2 Tinker AFB

Two historic property types have been identified at Tinker AFB: facilities associated with aircraft construction and modification, 1942-1946; and facilities associated with the Cuban Missile Crisis, 1962. The Douglas Cargo Aircraft manufacturing area has been designated as a historic district contributing seven buildings (Tinker AFB 2002a). Tinker also has five individually eligible buildings (1, 208, 230, 240, and 4029) (Tinker AFB 2005a).

Approximately 131 known archaeological sites are present in areas adjacent to the Base (Tinker AFB 2002a). In the fall of 2000, an archeological survey was completed on a 500-acre area located at the northwest corner of the Base. It determined that the area along Crutcho Creek is most likely to contain buried archeological sites along the flood deposits of the creek (Tinker AFB 2002a).

Tinker AFB has previously initiated consultations with three Native American tribes (Seminole Nation, Osage Nation, and Muskogee Nation). They have verbally commented that they have no Native American Graves Protection and Repatriation Act (NAGPRA) or American Indian Religious Freedom Act (AIRFA) concerns about Tinker AFB property. Additionally, they have communicated that Tinker AFB property is not suitable for religious or burial sites (Tinker AFB 2001).

3.11 Socioeconomics

3.11.1 Definition of Resource

Socioeconomics is defined as the basic attributes and resources associated with the human environment, particularly population and economic activity. Human population is affected by regional birth and death rates as well as net in- or out-migration. Economic activity typically comprises employment, personal income, and industrial growth. Impacts on these two fundamental socioeconomic indicators can also influence other components such as housing availability and public services provision.

Socioeconomic data in this section are presented at the county, state, and national level to analyze baseline socioeconomic conditions in the context of regional, state, and national trends. Data have been collected from previously published documents issued by Federal, state, and local agencies (e.g., US Census Bureau) and from state and national databases (e.g., US Bureau of Economic Analysis [BEA] *Regional Economic Information System*).

3.11.2 Existing Conditions

Population

Oklahoma County is one of 77 counties in the state. The City of Oklahoma is the most populated city in the state, with a 2005 population of 515,751 people with the next largest city, Tulsa, housing a population of 370,447 people (US Census Bureau 2006).

Between 1990 and 2004, the population of the Oklahoma City increased by a total of 16.0 percent (Table 3-9). The population growth rate in the Oklahoma City exceeded that of Oklahoma County, Oklahoma State, and the nation. Oklahoma County's population is expected to increase to 701,400 by 2010, an increase of 16.8 percent above 2005 levels (Oklahoma Department of Commerce 2002).

Table 3-9. Oklahoma Population Overview: 1990-2005

Jurisdiction	Estimated 2005	Census 2000	Census 1990	Total Percent Change (1990-2005)
United States	288,378,137	281,421,906	248,709,873	15.9%
Oklahoma	3,433,496	3,450,654	3,145,585	9.2%
Oklahoma County	666,904	660,408	599,611	11.2%
City of Oklahoma	515,751	506,132	444,724	16.0%

Source: US Census Bureau 2006.

3.11.2.1 Job Growth and Unemployment

Employment

The top five employers (by number of employees) in the Oklahoma City area are the State of Oklahoma, Tinker AFB, the United States Postal Service, the University of Oklahoma, and Oklahoma City Public Schools (Greater Oklahoma City Chamber 2006) (Table 3-10). The employment sectors providing the greatest number of jobs in Oklahoma County are: *services* and *government and government enterprises (*Table 3-11). Combined, these two sectors provide jobs for 60.7 percent of the industrial workforce which totaled 311,691 people in 2004. Many industrial sectors experienced a decrease in the total number of employees between 1990 and 2004, the largest decrease by percentage was *agriculture, forestry, and mining*, and the largest decrease by number of employees was in *retail trade*. Overall county employment levels increased between 1990 and 2004, experiencing growth of 76,232 jobs (17.4-percentgain), mostly in the *services* (increased by 82.9 percent) and *construction* (increased by 49.0 percent) industries (BEA 2006).

Table 3-10. Top Employers in the Oklahoma City Area

Employer	Product/Service	Number of Employees
State of Oklahoma	Government	38,100
Tinker AFB	Military	26,000
United States Postal Service	Government	8,706
University of Oklahoma	Education	7,902
Oklahoma City Public Schools	Education	5,900
FAA Mike Monroney Aeronautical Center	Government	5,600
City of Oklahoma	Government	4,320
INTEGRIS Baptist Medical Center	Health	4,102

Source: Greater Oklahoma City Chamber 2006.

Table 3-11. Jobs by Industrial Sector, Oklahoma County (1990, 2000, 2004)

Industrial Sector	1990	2000	2004	Total Change 1990-2004
Ag., Forestry, & Fishing	2,465	3,897	345	-86.0%
Mining	20,095	13,119	15,209	-24.3%
Construction	15,391	22,331	22,931	49.0%
Manufacturing	39,399	42,047	30,213	-23.3%
Transportation & Public Utilities	20,299	27,320	15,343	-24.4%
Wholesale Trade	22,621	26,892	20,420	-9.7%
Retail Trade	71,273	88,205	54,089	-24.1%
Finance, Insurance, Real Estate	33,169	38,273	42,991	29.6%
Services	123,648	174,046	226,182	82.9%
Govt. and Govt. Enterprises	88,640	85,056	85,509	-3.5%
Total	**437,000**	**521,186**	**513,232**	**17.4%**

Source: US BEA 2006.

Unemployment

In 2005, the unemployment rate in Oklahoma County was 7.6 percent, greater than the state (6.6 percent) and the nation (6.9 percent). In general, the nation experienced an increase in unemployment between 2000 and 2005. During this time, Oklahoma County's unemployment rate increased from 3.3 to 7.6 percent, during the same time period Oklahoma State's unemployment rate increased 3.3 percent and the US unemployment rate increased 3.2 percent (US Census Bureau 2006).

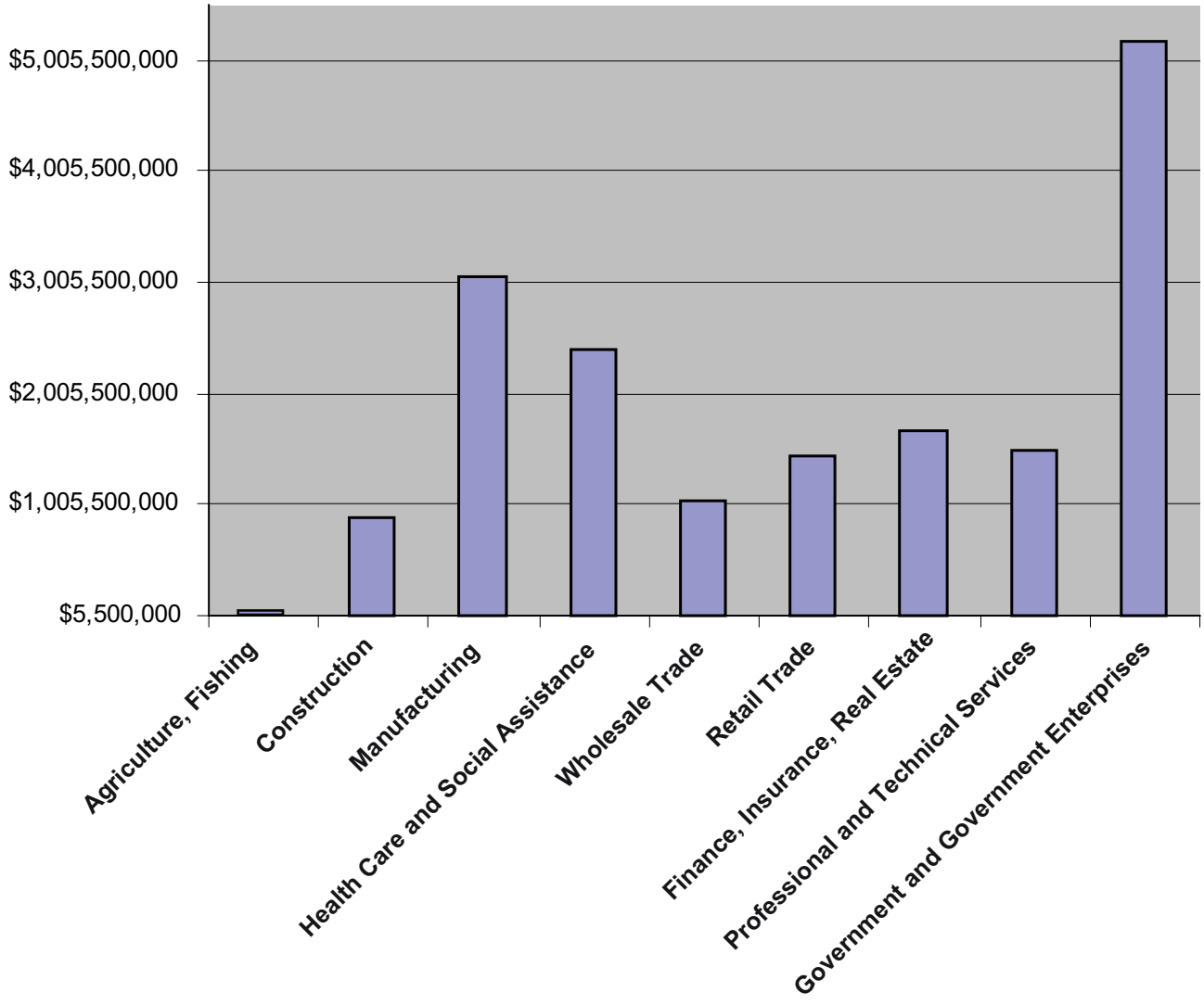
Earnings

Figure 3-9 presents Oklahoma County earnings per industrial sector in 2004, when the county had total earnings of approximately $22.4 billion. Greatest earnings in 2004 were reported in the *government and government enterprises* ($5.2 billion), *other services* ($3.4 billion), *manufacturing* ($3.0 billion) *health care and social assistance* ($2.4 billion), and *finance, insurance, and real estate* ($1.7 billion) sectors. Included within the *government* sector are *state and local, Federal civilian,* and *Federal military*, and *Federal civilian* categories which reported 2005 earnings of $2.3 billion, $2.2 billion, and $719 million, respectively (US BEA 2006).

Per capita personal income in Oklahoma County for 2004 was $32,980, 118.5 percent of the state average ($27,840) and 99.8 percent of the national average ($33,050). Average annual growth rate of per capita personal income in Oklahoma County was 5.5 percent between 1990 and 2004. The average annual growth rate for the state was 5.1 percent and for the nation was 4.9 percent during that time period (BEA 2006).

3.11.3 Tinker AFB

Tinker AFB comprises one of Oklahoma's largest industrial complexes and the state's second largest single employer, with an annual military and civilian payroll in excess of $737 million. More than 25,000 civilian and military personnel are assigned to the base (Tinker AFB 2004a).



Source: U.S. BEA 2006

EA	Annual Earnings Per Industrial Sector Oklahoma County	FIGURE 3-9

3.12 Environmental Justice and Protection of Children

3.12.1 Definition of Resource

In 1994, Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations,* was issued to focus attention of federal agencies on human health and environmental conditions in minority and low-income communities and to ensure that disproportionately high and adverse human health or environmental effects on these communities are identified and addressed.

Because children may suffer disproportionately from environmental health risks and safety risks, Executive Order 13045, *Protection of Children From Environmental Health and Safety Risks*, was introduced in 1997 to prioritize the identification and assessment of environmental health risks and safety risks that may affect children and to ensure that federal agencies' policies, programs, activities, and standards address environmental health risks and safety risks to children.

Data used for the environmental justice and protection of children analysis were collected from the *US Census Bureau 2005 American Community Survey.*

3.12.2 Existing Conditions

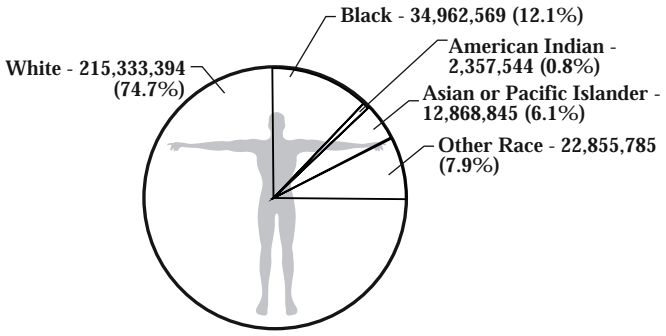
3.12.2.1 Minority and Low-Income Population

In order to comply with Executive Order 12898, ethnicity and poverty status in the vicinity of the Tinker AFB were examined and compared to regional, state, and national data to determine if any minority or low-income communities could potentially be disproportionately affected by implementation of the Proposed Action.

Based on data obtained from the 2005 Census estimates, the percentage of population in Oklahoma City living below the poverty level in 2005 was 18.7 percent (Figure 3-10). This poverty rate was higher than that of Oklahoma County (18.0 percent), the State of Oklahoma (16.5 percent), and the national average (13.3 percent) (US Census Bureau 2006). Most of Oklahoma City's population that has the lowest median income is concentrated in the core of Oklahoma City. However, patches of residents north of Tinker AFB have also been identified as having low median incomes (less than $25,000 annual income) (Oklahoma City 2003).

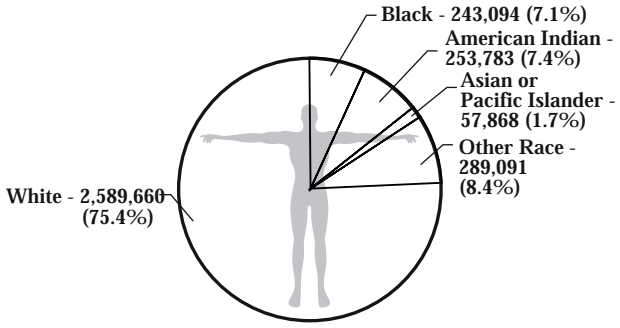
Oklahoma has the largest American Indian population of any state (Oklahoma Department of Tourism and Recreation 2006). The percentage of minority residents in Oklahoma City (33.0 percent) is highest among the four geographic areas examined for this analysis (Figure 3-10). By comparison, minority residents comprise lower percentages of the total population in Oklahoma County (30.9 percent), the State of Oklahoma (24.6 percent), and the nation (26.9 percent) (US Census Bureau 2006). Minority populations tend to be concentrated in regions of the core of Oklahoma City and not near Tinker AFB (Oklahoma City 2003).

United States



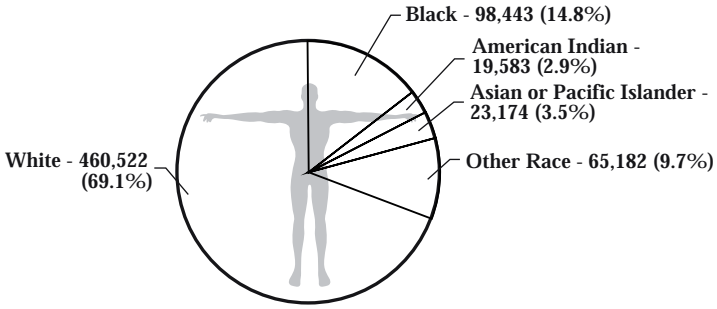
Total Population 288,378,137

State of Oklahoma



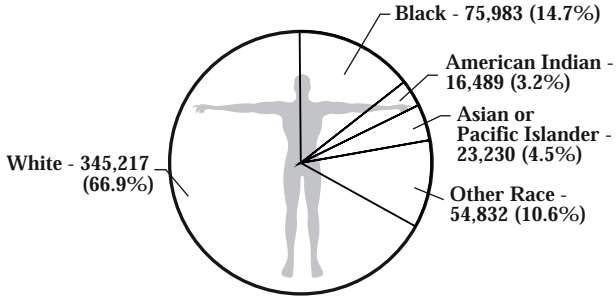
Total Population 3,433,496

Oklahoma County



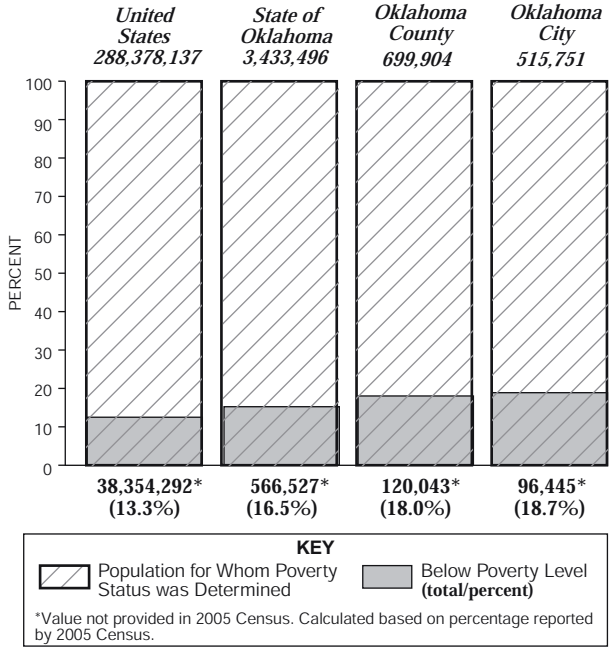
Total Population 666,904

Oklahoma City



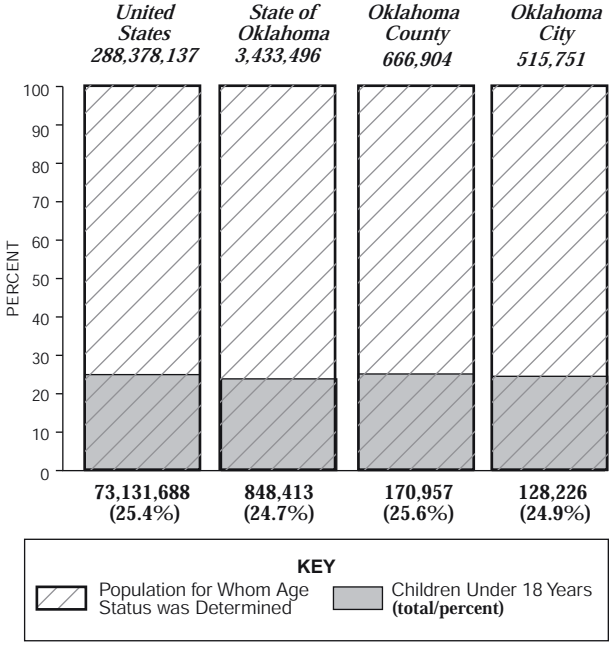
Total Population 515,751

Poverty Status



*Value not provided in 2005 Census. Calculated based on percentage reported by 2005 Census.

Age Distribution



Source:
U.S. Census Bureau 2006. 2005 American Community Survey.
Transmitted to AMEC via the Internet: http://factfinder.census.gov/home/saff/main.html on 22 November 2006

EA	Minority and Poverty Levels in Oklahoma City Oklahoma County	FIGURE 3-10

3.12.2.2 Protection of Children

In order to comply with Executive Order 13045, the number of children under age 18 was examined for those living in Oklahoma City and compared to county, state, and national levels. Additionally, locations where children may be concentrated (e.g., child care centers, schools, and parks) were identified to address potentially disproportionate health and safety risks to children that may result from implementation of the Proposed Action.

In 2005, approximately 24.7 percent of the total state population was comprised of children under age 18. This compares to 24.9 percent for Oklahoma City, 25.6 percent for Oklahoma County, and 25.4 percent for the nation (US Census Bureau 2006).

There is housing located in the northwest section of Tinker AFB which is directly accessed through the Vance Gate. In 2005, there were 483 children living on base.

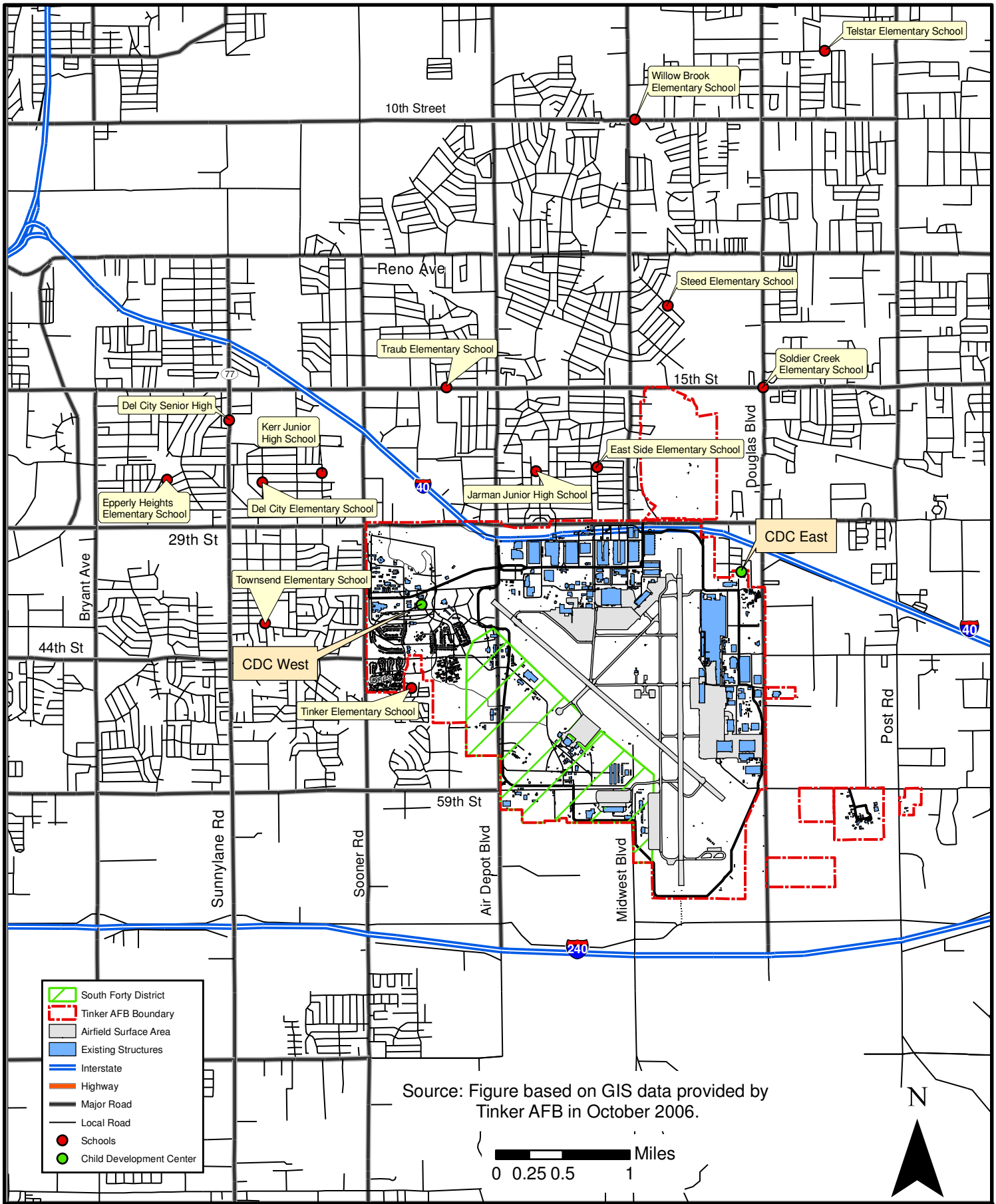
Schools

Oklahoma City is served by the Oklahoma City Public School District. It encompasses 82 schools educating approximately 37,216 students (Oklahoma City Public Schools 2006). Thirteen schools are located within a 1-mile radius of Tinker AFB, including 10 elementary schools (Table 3-12 and Figure 3-11). There are no schools located on Tinker AFB; however there are two child development centers (CDCs) and a youth center located on the base. The CDCs, CDC East and CDC West, have 150 and 198 children respectively. CDC East is located in the northeast corner of the base in the community services area and CDC West is located within the housing area in the northwest section of the base.

Table 3-12. Schools Located in the Vicinity of Tinker AFB

School	Number of Students
Del City Elementary School	458
Del City Senior High	1,064
East Side Elementary School	477
Epperly Heights Elementary School	694
Jarman Junior High School	533
Kerr Junior High School	671
Soldier Creek Elementary School	604
Steed Elementary School	663
Telstar Elementary School	347
Tinker Elementary School	454
Townsend Elementary School	529
Traub Elementary School	419
Willow Brook Elementary School	512

Source: National Center for Educational Statistics 2006



EA

Schools and Child Development Centers
Tinker Air Force Base and Vicinity

FIGURE
3-11

3.13 Hazardous Materials and Wastes

3.13.1 Definition of Resource

Hazardous materials are defined as substances with strong physical properties of ignitability, corrosivity, reactivity, or toxicity which may cause an increase in mortality, a serious irreversible illness, incapacitating reversible illness, or pose a substantial threat to human health or the environment. Hazardous wastes are defined as any solid, liquid, contained gaseous, or semisolid waste, or any combination of wastes which pose a substantial present or potential hazard to human health or the environment.

Issues associated with hazardous materials and wastes typically center around underground storage tanks (USTs); aboveground storage tanks (ASTs); and the storage, transport, and use of pesticides, bulk fuel, and petroleum, oils, and lubricants (POLs). When such resources are improperly used they can threaten the health and well-being of wildlife species, botanical habitats, soil systems, water resources, and people.

To protect habitats and people from inadvertent and potentially harmful releases of hazardous substances, the DoD has dictated that all facilities develop and implement a *Hazardous Waste Management Plan* and a *Spill Prevention and Response Plan*. Also, DoD has developed the Defense Environmental Restoration Program (DERP), intended to facilitate thorough investigation and cleanup of contaminated sites located at military installations. These plans and programs, in addition to established legislation (e.g., CERCLA and Resource Conservation and Recovery Act [RCRA]) effectively form the "safety net" intended to protect the ecosystems on which most living organisms depend.

3.13.2 Existing Conditions

3.13.2.1 Hazardous Materials

A large amount of hazardous materials are utilized to perform the mission of Tinker AFB. The Hazardous Materials Management Program (HMMP) manages the procurement and use of hazardous materials at the base. The HMMP functions through the Hazardous Materials Pharmacy, which consists of a decentralized Hazardous Material Pharmacy Cell and a Hazardous Materials electronic tracking system, the Hazardous Material Management System (HMMS). The HMMS database management system performs the following automated functions:

- Tracks training, exposure, inventory, and personal protective equipment,
- Dispenses hazardous materials according to units of use,
- Serves as central issue point for Just-In-Time control and issue,
- Creates on-line Material Safety Data Sheets (MSDS), and
- Maintains hazardous materials control by authorized user, zone, and task.

The tracking system provides the data necessary to meet reporting requirements, assess processes for pollution prevention opportunities, and measure success in minimizing hazardous materials usage (Tinker AFB 2006e).

Tinker AFB's OC-ALC Plan 19-2 *Spill Prevention and Emergency Response Plan for Hazardous and Extremely Hazardous Material and Spill Prevention Control and Countermeasures Plan* (Tinker AFB 2004b) presents specific procedures for preparing for and responding to inadvertent discharges of oil or releases of hazardous substances at the base. In 2002, Tinker AFB developed the Storm Water Pollution Prevention Plan (SWPPP) to comply with the conditions of the Multi-Section General Permit for Storm Water Discharges Associated with Industrial Activities (Permit Number GP-00-01) (Tinker AFB 2002b). The SWPPP is noted as a supporting plan in OC-ALC Plan 19-2. The SWPPP provides base-wide and facility-specific best management practices (BMPs) to reduce pollutants in storm water discharges from the base. The BMPs for Tinker AFB include:

- Source controls,
- Management practices,
- Preventive maintenance,
- Spill Prevention and response,
- Erosion and sediment controls, and
- Identification of storm water pollution prevention personnel.

3.13.2.2 Hazardous Waste Generation and Accumulation

Tinker AFB is permitted under RCRA as a Large Quantity Generator (LQG) and a Treatment, Storage and Disposal Facility (TSDF) of hazardous waste. The RCRA permit (number OK 1571724391) was issued to Tinker AFB in August 2002 by ODEQ, the primary oversight agency for RCRA compliance in Oklahoma (Tinker AFB 2006e). Hazardous wastes at the base are managed in accordance with the most recent Hazardous Waste Management Instruction guidelines (Tinker AFB Instruction 32-7004), which is included as Attachment 6 of the RCRA permit. Compliance with the provisions, regulations, and mandates put forth in Tinker AFB Instruction 32-7004 is mandatory for actions relating to hazardous waste on the installation. The purpose of the guidelines is to ensure safe and effective collection, handling, and disposal of hazardous waste on the installation in a manner that complies with applicable DoD, Air Force, federal, and State laws and regulations (Tinker AFB 2005a). Specific procedures for preparing for and responding to inadvertent discharges of oil or releases of hazardous substances at the base is provided in Tinker AFB's OC-ALC Plan 19-2 (Tinker AFB 2004b).

The largest amount of hazardous waste at the base is generated by aircraft and jet engine maintenance and overhaul activities. These activities include:

- Preparation of aircraft skins and structural members,
- Paint removal and application, degreasing, metal etching and carbon removal of engines, and
- Abrasive blasting.

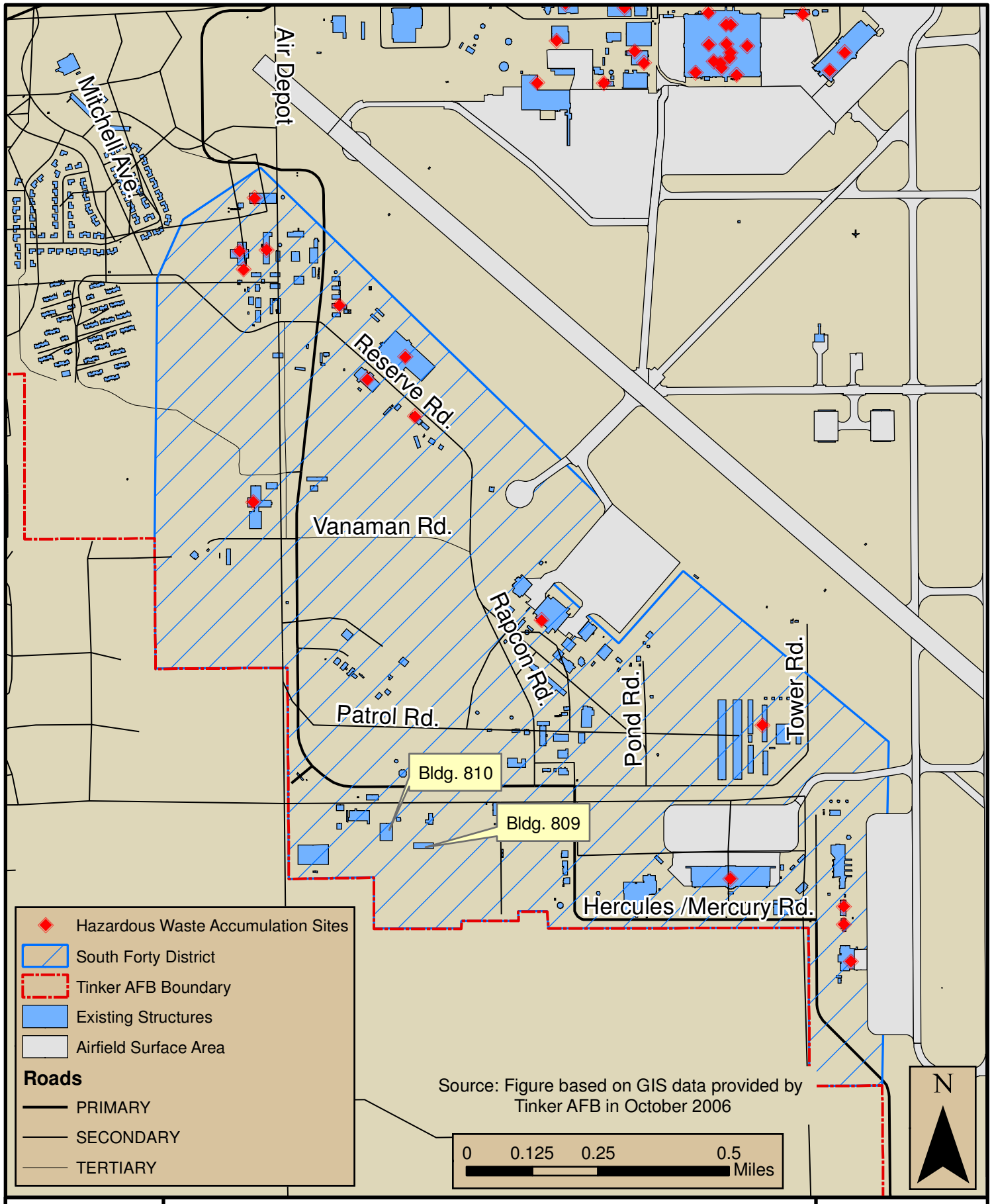
According to the Environmental Compliance Assessment and Management Program (ECAMP) FY 2006 Final Report for Tinker AFB, approximately 6000 containers of hazardous waste are generated at Tinker AFB each year excluding bulk roll-off and tanker trucks, industrial wastewater and environmental cleanups (Tinker AFB 2006e). A total of 354 organizations generate hazardous/industrial waste. These organizations manage their wastes through IAW TAFBI 32-7004 either as Immediate Removal, Collection Points, Initial Accumulation Sites (IAS), or Accumulation Sites located throughout the base (Tinker AFB 2006e). Waste containers from the IASs are brought to two centralized Accumulation Points (APs), which include Buildings 809 and 3125. Building 809 is the largest of the APs and processes the majority of containerized hazardous waste from the IAPs for transfer to the TSDF. The TSDF is located in Building 810 and is operated by the Defense Reutilization and Marketing Office (DRMO). The role of the TSDF is limited to conforming storage (Tinker AFB 2006e). Building 810 temporarily houses hazardous waste for a period up to one year (Tinker AFB 2005a). Hazardous waste accumulation sites at Tinker AFB South Forty, and vicinity, are shown in Figure 3-12.

3.13.2.3 Fuel Storage

The fuels and other fluids stored and handled in bulk at the base include JP-5, JP-8 (aviation fuel), JP-10 (missile fuel), Mogas (automotive gasoline), PF-1, diesel fuel, biodiesel fuel, calibration fluid and de-icing fluid. Conoco supplies JP-8 fuel to Tinker AFB through a six-inch supply line that enters the northern section of the base and continues to the main tank farm (Tinker AFB 2005a). Tanker trucks are used as a backup to deliver JP-8, which is dispensed to aircraft either from eleven R-11 refuelers or directly through hydrants on the aprons on the west, south, and east sides of the base.

Various fuels at the base are also stored in ASTs and USTs. Releases from ASTs and USTs (i.e., spills, overfill, and leaks) can cause fires or explosions that threaten human safety and can contaminate soil and groundwater that threaten human health. The main goal of the base's storage tank program is to protect groundwater and soil from contamination by ensuring that:

- All ASTs meet all applicable requirements including requirements for leak testing and preventing, responding to, reporting, and cleaning up spills,
- New USTs (including piping) are designed and constructed to provide the following: corrosion protection, release detection, spill and overfill prevention, proper installation, and secondary containment, and
- All existing USTs (any regulated UST installed before 22 December 1988) are upgraded to meet the standards for new USTs (Tinker AFB 2005a).



EA

Hazardous Waste Accumulation Sites
South Forty District and Vicinity
Tinker Air Force Base

FIGURE
3-12

An aggressive investigation of abandoned and active USTs at Tinker AFB began in September 1985. Eighty-eight active tanks and 38 abandoned tanks were identified and located. Most of those tanks were found in the vicinity of B3001 and in the north central portion of the base near buildings 201, 210 and the 290 Fuel Farm.

As of 31 July 1999, 26 sites have been established with the Oklahoma Corporation Commission (OCC) to investigate releases from USTs. Tinker AFB has completed the majority of the investigations for determining the nature and extent of contamination at each UST site; several of those sites are in active remediation. Currently, fifteen of the sites have been closed or deactivated in accordance with OCC regulations that were in effect prior to September 1996. These previous rules used a system that categorized UST sites for remediation based on generic contaminant levels in soils and groundwater. On 1 July 1996, the OCC issued new rules that classify sites for remediation based on risk to human health and the environment. The new process is referred to as the Oklahoma Risk-Based Corrective Action Program (ORBCA Program). Eleven sites are still open and are in remediation or have been recommended for case closure. In addition, two UST removals were performed in 1998, and tank closure reports were submitted to the OCC in December 1998 for each site. According to the ECAMP FY 2006 Final Report, Tinker AFB currently maintains 36 active USTs and 90 active ASTs (Tinker AFB 2006e).

Fuel storage in the vicinity of the Proposed Action area consists of six ASTs (Table 3-13). The two large ASTs located in the 507 ARW Fuel Yard are located within a concrete secondary containment berm. Two generators storing diesel fuel are also located in the vicinity of the Proposed Action area (Table 3-14). Oil/water separators (OWSs) serve each major fuel storage area and are used to separate oils, fuels, sand, and grease from wastewater and to prevent contaminants from entering the sanitary sewer and storm water drainage systems (Tinker AFB 2004b). OWSs currently located in the vicinity of the Proposed Action area at the 507 ARW Complex are summarized in Table 3-15. One OWS is located on the southwest corner of Building 1041; this OWS contains the only UST located in the vicinity of the Proposed Action associated with the 507 ARW. The OWS currently in Building 1041 will be relocated to the new Squadron Operations Building.

Table 3-13. Summary of Aboveground Storage Tanks in the Vicinity of the Proposed Action Area at 507 ARW

Tank ID	Location	Product Stored	Type of Tank	Capacity (gallons)	Release Location
1032	East of Building 1037	Diesel	Vaulted AST	500	Leakage may contaminate surficial aquifer.
21090	507 ARW Fuel Yard – southeast of 507 ARW Ramp	JP-8	AST	108,454	No storm drains are located on-site. Spills during transfer operations may reach nearby storm drain drop inlets draining to East Soldier Creek leaving at Outfall A10 as described in the SWPPP.
21091	507 ARW Fuel Yard – southeast of 507 ARW Ramp	JP-8	AST	108,903	No storm drains are located on-site. Spills during transfer operations may reach nearby storm drain drop inlets draining to East Soldier Creek leaving at Outfall A10 as described in the SWPPP.
21090	Southwest of Building 1058	Mogas	Vaulted AST	5,000	No storm drains are located on-site. Spills during transfer operations may reach nearby storm drain drop inlets draining to East Soldier Creek leaving at Outfall A10 as described in the SWPPP.
21091	Southwest of Building 1058	JP-8	Vaulted AST	6,000	Leakage may contaminate surficial aquifer.
21093	Southwest of Building 1058	Diesel	Vaulted AST	5,000	Leakage may contaminate surficial aquifer.

Source: Tinker AFB 2004b.

Table 3-14. Generators in the Vicinity of the Proposed Action Area at 507 ARW

Building	Location	Diesel Capacity (gallons)	Release Location
1082	South side of building	100	Northwest to Crutcho Creek leaving at Outfall A2 as described in the SWPPP.
1066	SW corner of building	200	Northwest to Crutcho Creek.

Source: Tinker AFB 2004b.

Table 3-15. Summary of Oil/Water Separators in the Vicinity of the Proposed Action Area at the 507 ARW Complex

Facility	Location	Separator/ Sump/ UST	Inspection Frequency	Discharge Location
1041	Southwest corner	Separator/UST	Monthly	Storm to Outfall A2 as described in the SWPPP
1082	Southeast of building (outside)	Separator	Monthly	
1091	507 Fuel Yard (connected to sanitary lift station)	Separator	Monthly	Sanitary Sewer
1030-1	Tar Mac Area of 1030	Separator	Monthly	Storm to Outfall A2 described in the SWPPP
1030-2	Southeast of building	Separator	Monthly	Sanitary Sewer

Source: Tinker AFB 2004b.

3.13.2.4 Environmental Restoration Program

The Secretary of Defense established the DERP in 1981 to investigate and remediate hazardous waste sites at DoD facilities. The USAF subsequently established its DERP to locate and investigate hazardous waste sites on its installations. The DERP execution strategy is to protect human health and the environment, satisfy legal agreements and have all sites closed or remedies in place by the end of FY 2008 (Tinker AFB 2005a). Fully restored and remediated Installation Restoration Program (IRP) sites present few constraints to future on-base development; however, the implementation of land use controls (LUCs) may be required. LUCs are physical, legal, or administrative mechanisms that restrict or limit access to contaminated property to promote beneficial land uses and to protect human health and the environment.

Tinker AFB began its DERP in 1980 with the completion of a Preliminary Assessment (PA) of 14 sites. Various base-wide surveys (i.e., underground storage tank and water quality surveys) identified other potential IRP sites and additional PAs were conducted for these sites. A total of 40 IRP sites including landfills, fire training pits, radioactive waste disposal sites, fuel storage areas, industrial waste pits, and the IWTP have been identified at Tinker AFB since the beginning of the DERP (Tinker AFB 2005a). A total of 13 IRP sites are located in the vicinity of the 507 ARW Complex (Table 3-16; Figure 3-13). The 507 ARW Complex is located in CG038 (Southwest Groundwater Management Unit [GWMU]). According to the *Tinker AFB, Site CG038 RCRA Facility Investigation Report* (2002), the potential sources of groundwater contamination in CG038 include:

- Landfill 1 (Solid Waste Management Unit [SWMU]-3),
- Landfill 2 (SWMU-4),
- Landfill 3 (SWMU-5),
- Landfill 4 (SWMU-6),
- Fire Training Area #1 (SWMU-7),
- Supernatant Pond (SWMU-11),
- Radioactive Waste Disposal Site, 1030W (SWMU-19),
- Radioactive Waste Disposal Site, 62598 (SWMU-21),
- Area of Concern Drainage (Crutcho Creek and other creeks), and
- Former Drum Storage Area.

Table 3-16. IRP Sites in the Vicinity of the 507 ARW Complex

IRP Site Code	Description	Materials Disposed and/or Site Contamination	Dates of Operation	DERP Status	Regulatory Mechanism
OT009	Crutcho Creek	Occasional spills, landfill seeps	N/A	LTM	DERP
LF 011	Landfill 1 (SWMU-3)	General household refuse, industrial waste	1942-1945	LTM	RCRA
LF 012	Landfill 2 (SWMU-4)	General refuse, industrial waste, radiological waste	1945-1952	LTM	RCRA
LF 013	Landfill 3 (SWMU-5)	General refuse, industrial waste	1952-1961	LTM	RCRA
LF 014	Landfill 4 (SWMU-6)	General refuse, industrial waste, radiological waste	1961-1968	LTM	RCRA
OT020	Multiple Creeks	N/A	N/A	NFRAP I	N/A
FT 021	Fire Training Area #1 (SWMU-7)	Fuel burned and extinguished	195l-1962	NFRAP IV	RCRA
FT 024	Fire Training Area #4	Site never existed; no contamination present	N/A	NFRAP I	DERP
WP 017	Supernatant Pond (SWMU-11)	Sewage disposal, liquid waste	1954-1984	LTM	RCRA
RW 025	Radioactive Waste Disposal Site, 1030W (SWMU-19)	Low-level radioactive refuse, mixed waste	1940s-1950s	NFRAP III	RCRA
RW 027	Radioactive Waste Disposal Site, 62598 (SWMU-21)	Radioactive “lead still” (not located)	1955	NFRAP IV	RCRA
RW 029	Radioactive Waste Disposal Site, 1022E (SWMU-22)	Two thorium objects, and one radium compass	Mid-1950s	NFRAP IV	RCRA
CG 038	Southwest GWMU	Solvents, Fuel	N/A	ROD/DD	ODEQ

Source: Based on Tinker AFB 2005a.

Notes

1. CERCLA will be used as the primary regulatory mandate. Individual components of the IWTP may also be under RCRA compliance standards as determined by EPA.

Symbols

+ = Operable units under Bldg 3001 NPL

++ = Operable units under Soldier Creek NPL

DERP and Non-DERP Status

FS = Feasibility Study

LTM = Long Term Management (including monitoring)

NFRAP = No further response action planned (including LTM)

RA-O = Remedial Action Operation

ROD/DD = Record of Decision/ Decision Document

Abbreviations

N/A = Not Applicable

ODEQ = Oklahoma Department of Environmental Quality

OK UST Program = Oklahoma Underground Storage Tank Program

IRP Site Codes

FT = Fire Training Area

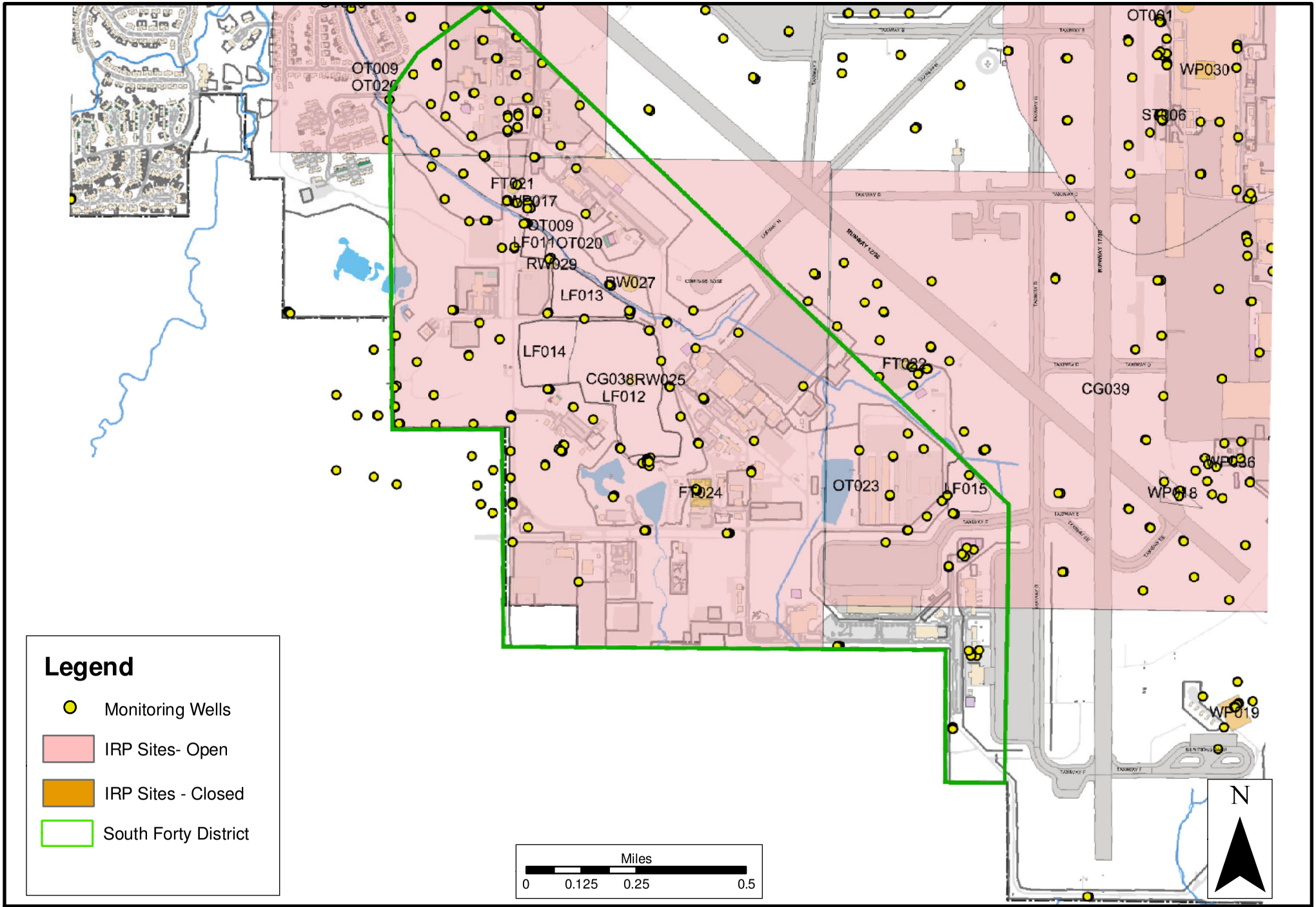
LF = Landfill

OT = Other

RW = Radioactive Waste

ST = Storage Tanks

WP = Waste Pit



EA

IRP Sites
South Forty District and Vicinity
Tinker Air Force Base

FIGURE
3-13

The principal groundwater contaminants in CG038 groundwater that exceed their MCLs are trichloroethene (TCE), cis-1, 2-dichloroethene (cis-1, 2-DCE), and vinyl chloride although other organic contaminants occur in the groundwater. Inorganic contaminants arsenic and chromium have also been identified as contaminants exceeding their MCLs; however, the arsenic detections could be associated with naturally occurring sources, and the chromium detections could be associated with the stainless steel well construction materials. The 507 ARW Complex is located in the CG038 sub-unit 2E. The primary contaminants affecting this sub-unit include TCE, vinyl chloride, cis-1, 2 DCE, and 1, 2-Dichloroethane (DCA) (Tinker AFB 2002c). Hexavalent chromium has also been detected recently; however, is not a factor at the 507th Complex (Tinker AFB 2007a). These contaminants are primarily restricted to the upper saturated zone (USZ) which is located approximately 20 feet bgs. The source area for groundwater contamination in Subunit 2E is most likely the former drum storage area and trenches and re-drumming area in Landfill 2. Landfill 2 is the largest of the four landfills in CG038 and has a surface area of 27.5 acres. Landfill 2 is bordered to the east by Reserve Road, to the north by Vanaman Road, and to the west by Landfill 4. A large part of the TCE and DCE plumes of sub-unit 2E extend upgradient about 1,000 feet from Landfill 2, suggesting other source(s) than this landfill. One possibility is the former drum storage area once located in the present 507 ARW Complex where Buildings 1030 and 1068 now stand. No contamination outside the USZ has been identified in this area.

In 1998, a groundwater extraction and treatment system was installed in the southwest quadrant of Tinker AFB as an interim corrective measure primarily to contain groundwater plumes at the base boundary in Subunits 2D and 2E, as well as capture and treat the contaminated groundwater. The system consists of 20 groundwater recovery wells and an air stripper treatment system and has been in full operation since March 1999 (Tinker AFB 2002c).

3.14 Safety

3.14.1 Definition of Resource

The primary safety concern with regard to military training flights is the potential for aircraft mishaps (i.e., crashes), which may be caused by mid-air collisions with other aircraft or objects (including bird-aircraft strikes) or weather difficulties.

3.14.2 Existing Conditions

3.14.2.1 Aircraft Mishaps

Five mishap classifications have been defined by the USAF. Class A mishaps result in a fatality or permanent total disability; total cost in excess of $1 million for injury, occupational illness, and property damage; or destruction or damage beyond repair to military aircraft. Class B mishaps result in a permanent partial disability; total cost in excess of $200,000 but less than $1 million for injury, occupational illness, and property damage; or hospitalization of five or more personnel. Class C mishaps result in total damages between $20,000 and $200,000, and Class D mishaps result in total damages between $2,000 and $20,000. The fifth mishap category,

Class E, comprises occurrences that do not meet reportable mishap classification criteria, but are deemed important to investigate/report for mishap prevention (USAF 2002b). Since 2000, seven flight mishaps have occurred involving 507 ARW aircrews. Of these, one mishap was Class B, three mishaps were Class C, and three mishaps were Class E (Tinker AFB 2006f).

3.14.2.2 Runway Protection Zones

APZs and CZs are rectangular zones extending outward from the ends of active military airfields and delineate those areas recognized as having the greatest risk of aircraft mishaps, most of which occur during takeoff or landing. The CZs and APZs for Runways 17/35 and 12/30 at Tinker AFB are depicted in Figure 3-14. Each end of Runway 17/35 at Tinker AFB has a 3,000 foot by 3,000 foot CZ and two APZs, while each end of Runway 12/30 has a 3,000 foot by 3,000 foot CZ and single 3,000 foot wide by 5,000 foot-long APZ (Tinker AFB 2006b).

Clear Zones

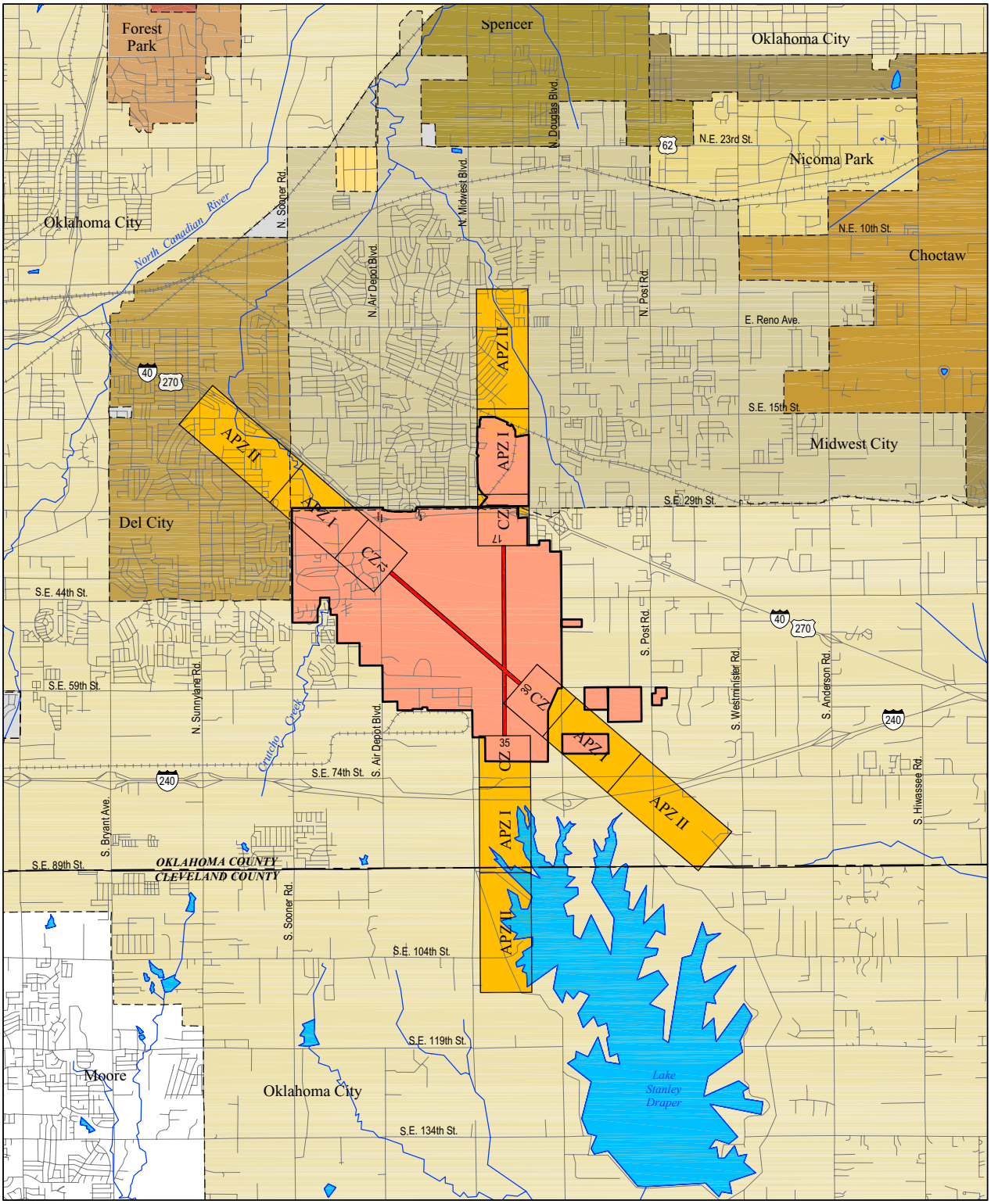
The CZ has the highest accident potential of the three zones, as 27 percent of accidents studied occurred in this area. As stated previously, it is Air Force policy to request that Congress authorize and appropriate funds to purchase the real property interests in this area to prevent incompatible land uses. Currently at Tinker AFB, all land use with CZs would be considered compatible (Tinker AFB 2006b).

Accident Potential Zones I and II

APZ I is an area that possesses somewhat less accident potential than the CZ, with 10 percent of the accidents studied occurring in this zone. APZ II has less accident potential than APZ I, with 6 percent of the accidents studied occurring in this zone. While the potential for aircraft accidents in APZs I and II does not warrant land acquisition by the USAF, land-use planning and controls are strongly encouraged in these areas for the protection of the public (Tinker AFB 2006b).

APZ I is 3,000 ft wide by 5,000 ft and has land use compatibility guidelines that are sufficiently flexible to allow reasonable economic use of the land, such as industrial/manufacturing, transportation, communication/utilities, wholesale trade, open space, recreation, and agriculture. APZ II, also 3,000 ft wide, is 7,000 ft long extending to 15,000 ft from the runway threshold. Acceptable uses include those of APZ I, as well as low density single family residential and those personal and business services and commercial/retail trade uses of low intensity or scale of operation. High density functions such as multi-story buildings, places of assembly (*e.g.*, theaters, churches, schools, restaurants, *etc*.), and high density office uses are not considered appropriate (Tinker AFB 2006b).

Incompatible land use is currently established within APZs associated with the airfield at Tinker AFB and is summarized in Table 3-17. APZs I and II located off Runways 17 and 12 contain commercial and sensitive receptors (i.e., residences, schools, libraries, etc.), respectively.



Source: Tinker AFB 2006a

EA

Clear Zones and Accident Potential Zones Tinker Air Force Base

FIGURE 3-14

Table 3-17. Acres of Incompatible Land Use within Clear Zones, Accident Potential Zones I and II Associated with Runways 12/30 and 17/35

Land Use	Acres of Incompatible Land Use		
	CZ	APZ I	APZ II
Residential	0	4	408
Commercial	0	41	0
Industrial	0	0	0
Public/Quasi-public	0	4	121
Recreational/Open Space/Agricultural/Low Density	0	0	0
Total	**0**	**49**	**529**

Source: Tinker AFB 2006b.

3.14.2.3 Bird-Aircraft Strike Hazard

Bird-Aircraft Strike Hazard (BASH) is defined as the threat of aircraft collision with birds or other wildlife during flight operations and is a safety concern at all airfields due to the frequency of aircraft operations and the possibility of encountering birds at virtually all altitudes. Most birds fly close to ground level; correspondingly, more than 95 percent of all reported bird-strikes occur below 3,000 ft AGL. At most military installations, about half of reported bird strikes occur in the immediate vicinity of the airfield and another 25 percent occur during low-altitude local training exercises.

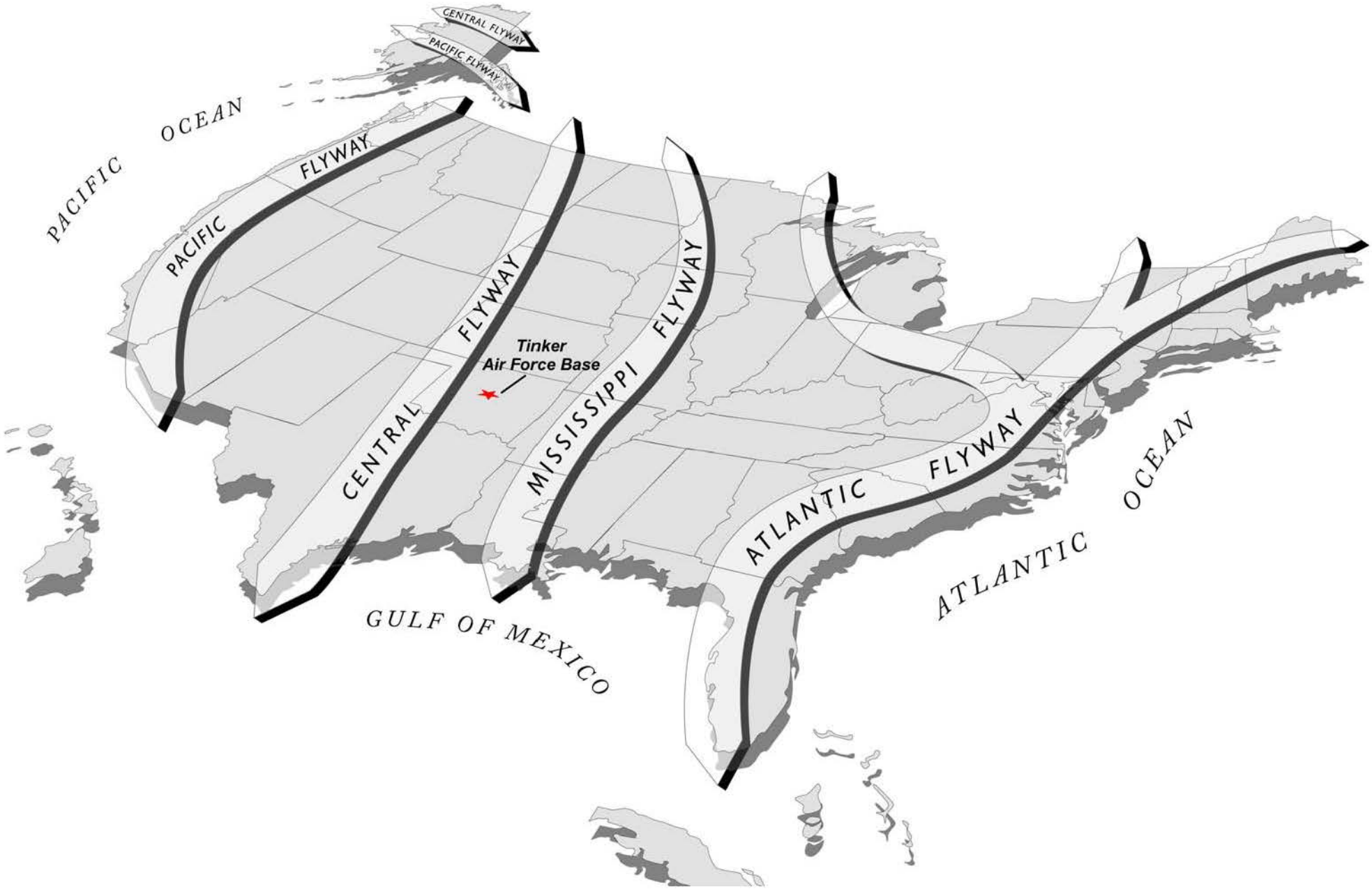
Bird-aircraft strikes present a potential threat to Tinker AFB and 507 ARW aircraft and aircrew safety due to resident bird species as well as the installation's proximity to Lake Stanley Draper and the bird migratory route known as the Central Flyway (Figure 3-15).

According to BASH data, 27 reported bird-strikes have occurred since 2000 at or in the immediate vicinity of Tinker AFB (Table 3-18) (Tinker AFB 2006g). The USAF BASH Team has developed bird avoidance models to predict and minimize the probability of hitting waterfowl and raptors within the base area; the team's studies show the relative bird strike possibility according to the time of year, time of day, and phase of flight. Late fall and winter months show higher rates for bird-strike probability. Waterfowl strike potential is highest in the night, while raptor strike potential is highest during midday. Bird strike potential is also higher during landing and low level phases of flight.

Table 3-18. Bird-Strike Occurrence for Tinker Air Force Base (2000-2005)

	2000	2001	2002	2003	2004	2005
Total	5	7	5	4	2	4

Source: Tinker AFB 2006g.



EA	**Migratory Flyways Over the United States**	FIGURE 3-15

In order to minimize the potential for bird-strikes, Tinker AFB has contracted the USDA-Wildlife Services to conduct all live bird control on the base, which includes two full-time professional bird-control staff to provide round-the-clock coverage. The 507 ARW has also implemented a *BASH Plan* (2006), key elements of which include:

- establishment of a Bird Hazard Working Group which designates responsibilities and establishes of procedures that aid supervisors in preventative actions intended to reduce bird-strike hazards;
- provision of appropriate channels for timely dissemination of bird hazard information and procedures for avoidance of such hazards (e.g., migratory flocks); and
- incorporation of standardized guidelines for reporting bird sightings and strikes.

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 4
ENVIRONMENTAL CONSEQUENCES

Environmental impacts that would result from implementation of the 2005 Base Realignment and Closure (BRAC) recommendations for the 507th Air Refueling Wing (507 ARW) at Tinker Air Force Base (AFB) are evaluated in this section. Analyses are presented by resource area, as presented in *Section 3, Affected Environment*.

4.1 Airspace and Airfield Operations

4.1.1 Approach to Analysis

The significance of potential impacts to airspace management depends on the degree to which the proposed mission change would affect the airspace environment. Significant impacts could result if the Proposed Action would: 1) impose major restrictions on air commerce opportunities; 2) significantly limit airspace access to a large number of users; or 3) require modifications to air traffic control (ATC) systems.

4.1.2 Impacts

4.1.2.1 Proposed Action

Implementation of the mission change would result in an increase in the number of hours flown (4,050) and the number of Primary Aircraft Inventory (PAI) KC-135R aircraft (12) maintained and operated by the 507 ARW (Table 4-1). The 507 ARW would continue its primary air-to-air refueling mission. Under the Proposed Action, aircrews from the 507 ARW would fly approximately 1,202 sorties per year, a 50.0-percent increase from current activity levels.

Table 4-1. Baseline and Proposed 507 ARW KC-135R Aircraft Operations

Scenario	Number of Aircraft	Flight Hours	Daily Sorties	Annual Sorties	Daily Operations
Baseline Operations	8	2,700	3.14	846	31.11
Proposed Operations	12	4,050	4.62	1,202	46.66

Source: Tinker AFB 2006a.

Airspace Use and Flight Procedures

The 507 ARW currently operates in several Air Traffic Control Assigned Airspace (ATCAA) areas between 19,000 feet (ft) mean sea level (MSL) and 28,000 ft MSL and within military operated areas (MOAs) above 15,000 ft MSL. Upon implementation of the Proposed Action, the frequency of aircraft activity conducted by the 507 ARW in both ATCAA and MOA airspace areas would increase slightly; however, no change to the configuration (i.e., size, shape, or location) of these areas is proposed or would be required to support the implementation or accomplishment of the proposed aircraft robust. In addition, implementation of the Proposed Action would not require modification of the ATC system at Tinker AFB. In addition, although

minimal, 507 ARW operations would continue at: Will Rogers World Airport, Amarillo International Airport, Clinton-Sherman Airport, and Altus AFB. No airspace areas or ATC facilities used by the 507 ARW would be adversely impacted by implementation of the Proposed Action based on the limited amount of air traffic at these airfields and the infrequent use of them by the 507 ARW.

Runways

Upon implementation of the proposed KC-135R aircraft robust, the type and distribution of runway use would remain unchanged; however, total aircraft operations at Tinker AFB would increase by 5.4 percent. For 507 ARW aircraft operations, Runway 17/35 would continue to be the primary runway. Departures would occur on Runways 17 (70 percent) and 35 (30 percent). Similar to the baseline scenario, about 10 percent of 507 ARW flight operations would involve sorties from which aircrews return to Tinker AFB after 10:00 PM. No runway modifications are proposed or would be necessary to accommodate the proposed aircraft robust. While there would be an increase in KC-135R operations at Tinker AFB (50 percent), this increase would be negligible in the context of overall USAF operations at Tinker AFB, comprising an increase of about 5.4 percent. Further, the increase in operations tempo would not surpass the ATC capacity of Tinker AFB. Therefore, no impacts to runway usage would occur under the Proposed Action.

4.1.2.2 Alternative 1: Hangar Repositioning

This alternative would implement all BRAC 2005 recommendations affecting the 507 ARW; the four additional KC-135R aircraft would be transferred to Tinker AFB and the 137 AW would be relocated to Tinker AFB and would be affiliated with the 507 ARW. In contrast to the Proposed Action, under this alternative the proposed hangar would be located near the 507 ARW's apron, which would not affect airspace management. With regard to airspace management, impacts under this alternative would be identical to those under the Proposed Action, not significant.

4.1.2.3 Alternative 2: Transfer of 137 AW Only

Alternative 2 would implement the transfer of the 137 AW only. The four KC-135R aircraft would not be transferred from Portland IAP AGS under this alternative. With regard to airspace management, selecting this alternative would not require an increase in 507 ARW aircraft or operations and no changes to existing airspace management would occur; therefore, impacts would remain as described in *Section 3.1, Airspace Management* and no impacts to airspace management would occur.

4.1.2.4 Alternative 3: No-Action Alternative

If the No-Action Alternative were selected, the 507 ARW would not implement the Proposed Action. Therefore, conditions would remain as described in *Section 3.1, Airspace Management* and no impacts to airspace management would occur.

4.2 Air Quality

4.2.1 Approach to Analysis

The 1990 Amendments to the Clean Air Act (CAA) require that Federal agency activities conform to the State Implementation Plan (SIP) with respect to achieving and maintaining attainment of National Ambient Air Quality Standards (NAAQS) and addressing air quality impacts. The U.S. Environmental Protection Agency (USEPA) General Conformity Rule requires that a conformity analysis be performed which demonstrates that a Proposed Action does not: 1) cause or contribute to any new violation of any NAAQS in the area; 2) interfere with provisions in the SIP for maintenance or attainment of any NAAQS; 3) increase the frequency or severity of any existing violation of any NAAQS; or 4) delay timely attainment of any NAAQS, any interim emission reduction, goals, or other milestones included in the SIP for air quality. A conformity review must be performed when a federal action generates air pollutants in a region that has been designated a *nonattainment* or maintenance area for one or more NAAQS. Nonattainment areas are geographic regions where the air quality fails to meet the NAAQS. Maintenance areas are regions where NAAQS were exceeded in the past, and are subject to restrictions specified in a SIP-approved maintenance plan to preserve and maintain the newly regained attainment status. Provisions in the General Conformity Rule allow for exemptions from performing a conformity determination if the total net increase in emissions of individual nonattainment or maintenance area pollutants resulting from the Proposed Action fall below the significant (*de minimus*) threshold values. Oklahoma County is designated as an *attainment* area for all criteria pollutants and holds an Early Action Compact Agreement with EPA for the 8-hour ozone standard. As such, the facility is exempt from conformity determination.

4.2.2 Impacts

4.2.2.1 Proposed Action

Pollutant emissions associated with implementation of the Proposed Action at Tinker AFB would include operational emissions associated with increased aircraft operations and construction emissions associated with demolition, facility upgrades, and development of new facilities. Construction emissions will include fugitive dust generated during ground disturbance and related site-preparation activities, and combustion emissions from vehicles and heavy-duty equipment used during construction. Construction emissions would be temporary and would not occur beyond completion of construction activities. Oklahoma County is in an Early Action Compact Agreement with EPA for the 8-hour ozone standard and is designated as an *attainment* area in compliance with all other NAAQS.

Construction Emissions

Dust Emissions

Under implementation of the Proposed Action, dust (i.e., particulate matter less than 10 micrometers in diameter [PM_{10}], a criteria pollutant) would be generated during construction activities including vegetation removal, grading, and demolition. Dust emissions can vary substantially daily depending on levels of activity, specific operations, and prevailing meteorological conditions. Based on studies at similar facilities, the expected emission rate is 1.2 tons of dust generated per acre per month of activity for previously undisturbed areas. Because the majority of construction and demolition activities associated with the Proposed Action would take place on already improved and paved sites, dust generation and associated emissions of PM_{10} are expected to be especially low.

Any short-term adverse impacts resulting from the proposed construction activities would be further mitigated through standard dust minimization practices, such as watering exposed soils, soil stockpiling, and soil stabilization. Emissions from this source are not expected to be significant.

Combustion Emissions

Combustion emissions associated with construction activities would result from construction-related vehicles and equipment operating on the site. In order to minimize impacts, all construction equipment and vehicles will be maintained at the construction location for the duration of construction activities. Emissions generated by construction equipment are expected to be temporary and short-term.

Operational Emissions

Implementation of the Proposed Action would result in changes in aircraft operations and personnel levels at Tinker AFB. Long-term operational emissions associated with the Proposed Action would be emissions from the addition of four KC-135 aircraft and their operations. While this represents an increase in KC-135R operations at Tinker AFB by 50 percent, the increase is negligible in the context of overall USAF operations at Tinker AFB, comprising an increase of about 5.4 percent.

Using project operations tempo and standard emission factors for KC-135R aircraft, implementation of the Proposed Action is estimated to result in annual emissions increases of 0.41 tons of NO_X, 0.02 tons of CO, 0.0004 tons of VOC, and 0.008 tons of PM_{10}. These emissions, when compared to the overall county-wide annual emissions (refer to Table 3-1) and current emissions generated by Tinker AFB-related aircraft operations (refer to Section 3.2) would be considered negligible and would not represent significant impact.

Other long-term operational emissions associated with the Proposed Action would include combustion of natural gas for the generation of industrial and utility electric power, heating of

commercial space. In addition, the Proposed Action would result in approximately 125 full-time personnel and 300 Traditional Guardsmen being transferred to Tinker AFB. This represents an increase of approximately 1.8 percent over current personnel levels at Tinker AFB. The addition of personnel would also result in an increase of combustion emissions associated with increased vehicular traffic in the vicinity of Tinker AFB. However, these vehicle trips are already occurring in the Oklahoma City region, since these personnel are currently commuting to Will Rogers World Airport. Further, in the context of total regional vehicle trips (refer to Section 3.8) and cumulative emissions from total vehicular traffic in the region, emissions from these trips would be negligible and not result in significant impact.

4.2.2.2 Alternative 1: Hangar Repositioning

This alternative would implement all BRAC 2005 recommendations affecting the 507 ARW; the four additional KC-135R aircraft would be transferred to Tinker AFB and the 137 AW would be relocated to Tinker AFB and would be associated with the 507 ARW. This alternative would differ from the Proposed Action only in the location of the hangar on base. With regard to air quality, implementation of this alternative would result in the same impacts as the Proposed Action (i.e., less than significant).

4.2.2.3 Alternative 2: Transfer of 137 AW Only

Alternative 2 would implement the transfer of the 137 AW only and the four KC-135R aircraft would not be transferred from Portland IAP AGS. This alternative would not be viable because it does not implement the BRAC 2005 recommendation of transferring the four KC-135R aircraft to Tinker AFB. The transfer of the 137 AW would result in an increase of approximately 1.8 percent over current personnel levels at Tinker AFB. A 1.8-percent increase in on-road mobile emissions associated with additional personnel is expected to be well below *de minimus* levels and would represent a less than significant impact. The four KC-135R aircraft would not be transferred; therefore, an increase in air emissions would not occur.

4.2.2.4 Alternative 3: No-Action Alternative

If the No-Action Alternative were selected, the 507 ARW would not implement the Proposed Action. Therefore, conditions would remain as described in *Section 3.2, Air Quality* and no impacts to air quality would occur.

4.3 Noise

4.3.1 Approach to Analysis

Noise impact analyses typically evaluate potential changes to existing noise environments that are instigated by implementation of a Proposed Action. These potential changes may be beneficial if they reduce the number of sensitive receptors exposed to unacceptable noise levels. Conversely, changes may be detrimental if they result in increased exposure to unacceptable

noise levels. An increase in noise levels due to introduction of a new noise source can create an impact on the surrounding environment.

4.3.2 Impacts

4.3.2.1 Proposed Action

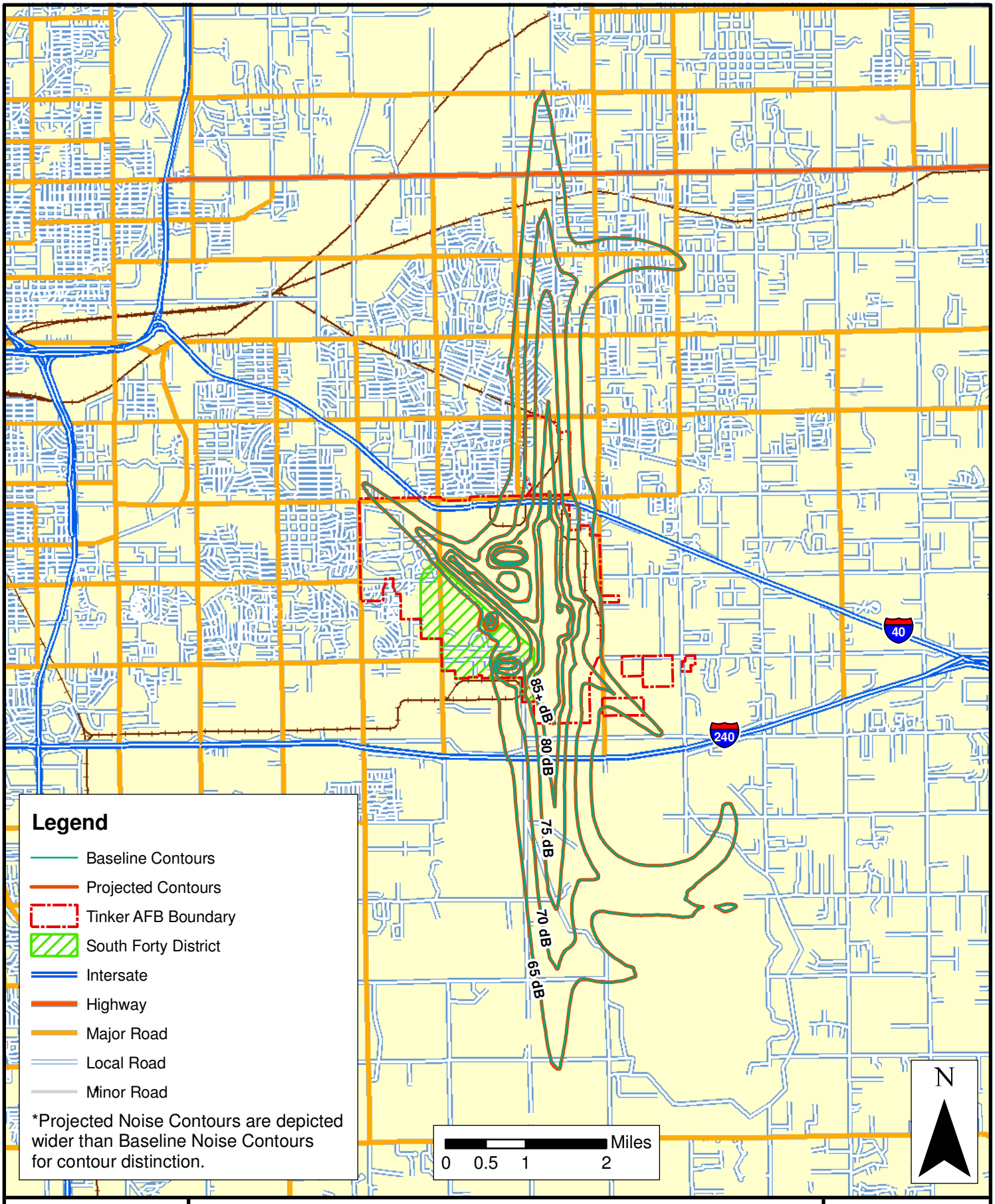
The NOISEMAP 7.0 noise model was used in the 2006 *AICUZ Study* process to calculate both current noise levels based on current aircraft inventory and projected noise levels associated with the proposed four KC-135R aircraft robust at Tinker AFB. Under the Proposed Action, non-507 ARW aircraft operations would remain as described in *Section 3.3, Noise* and the 507 ARW would increase the number of KC-135R aircraft and associated annual flight hours.

Aircraft-Related Noise

The proposed aircraft robust of the 507 ARW's current PAI from 8 KC-135R aircraft to 12 aircraft and associated increase in annual flight hours would result in a 50 percent increase in annual flight operations of this specific aircraft type (from 8,088 annual KC-135R operations to approximately 12,000 operations as compared to a base operations total of more than 75,000). Currently, noise exposure of 65 L_{dn} or higher associated with total military aircraft operations at Tinker AFB affects approximately 5,544 acres beyond the base boundary. Implementation of the Proposed Action would result in a 5.4-percent increase in the total number of annual aircraft operations at Tinker AFB and a marginal increase (less than one percent) in noise exposure outside the base boundary. The off-base area affected by noise levels of 65 L_{dn} or greater would increase negligibly as a result of a slight outward expansion of the baseline noise contours; cumulatively, this contour expansion would result in an increase in the area exposed to these noise levels of only 19 acres, from 3,691 acres under existing conditions to 3,710 acres based on anticipated operations (Table 4-2 and Figure 4-1). The projected sound levels in these areas resulting from this increase would be indistinguishable from sound levels associated with current aircraft operations, and no areas off base would be newly exposed to the 85+ L_{dn} noise contour (Tinker AFB 2006b). On-base, only slight expansion of noise contours – and related noise exposure – would occur, and these would be clustered around the aircraft apron and runway (Figure 4-2). These industrial areas are already exposed to high noise levels and lack sensitive noise receptors within them.

Table 4-2. Baseline and Proposed 507 ARW KC-135R Aircraft Operations

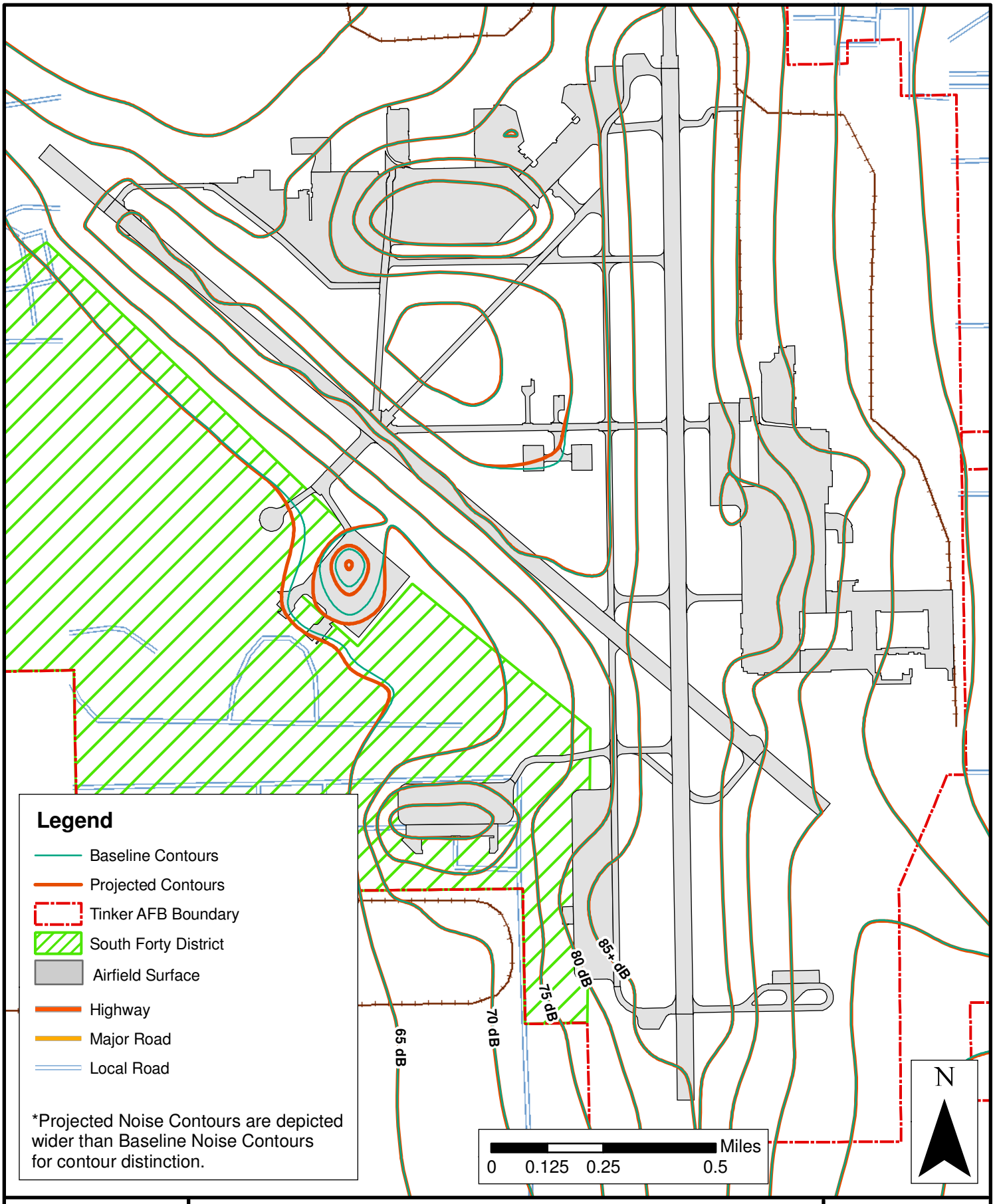
Noise Level	Acreage Beyond Base Boundary		Difference Acreage from Baseline	
	Baseline	Proposed Action	Percent	Acres
65-69	3,691	3,710	0.5	19
70-74	1,232	1,239	0.5	7
75-79	547	549	0.3	2
80-84	74	75	0.1	1
85+	0	0	0	0
Total > 65	**5,544**	**5,573**	**0.5**	**29**



EA

Baseline and Projected Noise Level Contours
Tinker Air Force Base

FIGURE
4-1



EA

Baseline and Projected Noise Level Contours
South Forty District
Tinker Air Force Base

FIGURE
4-2

According to the USAF, a significant noise impact would occur if analysis shows that the Proposed Action would cause noise sensitive areas to experience increased exposure to unacceptable noise levels. Implementation of the Proposed Action would not result in any sensitive receptors (e.g., residences, schools, etc.) currently within the baseline 65+ L_{dn} contour to experience a significant increase in noise levels. Sensitive receptors currently within the 65+ L_{dn} contour would experience a negligible increase in sound level that is dependent on location. Thus, a slight increase in sound levels would result from implementation of the proposed aircraft robust; however, this action would not significantly impact sensitive receptors.

With regard to noise levels in the airspace used by the 507 ARW, noise would increase slightly through implementation of the proposed robust; however, the increase would occur at an altitude above 15,000 ft MSL within MOAs and above 19,000 ft MSL within ATCAA where the noise level increase would not be noticeable. Also, the 507 ARW does not conduct any operations along low level military training routes (MTRs). Based on these factors, the USAF concludes that the noise impact from the proposed increase in operations within utilized airspace would not be significant.

Construction-Related Noise

Implementation of the Proposed Action would have minor, temporary effects on the noise environment in the vicinity of proposed construction and demolition sites. Use of heavy equipment for site preparation and development would generate noise exposure above typical ambient levels at the base. However, noise generation would be typical of construction activities, short-term, and associated impacts could be reduced through the use of equipment sound mufflers and restriction of construction activity to normal working hours (i.e., between 7:00 AM and 5:00 PM). Therefore, noise generated by construction and demolition activities associated with implementation of the Proposed Action would not significantly impact sensitive receptors on or in the vicinity of Tinker AFB.

Operations-Related Noise

Upon completion of proposed construction, none of the new facilities would comprise significant noise generators. Further, none of the new facilities would be noise sensitive or located in an incompatible area with regard to noise exposure. Therefore, long-term, operations-related noise impacts at new facilities would not be significant.

4.3.2.2 Alternative 1: Hangar Repositioning

This alternative would implement all BRAC 2005 recommendations affecting the 507 ARW; the four additional KC-135R aircraft would be transferred to Tinker AFB and the 137 AW would be relocated to Tinker AFB and would be associated with the 507 ARW. To maximize its operational effectiveness, the hangar would be located near the 507 ARW's apron, near the existing hangar. Given that the aircraft robust would occur under this alternative, impacts to noise under this alternative would be identical to those under the Proposed Action, not significant.

4.3.2.3 Alternative 2: Transfer of 137 AW Only

Alternative 2 would implement the transfer of the 137 AW personnel only and the four KC-135R aircraft would not be transferred from Portland IAP AGS. With regard to noise, selecting this alternative would not require an increase in 507 ARW aircraft or operations, thus impacts would not be significant. Under this alternative, noise levels would remain as described in *Section 3.3, Noise*.

4.3.2.4 Alternative 3: No-Action Alternative

If the No-Action Alternative were selected, the 507 ARW would not implement the Proposed Action. Therefore, conditions would remain as described in *Section 3.3, Noise* and no impacts to noise would occur.

4.4 Land Use

4.4.1 Approach to Analysis

Significance of potential land use impacts is based on the level of land use sensitivity in areas affected by a Proposed Action. In general, land use impacts are considered significant if they would: 1) be inconsistent or in noncompliance with applicable land use plans or policies; 2) preclude the viability of existing land use; 3) preclude continued use or occupation of an area; 4) be incompatible with adjacent or vicinity land use to the extent that public health or safety is threatened; or 5) conflict with airfield planning criteria established to ensure the safety and protection of human life and property.

4.4.2 Impacts

4.4.2.1 Proposed Action

Demolition and construction projects would be necessary to accommodate the association of the 137 AW with the 507 ARW and the additional four KC-135R aircraft that are required by the BRAC 2005 recommendations. These projects would provide adequately sized and functionally configured facilities to support the aerial refueling mission and include measures to specifically minimize the possibility of mass casualties in the buildings by applying appropriate measures compliant with Anti-Terrorism Force Protection protocols (as identified in *DoD Minimum Antiterrorism Standards for Buildings*) that establish a level of protection against terrorist attacks. The construction of the new hangar would also correct a current deficiency. The Proposed Action is consistent with Tinker AFB's planning policies and guidelines; further, all project components have been designed and sited to be compatible with existing base land use and airfield safety guidelines in the South Forty District. Construction components of the Proposed Action have been sited in accordance with established land use development guidelines addressing safety, functionality, and environmental protection zones. No adverse impacts to land use on Tinker AFB would occur.

With regard to off-site land use, no new types of land use activities would be introduced onto Tinker AFB as a result of the implementation of the Proposed Action. However, the proposed aircraft robust would increase the flight activity at the base, resulting in increased risk of accidents in all clear zones and accident potential zones. However, while implementation of the Proposed Action would increase 507 ARW aircraft operations noise levels in the surrounding community would negligibly increase. The size and location of the clear zones and accident potential zones would be unchanged and existing land uses in these areas would be unaffected; further, current land uses within the noise zones would remain unchanged and no land use areas would be newly introduced to the 65+ L_{dn} noise contour.

The proposed aircraft robust would result in only a 5.4-percent increase in total military aircraft operations at Tinker AFB and would be expected to negligibly increase noise levels when compared to current conditions. Under the Proposed Action, the increase in 507 ARW aircraft operations at Tinker AFB would not include the introduction of additional residential areas or sensitive receptors to the 65-Ldn noise contour, therefore impacts to land use would not be significant.

4.4.2.2 Alternative 1: Hangar Repositioning

Under this alternative, the hangar would be located to the north of the existing hangar in the floodplain associated with Crutcho Creek. All other components of the Proposed Action would be implemented. Positioning the hangar at this location would be compatible with existing land uses on the base and would be compliant with airfield planning criteria; therefore, impacts to land use from implementation of Alternative 1 would be less than significant. Land use impacts resulting from the operation of the additional KC-135R aircraft would be the same as for the Proposed Action, less than significant.

4.4.2.3 Alternative 2: Transfer of 137 AW Only

Selection of Alternative 2 would implement all of the BRAC 2005 recommendations affecting the 507 ARW with the exception of transferring four KC-135R aircraft to Tinker AFB. This alternative is similar to the Proposed Action in that it would include the demolition of buildings 1037 and 1041 and the construction of a new hangar. However, the four KC-135R aircraft would not be transferred under this alternative; therefore, impacts to land use would be less than significant and remain as described in *Section 3.4, Land Use*.

4.4.2.4 Alternative 3: No-Action Alternative

If the No-Action Alternative were selected, the 507 ARW would not implement the Proposed Action. No impacts to existing land use conditions, as described in *Section 3.4*, would result from the selection of the No-Action Alternative.

4.5 Geological Resources

4.5.1 Approach to Analysis

Protection of unique geological features, minimization of soil erosion, and the siting of facilities in relation to potential geologic hazards are considered when evaluating impacts of a Proposed Action on geological resources. Generally, such impacts can be avoided or minimized if proper construction techniques, erosion control measures, and structural engineering designs are incorporated into project development.

Analysis of potential impacts to geological resources typically includes: 1) identification and description of resources that could potentially be affected; 2) examination of the Proposed Action and the potential effects this action may have on the resource; 3) assessment of the significance of potential impacts; and 4) provision of mitigation measures in the event that potentially significant impacts are identified.

4.5.2 Impacts

4.5.2.1 Proposed Action

Geology

Potential geological impacts associated with the Proposed Action at Tinker AFB would be limited to ground-disturbing activities (i.e., during site preparation and construction). Minor impacts would result from proposed construction activities; however, the majority of construction activities would occur on previously disturbed land that is capable of supporting such development. Proposed construction activities would be localized, and would not have significant impacts on sensitive geologic or physiographic features in the region.

Soils

Implementation of the Proposed Action would require surface grading and subsurface excavation activities during construction. These activities would result in temporary disturbance to existing surface soils, in addition to the potential removal of underlying bedrock due to its shallow depth. The majority of naturally occurring soils within the proposed construction areas have been physically altered (e.g., cut, graded, or covered) or removed and replaced by imported fill to support existing structures and parking areas. Areas where construction is proposed are not utilized for agricultural or geologic (i.e., mineral) resources and implementation of best-management practices (BMPs) during construction would limit any impacts to naturally occurring soils that might result from construction activities. Dust from construction activities would be minimized by watering and/or soil stockpiling, thereby reducing the amount of exposed soil to negligible levels.

Topography

The majority of construction activities proposed within the base would occur on previously disturbed land, which is capable of supporting such development. Topography within the

proposed construction areas is relatively flat, and the proposed construction areas are currently paved (or heavily maintained grassy areas). The Proposed Action is not anticipated to significantly alter the existing site topography. However, the potential for small-scale soil loss via stormwater runoff will exist during the disturbance of site soils. Implementation of BMPs and stormwater pollution prevention plans by construction contractors will help contain and minimize soil loss. Excavations for building foundations/footers, the installation of new utility lines, or the possible relocation of existing utility lines will likely encounter shallow bedrock, possibly requiring removal. Ultimately, impacts to topography resulting from implementation of the Proposed Action would not be significant.

4.5.2.2 Alternative 1: Hangar Repositioning

Selection of Alternative 1 would implement all BRAC 2005 recommendations affecting the 507 ARW; however, the construction of the new hangar would occur in an alternate location. The hangar location associated with Alternative 1 is north of the existing hangar in the 100-year floodplain associated with Crutcho Creek (Figure 2-2). This area is not paved but consists of maintained grassland supporting the floodplain of Crutcho Creek. Due to the topography and soils of the proposed construction area, a significant amount of fill and special foundations would be required to construct the hangar in this location. Therefore, impacts to geologic resources would be adverse and potentially significant.

4.5.2.3 Alternative 2: Transfer of 137 AW Only

Selection of Alternative 2 would implement all of the BRAC 2005 recommendations affecting the 507 ARW with the exception of transferring four KC-135R aircraft to Tinker AFB. This alternative is similar to the Proposed Action in that it would include the demolition of buildings 1037 and 1041 and the construction of a new hangar. However, the four KC-135R aircraft would not be transferred under this alternative. Impacts of this alternative would be similar to the Proposed Action.

4.5.2.4 Alternative 3: No-Action Alternative

If the No-Action Alternative were selected, Tinker AFB would not implement the Proposed Action. Therefore, no impacts to geological resources (as described in *Section 3.5*) would occur under implementation of the No-Action Alternative.

4.6 Water Resources

Significance criteria for water resources impacts are based on water availability, quality, and use; existence of floodplains; and associated regulations. An impact to water resources would be significant if it would 1) reduce water availability to or interfere with the supply of existing users; 2) create or contribute to overdraft of groundwater basins or exceed safe annual yield of water supply sources; 3) adversely affect water quality or endanger public health by creating or worsening adverse health hazard conditions; 4) threaten or damage unique hydrologic

characteristics; or 5) violate established laws or regulations that have been adopted to protect or manage water resources of an area including wetlands. Impacts of flood hazards on the Proposed Action would be significant if such actions are proposed in areas with high probabilities of flooding.

4.6.1 Impacts

4.6.1.1 Proposed Action

Surface Water

The primary surface water within the 507 ARW Complex is Crutcho Creek. A stormwater retention pond is also located within the complex. Implementation of the construction elements of the Proposed Action would not result in any surface water discharges or otherwise permanently affect surface water. Construction could have localized (i.e., site-specific) temporary effects on hydrology and nearby surface water quality; however, BMPs would be incorporated during construction to minimize erosion, runoff, and sedimentation. Therefore, implementation of the Proposed Action would result in no significant impacts to surface water resources on or in the vicinity of the 507 ARW.

Groundwater

A large percentage of the 507 ARW Complex is paved and all proposed construction would occur on previously disturbed and paved areas. Therefore, no additional impervious surface areas would be established. Stormwater runoff would be captured by the on-base stormwater retention pond and creek systems. None of the proposed facilities or improvements comprises a significant water user or wastewater generator. Therefore, the Proposed Action would not have an adverse impact on groundwater resources.

Wetlands

Areas where construction would occur have been previously disturbed and contain no identified wetlands (Figure 4-3). Further, construction activity and staging areas would not be sited near known wetlands on base. Surface water runoff would be contained and channeled through existing and appropriately developed systems to eliminate the potential for runoff into and any associated siltation of wetlands. Therefore, implementation of the proposed project would not have an adverse impact on wetlands.

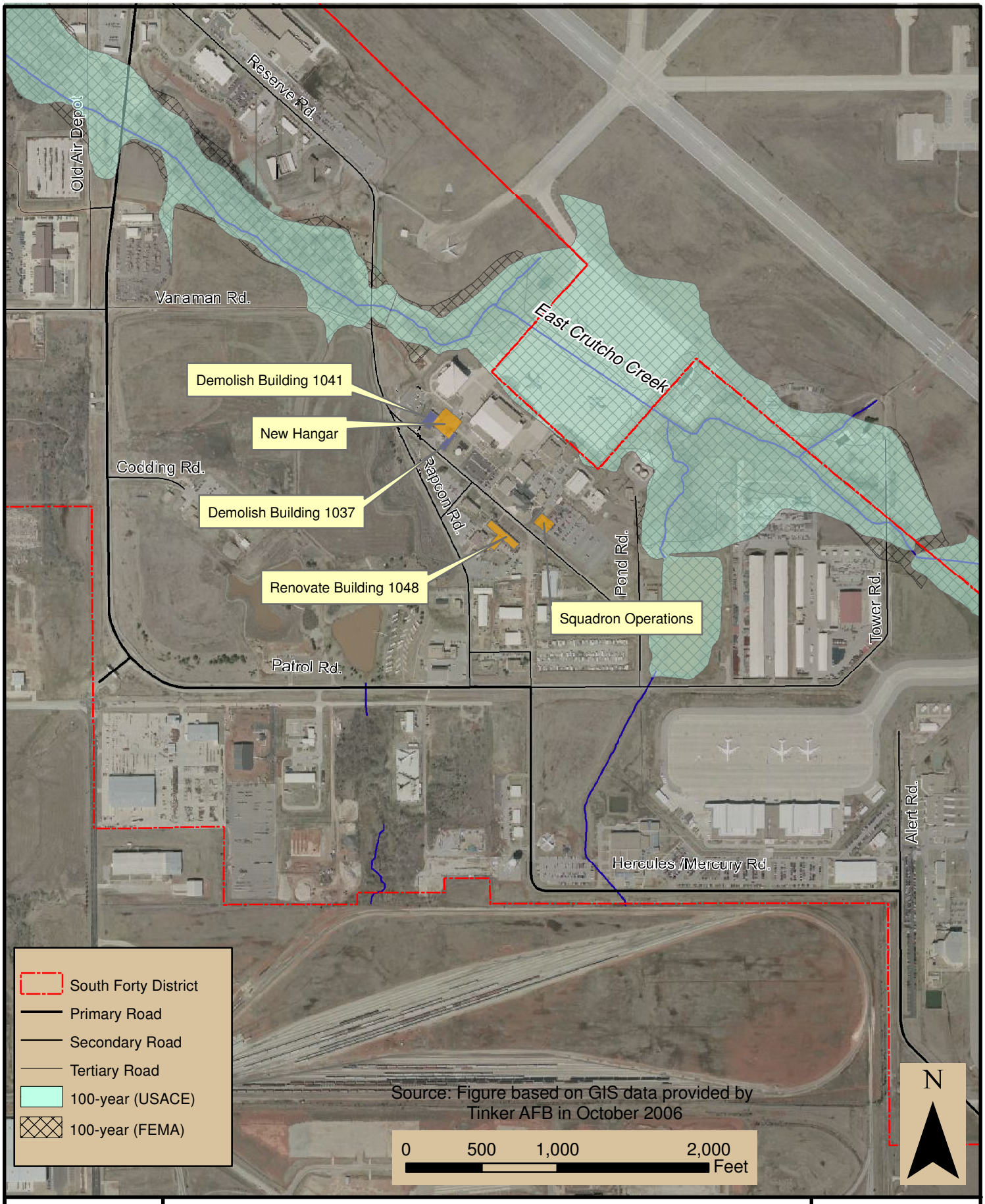
Floodplains

A portion of the land area associated with the 507 ARW is located within the 100-year floodplain delineated by the Federal Emergency Management Agency (FEMA) and US Army Corps of Engineers (USACE). However, the proposed construction areas are not within the 100-year floodplain (Figure 4-4); therefore, implementation of the Proposed Action would not impact or be impacted by 100-year floodplain or hazards associated with them.

EA

Proposed Action Components and Wetlands and Water Bodies
South Forty District
Tinker Air Force Base

FIGURE 4-3



EA	**Proposed Action Components and Floodplains** **South Forty District** **Tinker Air Force Base**	FIGURE 4-4

4.6.1.2 Alternative 1: Hangar Repositioning

Selection of Alternative 1 would implement all BRAC 2005 recommendations affecting the 507 ARW; however, the new hangar would be constructed in an alternate location, north of the existing hangar in the 100-year floodplain of Crutcho Creek (Figure 4-5). This area is not paved but rather consists of maintained grassland supporting the floodplain of Crutcho Creek.

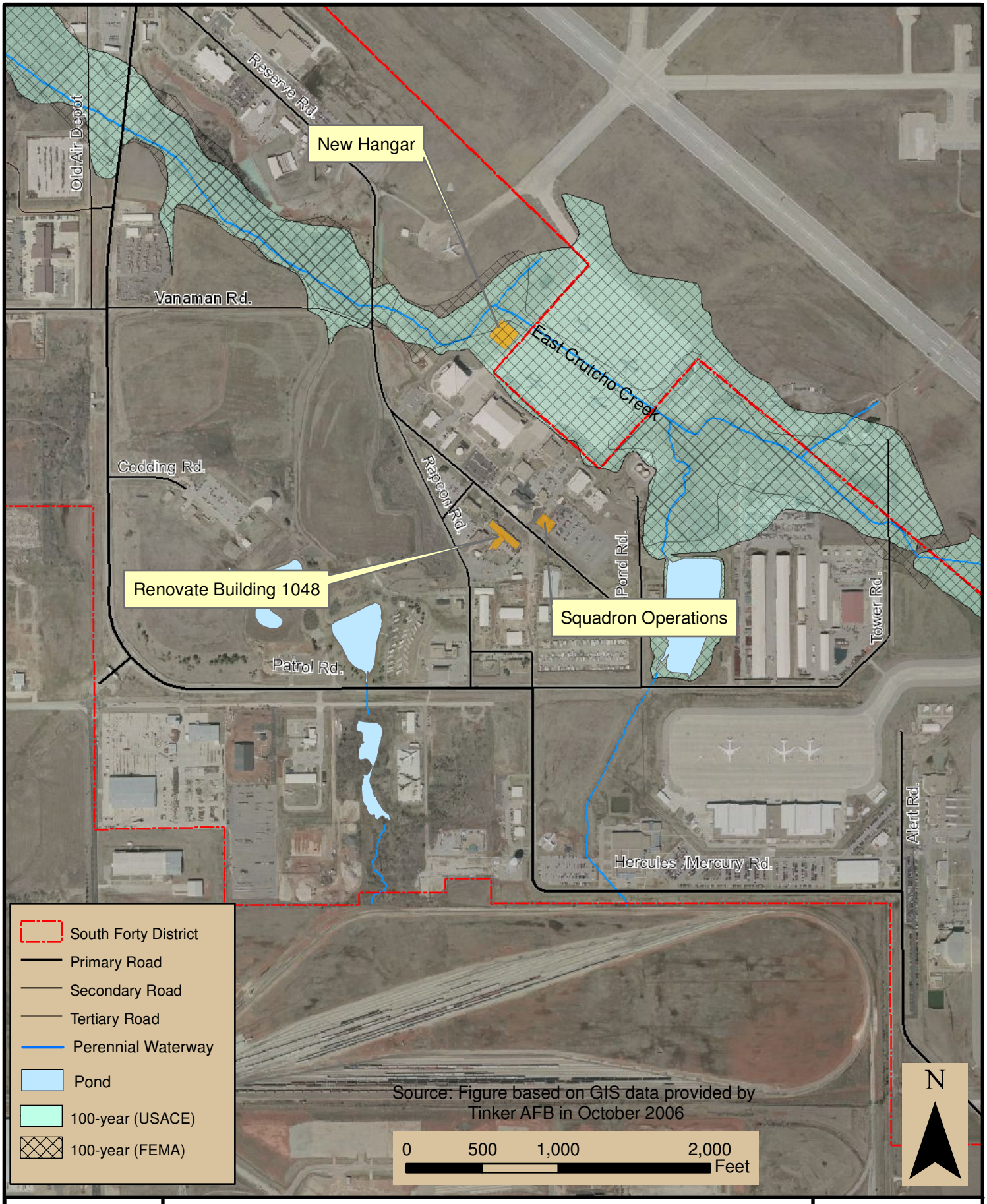
A significant amount of fill and special foundations would be required to construct the hangar in this location. This would increase the amount of surface water runoff from facilities associated with the 507 ARW flowing into Crutcho Creek. Further, the proposed construction area would be located approximately 100 feet from wetlands associated with Crutcho Creek, as depicted on National Wetland Inventory (NWI) maps (Figure 4-6). In order to implement hangar development in this location, BMPs would be incorporated during construction to minimize erosion, runoff, and sedimentation into wetland areas. Further, if any fill or other materials would be placed in the wetland areas under this alternative, the 507 ARW would need to coordinate with USACE and obtain the necessary Clean Water Act Section 404 and 401 permits. Also, since the hangar would be located within the 100-year floodplain of Crutcho Creek, the 507 ARW would need to obtain the necessary Floodplain Use Permit prior to construction. Construction of the new hangar in this location would reduce the capacity of the floodplain. The reduction in surface area for groundwater recharge would be regionally negligible; additional runoff would be captured by the on-base stormwater retention ponds and creek systems. Therefore, impacts to water resources associated with the selection and implementation of Alternative 1 would be adverse but considered less than significant following coordination with and permit approval from relevant agencies.

4.6.1.3 Alternative 2: Transfer of 137 AW Only

Selection of Alternative 2 would implement all of the BRAC 2005 recommendations affecting the 507 ARW with the exception of transferring four KC-135R aircraft to Tinker AFB. This alternative is similar to the Proposed Action in that it would include the demolition of Buildings 1037 and 1041 and the construction of a new hangar. In terms of water resources, impacts from this alternative would be similar to the Proposed Action (i.e., less than significant).

4.6.1.4 Alternative 3: No-Action Alternative

If the No-Action Alternative were selected, proposed construction activities would not be implemented and water resource conditions would remain unchanged from their current status, as described in *Section 3.6*. Selection of the No-Action Alternative would not impact regional or local water resources.



EA	**Alternative 1 (Hangar Repositioning) Components and Floodplains** **South Forty District** **Tinker Air Force Base**	FIGURE 4-5

EA	**Alternative 1 (Hangar Repositioning) Components and Wetlands and Water Bodies** **South Forty District** **Tinker Air Force Base**	FIGURE 4-6

4.7 Biological Resources

4.7.1 Approach to Analysis

Determination of the significance of potential impacts to biological resources is based on: 1) the importance (i.e., legal, commercial, recreational, ecological, or scientific) of the resource; 2) the proportion of the resource that would be affected relative to its occurrence in the region; 3) the sensitivity of the resource to proposed activities; and 4) the duration of ecological ramifications. Impacts to biological resources are significant if species or habitats of concern are adversely affected over relatively large areas or disturbances cause reductions in population size or distribution of a species of concern.

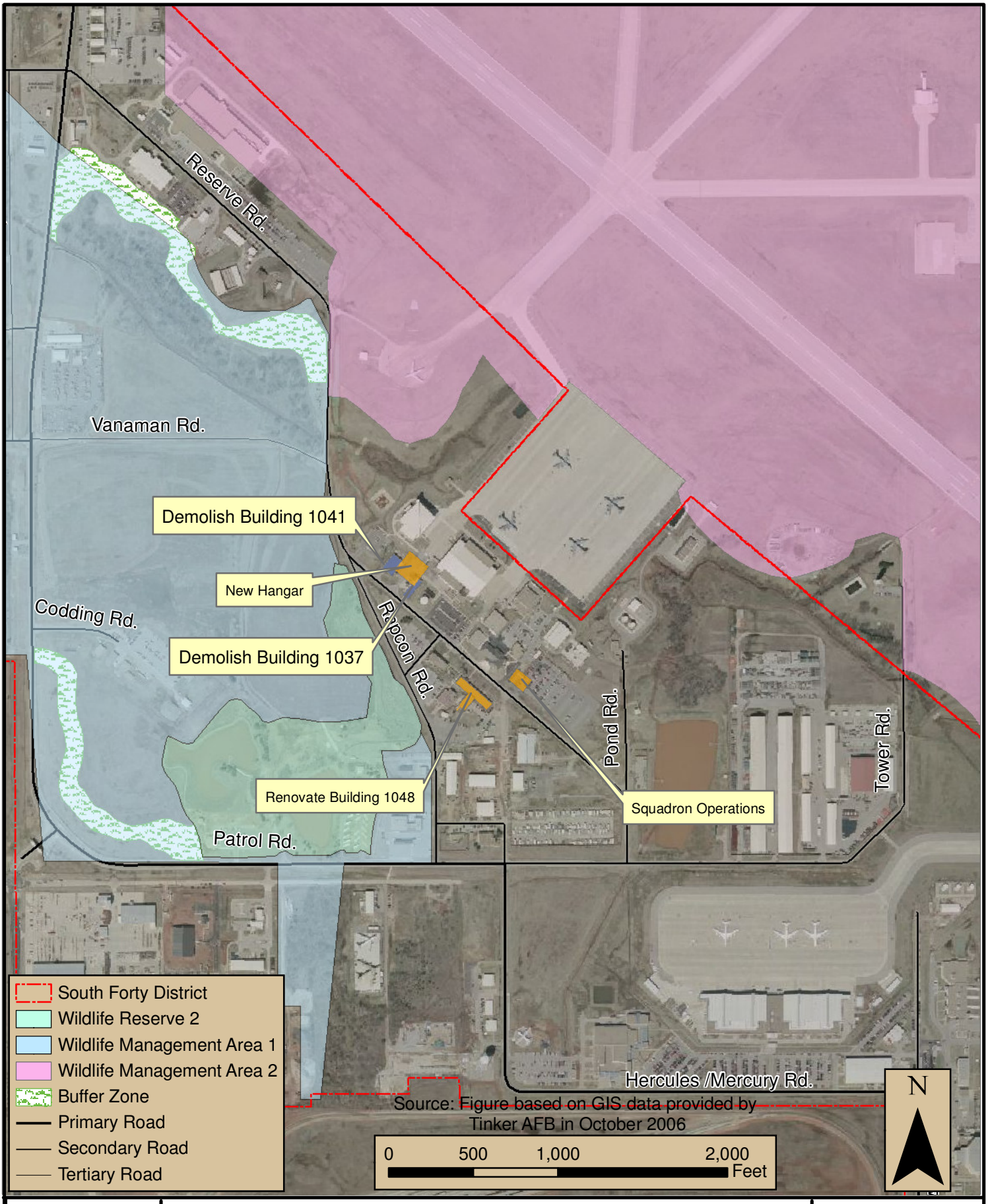
Data from the USFWS, Oklahoma Wildlife Department, and Tinker AFB Integrated Natural Resources Management Plan were reviewed to determine the presence or potential occurrence of sensitive species and habitats in the study area. Potential physical impacts such as habitat loss, noise, and impacts to surface water were evaluated to assess potential impacts to biological resources resulting from implementation of the Proposed Action and identified alternatives.

4.7.2 Impacts

4.7.2.1 Proposed Action

Construction associated with the Proposed Action would be located outside all identified wildlife management areas (Figure 4-7) and would require almost no vegetation removal. Based on the lack of sensitive or native plants species on the 507 ARW Complex, proposed construction would not have significant impacts on vegetation or the habitat it may provide. Areas where construction would occur have been previously disturbed and are primarily paved or otherwise developed and contain no known critical habitats. The Texas Horned Lizard (*Phrynosoma cornutum)*, a federal species of concern, is known to be present in the South Forty District; however, the sites proposed for construction of facilities associated with the Proposed Action are not located in known distribution areas for this species (see Figure 3-15). No other sensitive species are known to occur in or near areas that would be affected by implementation of the Proposed Action. Therefore, there would be no impact to sensitive species.

The aircraft robust and corresponding increase in flight activities is not expected to increase disturbances to wildlife living in proximity to the base. The increase in noise associated with the aircraft robust would occur to the north and south of the base in areas which are developed and are not known to support sensitive wildlife species. No sensitive biological areas would be exposed to increased levels of disturbance as a result of the Proposed Action. Therefore, impacts to biological resources would not be significant.



EA

Proposed Action Components and Wildlife Management Areas
South Forty District
Tinker Air Force Base

FIGURE 4-7

4.7.2.2 Alternative 1: Hangar Repositioning

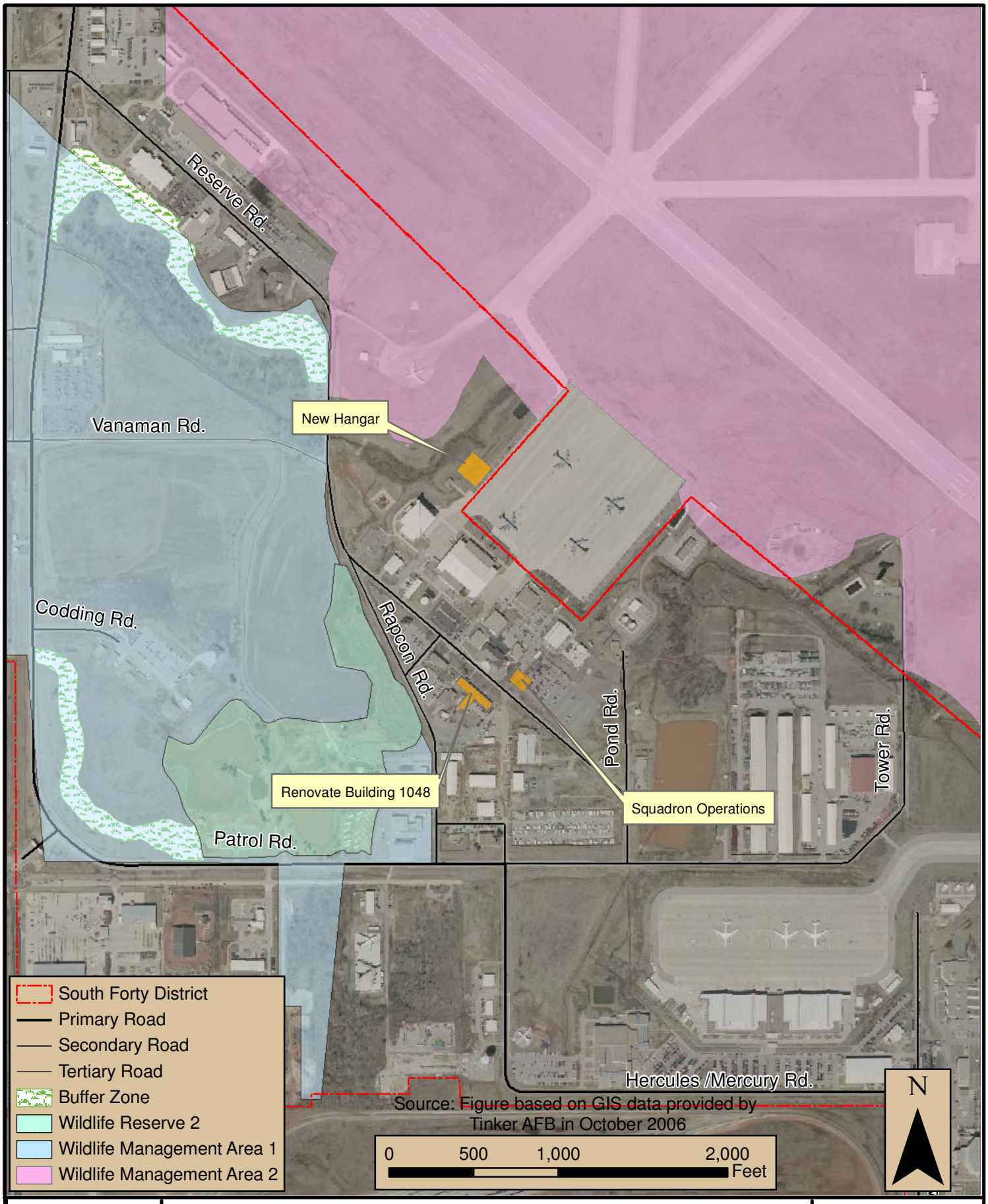
Under this alternative, the new hangar would be constructed on the north side of the 507 ARW in the 100-year floodplain associated with Crutcho Creek; this alternative does not include the demolition of Buildings 1037 and 1041. All other actions would be implemented as described in the Proposed Action. As would occur under the Proposed Action, construction associated with the Proposed Action would be located outside all identified wildlife management areas (Figure 4-8). Under this alternative, the mixed grassland adjacent to the existing apron would be paved; therefore, greater amount of vegetation would be disturbed than under the Proposed Action. However, the maintained, mixed grassland does not contain sensitive vegetation species and developing the grassland would not expose sensitive species to increased levels of disturbance. Areas where construction would occur have been previously disturbed from their original habitat and contain no known critical habitats. Construction of the new hangar would occur less than 100 ft from wetlands along Crutcho Creek which could have direct and indirect impacts on aquatic biota including the removal of wetland species. To reduce impacts to aquatic species, the 507 ARW would implement appropriate mitigation measures, including ensuring that a trained biological monitor remains on site for the duration of construction activities and installing temporary fencing around wetland areas. Under this alternative, adverse impacts to biological resources would be potentially greater than those described under the Proposed Action but would still be less than significant.

4.7.2.3 Alternative 2: Transfer of 137 AW Only

Selection of Alternative 2 would implement all of the BRAC 2005 recommendations affecting the 507 ARW with the exception of transferring four KC-135R aircraft to Tinker AFB. This alternative is similar to the Proposed Action in that it would include the demolition of buildings 1037 and 1041 and the construction of a new hangar. However, the four KC-135R aircraft would not be transferred under this alternative. In terms of biological resources, impacts from this alternative would be similar to the Proposed Action (i.e., less than significant).

4.7.2.4 Alternative 3: No-Action Alternative

If the No-Action Alternative were selected, Tinker AFB would not implement the Proposed Action. Therefore, no impacts to existing biological resources, as described in *Section 3.7*, would result from selection of the No-Action Alternative.



EA	**Alternative 1 (Hangar Repositioning) Components and Wildlife Management Areas** **South Forty District** **Tinker Air Force Base**	FIGURE 4-8

4.8 Transportation and Circulation

4.8.1 Approach to Analysis

Potential impacts to transportation and circulation are assessed with respect to anticipated disruption or improvement of current transportation patterns and systems; deterioration or improvement of existing levels of service; and changes in existing levels of transportation safety. Beneficial or adverse impacts may arise from the physical changes to circulation (e.g., closing, rerouting, or creating roads), construction activity, introduction of construction-related traffic on local roads, or changes in daily or peak-hour traffic volumes created by base workforce or population changes. Adverse impacts on roadway capacities would be significant if roads with no history of exceeding capacity were forced to operate at or above their full design capacity.

4.8.1.1 Proposed Action

Construction-Related Impacts

Implementation of the Proposed Action would require delivery of materials to construction sites. However, construction traffic would make up only a small portion of the total existing traffic volume in the region and at the base, and many of the vehicles would be driven to and kept on site for the duration of construction, resulting in very few actual increased trips. Further, increases in traffic volumes associated with construction activity would be short-term; upon completion of construction, no long-term impacts to off-site transportation systems would result.

Operation-Related Impacts

Implementation of the Proposed Action would result in the addition of 125 full-time personnel and 300 Traditional Guardsmen to staff and support the associate squadron. Although this represents an increase of approximately 1.8 percent over current personnel levels at Tinker AFB, these vehicle trips are already occurring in the Oklahoma City region since these personnel are currently commuting to Will Rogers World Airport. Further, in the context of total local and regional vehicle trips, these additional trips would be negligible and not result in significant impact to local and regional transportation.

Assuming one privately owned vehicle (POV) per new full-time staff member, the additional 125 POVs would create additional traffic at gates in the mornings when personnel arrive at work. However, once on base, POVs would be driven to parking spaces beyond the gate and most would remain on site for the duration of the workday; therefore, the additional POVs would not significantly impact circulation on-base.

With regard to parking, as stated in *Section 3.8*, the base currently has 750 POV spaces assigned to the 507 ARW. A total of 92 spaces would be lost for the construction of the Squadron Operations Building, leaving 658 spaces available for use by the 507 ARW. The addition of 125 POVs during the work week would not significantly affect the capacity of base or USAF standards regarding parking ratios. Parking space on drill weekends is already below the USAF

standards and the addition of 425 POVs would exacerbate the situation. However, as described in *Section 3.8,* 507 ARW reservists are broken into groups and drill weekends are staggered to alleviate the parking constraints and effectively meet USAF standards. The additional 300 Traditional Guardsmen would be similarly divided among the groups. Therefore, impacts with regard to parking are anticipated to be less than significant.

4.8.1.2 Alternative 1: Hangar Repositioning

Under this alternative, the new hangar would be constructed on the north side of the 507 ARW and buildings 1037 and 1041 would not be demolished. All other elements of the Proposed Action would be implemented. Impacts resulting from the implementation of this alternative would be the same as for the Proposed Action.

4.8.1.3 Alternative 2: Transfer of 137 AW Only

Selection of Alternative 2 would implement all of the BRAC 2005 recommendations affecting the 507 ARW with the exception of transferring four KC-135R aircraft to Tinker AFB. This alternative is similar to the Proposed Action in that it would include the demolition of Buildings 1037 and 1041 and the construction of a new hangar. However, the four KC-135R aircraft would not be transferred under this alternative. This alternative would transfer the personnel of the 137 AW, therefore, impacts to traffic and parking would occur as described for the Proposed Action (i.e., adverse but less than significant).

4.8.1.4 Alternative 3: No-Action Alternative

If the No-Action Alternative were selected, Tinker AFB would not implement facilities construction projects and the associate wing would not be created. Therefore, no changes to the number of personnel or to transportation, parking, or circulation would occur.

4.9 Visual Resources

4.9.1 Approach to Analysis

Determination of the significance of impacts to visual resources is based on the level of visual sensitivity in the area. Visual sensitivity is defined as the degree of public interest in a visual resource and concern over adverse changes in the quality of that resource. In general, an impact to a visual resource is significant if implementation of the Proposed Action would result in substantial alteration to an existing sensitive visual setting.

4.9.2 Impacts

4.9.2.1 Proposed Action

Facilities construction and increased aircraft operations associated with the Proposed Action would be visually consistent with existing structures. Further, new structures would be located such that they would not be visible from offsite, and an overall increase in aircraft operations by

5.4 percent would not be noticeable to the general public. The visual environment of Tinker AFB does not constitute a unique or sensitive viewshed and any realized impact would be negligible; therefore, no significant impacts to regional visual resources would occur upon implementation of the Proposed Action.

4.9.2.2 Alternative 1: Hangar Repositioning

If this alternative were selected, the hangar would be constructed north of the existing 507 ARW hangar; all other components of the Proposed Action would be implemented. Overall visual characteristics at the base and views from off site areas would not be affected with implementation of this alternative. Implementation of this alternative would result in alteration of the riparian vegetation of Crutcho Creek which includes large, mature trees and undergrowth. The riparian vegetation buffers the view of the 507 ARW apron from the runways but does not constitute a unique or sensitive viewshed; therefore, impacts to regional visual resources would not be significant under Alternative 1.

4.9.2.3 Alternative 2: Transfer of 137 AW Only

Selection of Alternative 2 would implement all of the BRAC 2005 recommendations affecting the 507 ARW with the exception of transferring four KC-135R aircraft to Tinker AFB. This alternative is similar to the Proposed Action in that it would include the demolition of buildings 1037 and 1041 and the construction of a new hangar. However, the four KC-135R aircraft would not be transferred under this alternative. As with the Proposed Action, the facilities construction projects associated with this alternative would be visually consistent with existing structures at the base and cannot be viewed from off base. Further, the visual environment of Tinker AFB does not constitute a unique or sensitive viewshed; therefore, no significant impact to regional visual resources would occur upon implementation of this alternative.

4.9.2.4 Alternative 3: No-Action Alternative

No impacts to existing visual resources at or in the vicinity of Tinker AFB would occur if the No-Action Alternative were selected and visual resources conditions would remain as described in *Section 3.9*.

4.10 Cultural Resources

4.10.1 Approach to Analysis

Cultural resources are subject to review under both federal and state laws and regulations. Section 106 of the National Historic Preservation Act (NHPA) of 1966 empowers the Advisory Council on Historic Preservation to comment on federally initiated, licensed, or permitted projects affecting cultural sites listed or eligible for inclusion on the National Register of Historic Places (NRHP).

Once cultural resources have been identified, significance evaluation is the process by which they are assessed relative to significance criteria for scientific or historic research, for the general public, and for traditional cultural groups. Only cultural resources determined to be significant (i.e., eligible for the NRHP) are protected under the NHPA.

Analysis of potential impacts to cultural resources considers both direct and indirect impacts. Direct impacts may occur by 1) physically altering, damaging, or destroying all or part of a resource; 2) altering characteristics of the surrounding environment that contribute to resource significance; 3) introducing visual, audible, or atmospheric elements that are out of character with the property or alter its setting; or 4) neglecting the resource to the extent that it deteriorates or is destroyed.

Direct impacts can be assessed by identifying the types and locations of Proposed Actions and determining the exact locations of cultural resources that could be affected. Indirect impacts primarily result from the effects of project-induced population increases and the resultant need to develop new housing areas, utility services, and other support functions necessary to accommodate population growth. These activities and facilities' subsequent use can disturb or destroy cultural resources.

4.10.2 Impacts

4.10.2.1 Proposed Action

Buildings 1041 and 1037 are proposed for demolition under the Proposed Action. Both buildings are less than 50 years old and are neither is recognized as a facility of historical importance. Neither of these facilities is known to have military or architectural significance.

Further, all construction projects associated with the Proposed Action have been sited in previously developed areas on the base. No NRHP-listed or eligible archaeological resources have been recorded at the 507 ARW Complex. Although the proposed construction sites have been heavily disturbed during establishment and subsequent development and use of the base, the potential exists – however slight – for currently buried remains to be uncovered during ground-disturbing activities (i.e., construction and expansion of facilities). If such resources were uncovered during development of the Proposed Action, activities would be suspended and Tinker AFB would consult with the Oklahoma State Historic Preservation Office to determine the significance of the resource(s).

There are no known federally recognized Native American lands or resources at Tinker AFB. Tinker AFB has initiated consultations with three Native American tribes (Seminole Nation, Osage Nation, and Muskogee Nation). Each of these tribes has previously verbally commented that they have no Native American Graves Protection and Repatriation Act (NAGPRA) or American Indian Religious Freedom Act (AIRFA) concerns with regard to the Proposed Action. Additionally, the tribes have communicated that Tinker AFB property is not suitable for religious or burial sites (Tinker AFB 2001).

If Native American lands or resources are determined to be present near any of the proposed project locations, activities would be suspended until a qualified archaeologist and Native American representative could determine the significance of the resource(s). Therefore, based on information currently available, impacts with regard to cultural resources would not be significant.

4.10.2.2 Alternative 1: Hangar Repositioning

Under this alternative, all projects described under the Proposed Action would be implemented; however, the new hangar would be repositioned to the north side of the 507 ARW's apron, in the 100-year floodplain associated with Crutcho Creek. Although the maintained, mixed grassland was previously disturbed during the development of the base and runways, the potential exists for previously buried remains to be uncovered during construction of the new hangar. Similar to the Proposed Action, if any remains were uncovered, all activity would be suspended until a qualified archaeologist could determine the significance of the resource(s). All other impacts would be similar to the Proposed Action (i.e., less than significant).

4.10.2.3 Alternative 2: Transfer of 137 AW Only

Selection of Alternative 2 would implement all of the BRAC 2005 recommendations affecting the 507 ARW with the exception of transferring four KC-135R aircraft to Tinker AFB. This alternative is similar to the Proposed Action in that it would include the demolition of buildings 1037 and 1041 and the construction of a new hangar. However, the four KC-135R aircraft would not be transferred under this alternative. In terms of cultural resources, impacts from this alternative would be similar to the Proposed Action (i.e. less than significant).

4.10.2.4 Alternative 3: No-Action Alternative

Cultural resources, as described in *Section 3.10*, would not be impacted if the No-Action Alternative were selected. Therefore, no significant impacts to cultural resources would occur under implementation of the No-Action Alternative.

4.11 Socioeconomics

4.11.1 Approach to Analysis

Significance of population and expenditure impacts are assessed in terms of their direct effects on the local economy and related effects on other socioeconomic resources (e.g., housing). The magnitude of potential impacts can vary depending on the location of a Proposed Action; for example, implementation of an action that creates 20 employment positions may be unnoticed in an urban area but may have significant impacts in a more rural region. Potential socioeconomic impacts would be considered significant if they would result in substantial shifts in population trends, or adversely affect regional spending and earning patterns.

4.11.2 Impacts

4.11.2.1 Proposed Action

The Proposed Action includes the transfer of 125 full-time and 300 Traditional Guardsmen from the 137 AW to Tinker AFB. The 137 AW is located at the Will Rogers Airport in southwest Oklahoma City, and the employees that would transfer to Tinker AFB currently reside in or near Oklahoma City. Therefore, the Proposed Action would not require new employees to move into the region. Economic activity associated with proposed construction activities, such as hiring of temporary laborers and purchasing of materials, would provide short-term economic benefits to the local economy. However, beneficial impacts resulting from construction payrolls and materials purchased would be negligible on a regional scale. Therefore, the Proposed Action would have beneficial but less than significant impacts on local socioeconomic characteristics.

4.11.2.2 Alternative 1: Hangar Repositioning

This alternative would implement all elements of the Proposed Action. However, the proposed hangar would be constructed in an alternate location and no building demolition would be required. The feasible alternative location for the hangar is north of the existing hangar in the floodplain of Crutcho Creek. Like the Proposed Action, no measurable socioeconomic impacts would result from the transfer of 137 AW personnel. Short-term beneficial impacts to the local economy from construction-related employment and purchasing would occur; however, these benefits would be negligible on a regional scale. Similar to the Proposed Action, no long-term socioeconomic impacts would occur, and socioeconomic impacts associated with this alternative would not be significant.

4.11.2.3 Alternative 2: Transfer of 137 AW Only

Alternative 2 would implement the transfer of the 137 AW only. This alternative is similar to the Proposed Action in that it would include the demolition of buildings 1037 and 1041 and the construction of a new hangar. However, the four KC-135R aircraft would not be transferred from Portland IAP AGS under this alternative. Like the Proposed Action, no significant socioeconomic impacts would result from the transfer of 137 AW and short-term beneficial impacts to the local economy from construction-related employment and purchasing would be negligible on a regional scale. Similar to the Proposed Action, no long-term socioeconomic impacts would occur.

4.11.2.4 Alternative 3: No-Action Alternative

Under the No-Action Alternative, the 137 AW would remain at Will Rogers AGS; no aircraft would be transferred from Portland IAP AGS; and no construction, demolition, or renovation to provide support facilities for the aerial refueling mission would occur. No change to regional socioeconomic characteristics would occur and socioeconomic conditions would remain as described in *Section 3.11*.

4.12 Environmental Justice and Protection of Children

4.12.1 Approach to Analysis

In order to comply with Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, ethnicity and poverty status in the vicinity of Tinker AFB have been examined and compared to city, regional, state, and national data to determine if any minority or low-income communities could potentially be disproportionately affected by implementation of the Proposed Action or alternatives. Similarly, to comply with Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks,* the distribution of children and locations where numbers of children may be proportionally high on and in the vicinity of Tinker AFB were determined to ensure that environmental risks and safety risks to children are addressed.

4.12.2 Impacts

4.12.2.1 Proposed Action

In general, residents in communities near the base may be considered both minority and low-income. The percentage of the population living below the poverty level in Oklahoma City (18.7 percent) is greater than that of the county, state, or nation. The number of minority residents living in Oklahoma City (33.0 percent) is higher than the county, state, and nation. However, communities near the base do not comprise dense minority populations.

Protection of Children

Oklahoma City has 24.9 percent of its total population represented by children under age 18; this is less than the county and nation averages but greater than the state. Housing and facilities for children are present on Tinker AFB; however, children would not have access to construction sites. Tinker AFB has recently completed an *AICUZ Study* that documented the anticipated change in noise contours associated with implementation of the Proposed Action and the resulting increased flying operations. As described in Section 3.3, impacts with regard to noise off-base would not be significant and no new sensitive receptors would be included within the 65+ noise contour. Therefore, impacts with regard to protection of children would be less than significant.

4.12.2.2 Alternative 1: Hangar Repositioning

This alternative would implement all elements of the Proposed Action. However, the proposed hangar would be constructed in an alternate location and no building demolition would be required. The feasible alternative location for the hangar is north of the existing hangar in the floodplain of Crutcho Creek. Like the Proposed Action, this alternative would not result in direct impacts to children.

4.12.2.3 Alternative 2: Transfer of 137 AW Only

Alternative 2 would implement the transfer of the 137 AW only. This alternative is similar to the Proposed Action in that it would include the demolition of Buildings 1037 and 1041 and the construction of a new hangar. Like the Proposed Action, the construction and transfer of 137 AW would not result in impacts to children. No aircraft would be added to the base. Therefore, no changes to noise contours would be expected and impacts to Environmental Justice and the Protection of Children would be less than significant.

4.12.2.4 Alternative 3: No-Action Alternative

If the No-Action Alternative were selected, the 137 AW would remain at Will Rogers AGS; no aircraft would be transferred from Portland IAP AGS; and no construction, demolition, or renovation to provide support facilities for the aerial refueling mission would occur. Therefore, Environmental Justice and Protection of Children conditions would remain as described in *Section 3.12* and no significant impacts would occur with selection of the No-Action Alternative.

4.13 Hazardous Materials and Wastes

4.13.1 Approach to Analysis

Numerous local, state, and federal laws regulate the storage, handling, disposal, and transportation of hazardous materials and wastes; the primary purpose of these laws is to protect public health and the environment. The significance of potential impacts associated with hazardous substances is based on their toxicity, ignitability, and corrosivity. Impacts associated with hazardous materials and wastes would be significant if the storage, use, transportation, or disposal of hazardous substances substantially increases the human health risk or environmental exposure.

4.13.2 Impacts

4.13.2.1 Proposed Action

Hazardous Materials and Waste

During implementation of the Proposed Action, a temporary increase in the storage of hazardous materials and waste throughout construction/modification of facilities would occur. However, the increase in construction-related hazardous materials and wastes would be temporary and would not comprise a significant impact.

Upon implementation of the Proposed Action, the 507 ARW would continue to operate KC-135R aircraft but would increase its inventory from 8 to 12 aircraft. Because 507 ARW operations comprise only a small portion of overall aircraft operations at the base, the aircraft robust is anticipated to minimally increase the storage and use of hazardous materials at Tinker AFB (Tinker AFB 2006j). The anticipated increase would affect only one hazardous waste

storage point, located in B1041, that would move into the new building after demolition of B1041. Wastes stored in B1041 include oil rags, blast media, petroleum distillate-680, and used oil. Further, the storage and use of these materials would continue to be accomplished in accordance with applicable laws and regulations and base policies, and the increased volume would be accommodated within the framework of existing management, handling, and disposal processes. Therefore, impacts with regard to hazardous materials and waste would be less than significant.

Defense Environmental Restoration Program

As stated in *Section 3.13*, the 507 ARW Complex is located in CG038 sub-unit 2E. The primary contaminants affecting this area include TCE, vinyl chloride, cis-1,2 DCE, and 1,2-Dichloroethane (DCA) (Tinker AFB 2002c). These contaminants are primarily restricted to the USZ which is located approximately 20 feet below ground surface (bgs). A groundwater extraction and treatment system has been in operation in the southwest quadrant of Tinker AFB since 1999. Based on the depth of construction, ground-disturbing activities associated with the Proposed Action should not encounter contaminated soil or groundwater; however, workers would cease work and notify the Environmental Manager if suspect materials or other signs of hazardous substances are detected during construction. Once operational, no further ground disturbance would be required and no long-term impacts related to IRP sites would occur. Therefore, impacts with regard to IRP sites would be less than significant.

4.13.2.2 Alternative 1: Hangar Repositioning

With regard to hazardous materials and waste, impacts from this alternative would be similar to the Proposed Action. The temporary increase in the storage of hazardous materials and wastes during construction/demolition would be insignificant, and the increase in hazardous materials and wastes volume would be accommodated within the regulatory and procedural framework established at the base. Therefore, no significant impacts to hazardous materials and wastes at the base would occur under implementation of this alternative.

4.13.2.3 Alternative 2: Transfer of 137 AW Only

Selection of Alternative 2 would implement all of the BRAC 2005 recommendations affecting the 507 ARW with the exception of transferring four KC-135R aircraft to Tinker AFB. This alternative is similar to the Proposed Action in that it would include the demolition of buildings 1037 and 1041 and the construction of a new hangar. However, the four KC-135R aircraft would not be transferred under this alternative, which would essentially eliminate the increase in hazardous materials usage and hazardous waste generation. Therefore, impacts with regard to hazardous materials and waste would be less than as described under the Proposed Action.

4.13.2.4 Alternative 3: No-Action Alternative

If the No-Action Alternative were selected, Tinker AFB would not implement the Proposed Action. Therefore, no impacts with regard to hazardous materials would occur and conditions would remain as described in *Section 3.13*.

4.14 Safety

4.14.1 Approach to Analysis

If implementation of the Proposed Action would substantially increase risks associated with aircraft mishap potential or flight safety relevant to the public or the environment, it would represent a significant impact. For example, if an action involved an increase in aircraft operations such that mishap potential would increase significantly, air safety would be compromised; conversely, beneficial impacts would be those reducing aircraft mishap potential.

Further, if implementation of the Proposed Action would result in incompatible land use with regard to safety criteria such as clear zones (CZs) or accident protection zones (APZs), impacts would be significant. Beneficial impacts would include those reducing exposure to mishaps.

4.14.2 Impacts

4.14.2.1 Proposed Action

Mishap Potential and Bird-Aircraft Strike Hazard

Implementation of the Proposed Action would result in an increase in the frequency of aircraft operations performed by the 507 ARW. Under the Proposed Action, the 507 ARW would receive four additional KC-135R aircraft, increasing the unit's complement of eight aircraft at the base to 12. Since the KC-135R has been in operation, the Class A mishap rate for the aircraft is 0.66 per 100,000 flying hours (USAF 2002b). Based on an average KC-135R sortie duration of 1.8 hours, the increase in aircraft operations represents a corresponding increase of 0.072 mishaps per year.

As described in *Section 3.14*, bird-aircraft strikes present a potential threat to Tinker AFB and 507 ARW aircraft and aircrew safety due to resident bird species as well as the base's proximity to Lake Stanley Draper and the Central Flyway. Implementation of the Proposed Action would result in changes to the frequency of aircraft operations performed by the 507 ARW which could correspond to an associated increase in likelihood of bird-aircraft strikes. However, Tinker AFB implemented a Bird-Aircraft Strike Hazard (BASH) Plan in 2006 which established preventative measures to reduce bird-aircraft strikes and has contracted with the US Department of Agriculture (USDA) to conduct live bird control on the base. With the implementation of these measures and the minimal statistical increase of mishap potential, impacts with regard to mishaps and BASH would be less than significant.

Accident Protection Zones

All proposed construction activities identified in the Proposed Action have been designed and sited to comply with all airfield safety criteria and are consistent with guidelines established in the base's *Master Plan*. No facilities development is proposed within airfield CZs or APZs; further, implementation of the Proposed Action would not result in a change in shape or shift in location of established CZs or APZs. Current land use incompatibilities exist with APZs I and II off Runways 17 and 12, respectively; however, no new incompatible land use would be introduced as a result of implementation of the Proposed Action. Although the increase in tempo of aircraft operations results in a slight increase in mishap potential (see above), such an increase is statistically insignificant. Therefore, no significant adverse impacts to airfield safety would result from implementation of the Proposed Action.

4.14.2.2 Alternative 1: Hangar Repositioning

This alternative would implement BRAC 2005 recommendations affecting the 507 ARW; the four additional KC-135R aircraft would be transferred to Tinker AFB and the 137 AW would be relocated Tinker AFB to associate with the 507 ARW. To maximize its operational effectiveness, the hangar should be located near the 507 ARW's apron, near the existing hangar. Although the aircraft robust would occur under this alternative, no significant adverse impacts to safety under this alternative would occur.

4.14.2.3 Alternative 2: Transfer of 137 AW Only

Alternative 2 would implement the transfer of the 137 AW only and the four KC-135R aircraft would not be transferred from Portland IAP AGS. This alternative would not be viable because it does not implement the BRAC 2005 recommendation of transferring the four KC-135R aircraft to Tinker AFB. With regard to safety, selecting this alternative would not require an increase in 507 ARW aircraft or operations; therefore, impacts would be identical to baseline conditions and not significant.

4.14.2.4 Alternative 3: No-Action Alternative

If the No-Action Alternative were selected, the 507 ARW would not implement the Proposed Action. Therefore, safety conditions would remain as described in *Section 3.14, Safety*.

SECTION 5
CUMULATIVE IMPACTS

Cumulative impacts on environmental resources result from a combination of incremental impacts of the Proposed Action with other past, present, and reasonably foreseeable future projects in an affected area. Cumulative impacts can result from minor but collectively substantial actions undertaken over a period of time by various agencies (federal, state, or local) or persons. In accordance with NEPA, the cumulative impacts resulting from projects that are proposed, under construction, recently completed, or anticipated to be implemented in the near future are discussed below.

Several projects in addition to the Proposed Action are planned within the South Forty District of Tinker AFB. These projects include:

- Construction of Substation Six
- Construction of a Child Development Center
- Replacement of a Medical Clinic
- Reconfiguration of Gott Gate.

Tinker AFB performed EAs for Substation Six, the Child Development Center, and Replacement of the Medical Clinic. No significant impacts were found to be associated with these individual projects (Tinker AFB 2005d, 2006h, and 2006i). An EA will be performed for the Gott Gate proposal.

All of the above-mentioned projects are planned for construction during approximately the same timeframe as the Proposed Action. Consequently, the potential exists for cumulative impacts to occur with regard to air quality, noise, and traffic. Cumulative air quality and noise impacts are expected to be less than significant since all projects would be required to implement best management practices to reduce air and noise emissions below significance thresholds and comply with local noise regulations.

The Proposed Action, the Child Development Center, and Gott Gate project would result in an increase in impervious surface, which will increase stormwater runoff into Crutcho Creek. SWPPPs would be prepared for each of these projects and vegetation would be maintained and/or restored to reduce runoff impacts to Crutcho Creek; therefore, these projects would not result in significant cumulative impacts to water quality.

Following completion of the Gott Gate project, traffic conditions in the South Forty District of Tinker AFB would be improved. The proposed project would be located on donated property to the southwest of the base, just outside the current base boundary. The project would accommodate the needed expansion and relocation of community and service-related facilities at Tinker AFB. Concurrent with this project, the 72 ABW also proposes to improve vehicular circulation throughout the base to accommodate the projected growth of existing and future

missions in the South Forty District. As a part of this project, Air Depot Boulevard would be upgraded to a four-lane road and Patrol Road and Southeast 59th Street would be upgraded as extensions of the north-south arterial. The implementation of this project would alleviate potential back-ups at gates allowing entry to the base during peak flow and provide a beneficial impact to transportation and circulation on base. Both the Child Development Center and Medical Clinic would have associated parking; therefore, significant cumulative impact to parking would not occur.

Regionally, the General Motors (GM) plant located south of Tinker AFB recently closed. This closure resulted in a decrease in traffic in the vicinity of the South Forty District would offset increases in traffic associated with the Proposed Action. However, this decrease would be temporary if the former GM plant is purchased and re-opened as a manufacturing facility.

SECTION 6
SUMMARY OF FINDINGS

A summary of environmental impacts anticipated to result from implementation of the proposed aircraft robust and short-term construction projects to implement the 2005 BRAC Recommendations for the 507 ARW at Tinker AFB is included in this section.

Airspace and Airfield Operations. Implementation of the Proposed Action would result in a 50-percent increase in the number of hours flown and the number of KC-135R aircraft maintained by the 507 ARW; however, this increase would only account for a 5.4 percent increase in total aircraft operations at Tinker AFB. The increase in KC-135R operations would not surpass the air traffic capacity of Tinker AFB and no impacts to runway usage would occur under the Proposed Action. The frequency of aircraft activity conducted by the 507 ARW in currently affected ATCAA areas (between 19,000 ft MSL and 28,000 ft MSL) and MOA airspace areas (above 15,000 ft MSL) would increase slightly; however, no change to the configuration (i.e., size, shape, or location) of these areas is proposed or would be required to support the implementation or accomplishment of the proposed aircraft robust. In addition, no modification of the ATC system at Tinker AFB would be required. Minimal 507 ARW operations would continue at the following airfields: Will Rogers World Airport, Amarillo International Airport, Clinton-Sherman Airport, and Altus Air Force Base. No airspace areas or ATC facilities used by the 507 ARW would be adversely impacted by implementation of the Proposed Action based on the limited amount of air traffic at these airfields and the infrequent use by the 507 ARW.

Air Quality. Implementation of the Proposed Action would result in the generation of PM_{10} during construction activities including grading and demolition. Because the majority of construction and demolition activities associated with the Proposed Action would take place on already disturbed and paved sites, dust generation and therefore emissions of PM_{10} are expected to be especially low. Any short-term adverse impacts resulting from the proposed construction activities would be further mitigated through standard dust minimization practices, such as watering exposed soils, soil stockpiling, and soil stabilization. Emissions from this source would not be significant.

Implementation of the Proposed Action would result in changes in aircraft operations and personnel levels at Tinker AFB. Long-term operational emissions associated with the Proposed Action would be emissions from the addition of four KC-135 aircraft and their operations. Increased flying operations associated with the KC-135 robust would result in annual emissions of 0.41 tons of NO_X, 0.02 tons of CO, 0.0004 tons of VOC, and 0.008 tons of PM_{10}. These emissions, when compared to the overall county-wide annual emissions, would be considered negligible and would not represent a significant impact. In addition, the Proposed Action would result in approximately 125 full-time personnel and 300 Traditional Guardsmen being transferred to Tinker AFB. This represents an increase of approximately 1.8 percent over current personnel levels at Tinker AFB. The addition of personnel would result in an increase of combustion

emissions associated with increased vehicular traffic in the vicinity of Tinker AFB. However, these vehicle trips are already occurring in the Oklahoma City region since these personnel are currently commuting to Will Rogers World Airport. Further, in the context of total regional vehicle trips, emissions would be negligible and not result in significant impact.

Noise. The proposed aircraft robust of the 507 ARW's current PAI from 8 KC-135R aircraft to 12 aircraft and associated increase in annual flight hours would result in a 50-percent increase in annual flight operations associated with this unit. Currently, noise exposure of 65 L_{dn} or higher associated with total military aircraft operations at Tinker AFB affects approximately 5,573 acres beyond the base boundary. Implementation of the Proposed Action would result in a 5.4-percent increase in the total number of annual aircraft operations at Tinker AFB; however, the off-base area affected by noise levels of 65 L_{dn} or greater would increase negligibly; cumulatively, this contour expansion would result in an increase in the area exposed to these noise levels off-base of only 19 acres, from 3,691 acres under existing conditions to 3,710 acres based on anticipated operations. No new areas off base would be newly exposed to the 65+ L_{dn} noise contour. Further, implementation of the Proposed Action would not result in any sensitive receptors (e.g., residences, schools, etc.) currently within the baseline 65+ L_{dn} contour to experience a significant increase in noise levels. Sensitive receptors currently within the 65+ L_{dn} contour would experience a negligible increase in sound level that is dependent on location. Thus, a slight increase in sound levels would result from implementation of the proposed aircraft robust; however, this action would not significantly impact sensitive receptors.

Implementation of the Proposed Action would have minor, temporary effects on the noise environment in the vicinity of proposed construction and demolition sites. However, noise generation would be typical of construction activities, short-term, and associated impacts could be reduced through the use of equipment sound mufflers and restriction of construction activity to normal working hours (i.e., between 7:00 AM and 5:00 PM). Therefore, noise generated by construction and demolition activities associated with implementation of the Proposed Action would not significantly impact sensitive receptors on or in the vicinity of Tinker AFB.

Land Use. All project components have been designed and sited to be compatible with existing installation land use and airfield safety guidelines and to be inherently consistent with Tinker AFB planning policies. In addition, the BRAC-required construction projects are necessary to comply with the 2005 BRAC Recommendations and to accommodate the aircraft robust and additional personnel. Construction components of the Proposed Action have been sited in accordance with established land use development guidelines addressing safety, functionality, and environmental protection zones. No adverse impacts to land use on Tinker AFB would occur.

With regard to off-site land use, no new types of land use activities would be introduced onto Tinker AFB as a result of the implementation of the Proposed Action. However, the proposed aircraft robust would increase the flight activity at the base, resulting in increased risk of accidents in all CZs and APZs. Although implementation of the Proposed Action would increase

507 ARW aircraft operations, noise levels in the surrounding community would negligibly increase. The size and location of the clear zones and accident potential zones would be unchanged and existing land uses in these areas would be unaffected; further, current land uses within the noise zones would remain unchanged and no land use areas would be newly introduced to the 65+ L_{dn} noise contour.

Geological Resources. Potential geologic impacts associated with the Proposed Action at the 507 ARW Complex would be limited to ground-disturbing activities. Minor impacts would result from proposed construction activities; however, all construction activities would occur on previously disturbed land and soils that are capable of supporting such development. Proposed construction would not have significant impacts on sensitive or regional geologic or physiographic features. Best management practices and standard erosion control measures would be incorporated to reduce any potential impacts related to geology and soils to less than significant levels. Therefore, impacts to soil, soil productivity, and geological resources due to the Proposed Action would not be significant.

Water Resources. With regard to surface water, construction would have localized and temporary effects on nearby hydrology and water quality; however, best management practices would be incorporated during construction to minimize erosion, runoff, and sedimentation. No additional impermeable surface areas would be created; therefore no impacts would occur with regard to groundwater hydrology. Storm water runoff would be captured by the on-base storm water retention pond and creek systems. None of the proposed facilities or improvements comprises a significant water user or wastewater generator. Therefore, the Proposed Action would not have an adverse impact on groundwater resources. Further, construction activities and staging areas would not be sited in or near identified wetlands on base; therefore, the Proposed Action would not impact wetlands. In addition, the proposed construction areas are not within the 100-year or 500-year floodplains; therefore, implementation of the Proposed Action would not impact or be impacted by 100-year floodplain or hazards associated with them.

Biological Resources. Construction associated with the Proposed Action would require almost no vegetation removal and, based on the lack of sensitive or native plants species on the 507 ARW Complex, proposed construction would not have significant impacts on vegetation or the habitat it may provide. Areas where construction would occur have been previously disturbed and are primarily paved or otherwise developed and contain no known critical habitats. The Texas Horned Lizard, a federal species of concern, is known to be present in the South Forty Distrct; however, the sites proposed for construction of facilities associated with the Proposed Action are not located in known distribution areas for this species. No other sensitive species are known to occur in or near areas that would be affected by implementation of the Proposed Action. Therefore, there would be no impact to sensitive species.

Transportation and Circulation. Once operational, implementation of the Proposed Action would result in the addition of 125 full-time personnel and 300 part-time Traditional Guardsmen to staff and support the associate squadron. The increase in personnel would result in a direct

increase in the number of vehicles on base; however, traditional guardsmen would only be on base during drill weekends and would therefore not impact base circulation. Once on base, the vehicles for the additional full-time personnel would be driven to parking spaces and most would remain on site for the duration of the workday; therefore, the additional vehicles would not significantly impact circulation on-base. Finally, from a regional perspective, the increase in personnel levels at Tinker AFB will be offset by the corresponding decrease in the number of commuters currently traveling to and from Will Rogers World Airport; ultimately, there will be no noticeable net change in the number of POV trips in the region. With regard to parking, the addition of 125 vehicles during the work week would not exceed the capacity on base or USAF standards regarding parking ratios. Parking space on drill weekends is already below the USAF standards and the addition of 425 vehicles would exacerbate the situation. However, drill weekends would be appropriately staggered to alleviate the parking constraints.

Visual Resources. Facilities construction projects and increased aircraft operations associated with the Proposed Action would be visually consistent with existing structures and activities at Tinker AFB. Further, the visual environment of Tinker AFB does not constitute a unique or sensitive viewshed; therefore, no significant impact to regional visual resources would occur upon implementation of the Proposed Action.

Cultural Resources. Buildings 1041 and 1037 are proposed for demolition under the Proposed Action. Both buildings are less than 50 years old and neither is recognized as a facility of historical importance. Neither of these facilities is known to have military or architectural significance. All construction projects associated with the Proposed Action have been sited in previously developed areas on the base. No NRHP-listed or eligible archaeological resources have been recorded at the 507 ARW Complex. There are no known federally recognized Native American lands or resources at Tinker AFB. Tinker AFB has initiated consultations with three Native American tribes (Seminole Nation, Osage Nation, and Muskogee Nation). Each of these tribes has verbally commented that they have no Native American Graves Protection and Repatriation Act (NAGPRA) or American Indian Religious Freedom Act (AIRFA) concerns with regard to the Proposed Action. Therefore, impacts to cultural resources are considered less than significant.

Socioeconomics. The Proposed Action includes the transfer of 125 full-time and 300 part-time Traditional Guardsmen from the 137 AW to Tinker AFB. The 137 AW is located at the Will Rogers Airport in southwest Oklahoma City, and the employees that would transfer to Tinker AFB currently reside in or near Oklahoma City. Therefore, the Proposed Action would not require new employees to move into the region. Economic activity associated with proposed construction activities, such as hiring of temporary laborers and purchasing of materials, would provide short-term economic benefits to the local economy. However, beneficial impacts resulting from construction payrolls and materials purchased would be negligible on a regional scale. Therefore, the Proposed Action would have beneficial but less than significant impacts on local socioeconomic characteristics.

Environmental Justice. *Minority and Low-Income Populations.* In general, residents in communities near the base may be considered both minority and low-income. The percentage of the population living below the poverty level in Oklahoma City (18.7 percent) is greater than that of the county, state, or nation. The number of minority residents living in Oklahoma City (33.0 percent) is higher than the county, state, and nation. However, communities near the base do not comprise dense minority populations.

Tinker AFB is in the process of developing an AICUZ Study that will determine the anticipated change in noise contours associated with implementation of the Proposed Action and the resulting increased flying operations. However, as described in Section 3.3, impacts with regard to noise off-base would not be significant and no new sensitive receptors minority and low-income populations would be less than significant.

Protection of Children. The City of Oklahoma has 24.9 percent of its total population represented by children under age 18; this is lower than the county and nation, but higher than the state. Housing and facilities for children are present on Tinker AFB; however, children would not have access to construction sites. Tinker AFB is in the process of developing an AICUZ Study that will determine the anticipated change in noise contours associated with implementation of the Proposed Action and the resulting increased flying operations. However, as described in Section 3.3, impacts with regard to noise off-base would not be significant and no new sensitive receptors would be included within the 65+ noise contour. Therefore, impacts with regard to protection of children would be less than significant.

Hazardous Material and Wastes. Upon implementation of the Proposed Action, a temporary increase in the storage of hazardous materials and waste would occur throughout construction/modifications of the proposed facility; however, the increase in construction-related hazardous materials and wastes would be temporary and would not comprise a significant impact. Additionally, the 507 ARW would continue to operate the KC-135R, but would increase its inventory from 8 to 12 aircraft. Because 507 ARW operations comprise only a small portion of overall aircraft operations at the base, the aircraft robust is anticipated to minimally increase the storage and use of hazardous materials at Tinker AFB. Further, the storage and use of these materials would continue to be accomplished in accordance with applicable laws, regulations, and base policies; and the increased volume would be accommodated within the framework of existing management, handling, and disposal processes. Therefore, impacts with regard to hazardous materials and waste would be less than significant.

Ground-disturbing activities associated with the Proposed Action are not expected to encounter contaminated soil or groundwater; however, workers would cease work and notify the Environmental Manager if suspect materials or other signs of hazardous substances are detected during construction. Once operational, no further ground disturbance would be required and no long-term impacts related to IRP sites would occur. Therefore, impacts with regard to IRP sites would be less than significant.

Safety. Implementation of the Proposed Action would result in changes to the frequency of aircraft operations performed by the 507 ARW. Bird-aircraft strikes present a potential threat to Tinker AFB and 507 ARW aircraft and aircrew safety due to resident bird species as well as the installation's proximity to Lake Stanley Draper and the Central Flyway. Implementation of the Proposed Action would result in changes to the frequency of aircraft operations performed by the 507 ARW which could correspond in an associated increase in likelihood of bird-aircraft strikes and other mishaps. Since the KC-135R has been in operation, the Class A mishap rate for the aircraft is 0.66 per 100,000 flying hours. Based on an average KC-135R sortie duration of 1.8 hours, the increase in aircraft operations represents a corresponding increase of 0.072 mishaps per year. Further, Tinker AFB implemented a BASH Plan in 2006 which established preventative measures to reduce bird-aircraft strikes and has contracted with the USDA to conduct live bird control on the base. With the implementation of these new measures, impacts with regard to mishaps and BASH are anticipated to be less than significant. All proposed construction activities identified in the Proposed Action have been designed and sited to comply with all airfield safety criteria and are consistent with guidelines established in the base's *Master Plan*. No facilities development is proposed within airfield CZs or APZs; further, implementation of the Proposed Action would not result in a change in shape or shift in location of established CZs or APZs. While current land use incompatibilities exist with APZs I and II off Runways 17 and 12, respectively, no new incompatible land use would be introduced as a result of implementation of the Proposed Action; therefore, minimal impacts to airfield safety would result from implementation of the Proposed Action.

SECTION 7
SPECIAL PROCEDURES

Impact evaluations contained in this EA have determined that no significant environmental impacts would result from implementation of the Proposed Actions or any identified alternative. This determination is based on thorough review and analysis of existing resource information, the application of accepted modeling methodologies, and coordination with knowledgeable, responsible personnel from Tinker AFB and relevant local, state, and federal agencies.

Since implementation of the Proposed Actions at Tinker AFB would not require changes or modifications to airspace, and for all resource areas were identified no adverse environmental impacts associated with the Proposed Actions, no recommendations for special procedures are required.

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 8
REFERENCES

Air Force Reserve Command (AFRC). 2006. Form 1391, Project Nos. WWYK079000, WWYK079003, and WWYK079005. Obtained from Tinker Air Force Base, 29 August 2006.

AFRC. 2006a. *SATAF Report, 507 ARW BRAC SATAF #1, 137th AW (ANG) Realignment to Associate Structure with the 507 ARW (AFRC), Tinker AFB, OK*. April 2006.

Bies, D.A. and C.H. Hansen. 1988. *Engineering Noise Control*. Unwin Hyman Ltd., London, pp. 89-95.

Department of Defense (DoD). 1978. Departments of the Air Force, the Army, and the Navy. *Planning in the Noise Environment*. AFM 9-10, TM 5-803-2, and NAVFAC P-970. Washington, DC.

DoD. 2002. Land Use Compatibility with AICUZ (pre-2002 and post-2002). Department of Defense 2002.

DoD. 2003. *DoD Minimum Antiterrorism Standards for Buildings.* October 2003.

DoD. 2005. *Base Closure and Realignment Report*. May 2005. Transmitted to AMEC Earth and Environmental, Inc. (AMEC) via the Internet (http://www.brac.gov/finalreport.html), 12 September 2006.

Federal Interagency Committee On Noise (FICON). 1992. *Federal Agency Review of Selected Airport Noise Analysis Issues.* Washington, DC.

Greater Oklahoma City Chamber. 2006. *Major Employers of the Area*. Transferred to AMEC via the Internet (http://www.okcchamber.com/page.asp?atomid=124), 26 November 2006.

Greater Oklahoma City Partnership. 2006. *Oklahoma County*. Accessed by AMEC via the Internet (http://www.greateroklahomacity.com/page.asp?atomid=535), 11 November 2006.

Hoagland, Bruce. 1999. *The Vegetation of Oklahoma: A Classification for Landscape Mapping and Conservation Planning*. Southwestern Naturalist 45(4): 385-420.

National Center for Educational Statistics (NCES). 2006. *Search for Schools, Colleges, and Libraries*. Tranferred to AMEC via the Internet (http://nces.ed.gov/globallocator/), 27 November 2006.

Oklahoma Air National Guard. 2006. *137 AW History*. Transmitted to AMEC via the Internet (http://www.okokla.ang.af.mil/history), 22 September 2006.

Oklahoma City. 2003. *Population Housing and Trends 1980-2000*. Planning Department. 19 September 2003. Transmitted to AMEC via the Internet (http://www.okc.gov/planning/census/ppt/census_files/frame.htm) 28 November 2006.

Oklahoma City Convention and Visitors Bureau (OCCVB). 2006. *Oklahoma City History*. Transmitted to AMEC via the Internet (http://www.okccvb.org/history.html), 9 November 2006.

Oklahoma City Planning Department. 2006. *Oklahoma City Plan (OKC Plan)*. 2000, as amended 10 August 2006. Transmitted to AMEC via the Internet (http://www.okc.gov/query.html?planning/index.html), 8 November 2006.

Oklahoma City Public Schools. 2006. *2005-2006 Quick Facts*. Transmitted to AMEC via the Internet (http://www.okcps.org/news/qf05-06.pdf), 26 November 2006.

Oklahoma County Assessor Online Mapping (OCA). 2006. Geocortex Internet Mapping. Transmitted to AMEC via the Internet (http://oklahoma.latitudegeo.com/imf/sites/oklahoma/launch.html), 15 November 2006.

Oklahoma Department of Commerce. 2002. *Population Projections 2000 – 2030, City by County*. November 2002. Transferred to AMEC via the Internet (http://www.okcommerce.gov/), 22 November 2006.

Oklahoma Department of Tourism and Recreation. 2006. *A Look at Oklahoma Student Guide*. Transferred to AMEC via the Internet (http://www.otrd.state.ok.us/StudentGuide/default.html), 27 November 2006.

Oklahoma Department of Transportation. 2006. *2005 Annual Average Daily Traffic, Oklahoma City Urbanized Area.* Transferred to AMEC via the Internet (http://www.okladot.state.ok.us/hqdiv/p-r-div/maps/aadt/okla-urban05.pdf), 11 November 2006.

Oklahoma Department of Wildlife Conservation (ODWC). 2006. *Oklahoma's Endangered and Threatened Species and Species of Special Concern.* Transmitted to AMEC via the Internet (http://www.wildlifedepartment.com/enlander2.htm), 31 October 2006.

Oklahoma Natural Heritage Inventory Database (ONHI). May 05, 2003. Federal and State Endangered, Threatened, and Candidate Species in Oklahoma by County, OK. Transmitted to AMEC via the Internet, (http://www.biosurvey.ou.edu/download/heritage/countypr0503.pdf), 31 October 2006.

Oklahoma University (OU). 2006. *Oklahoma's Past, Oklahoma County*. Oklahoma Archeological Society, OK. Transmitted to AMEC via the Internet (http://www.ou.edu/cas/archsur/counties/oklahoma.htm), 09 November 2006.

Oklahoma Water Resources Board (OWRB). 2006. *Groundwater and Surface Water of Oklahoma County, OK*. Transmitted to AMEC via the Internet (http://www.owrb.state.ok.us), 08 November 2006.

Tinker Air Force Base (Tinker AFB). 2001. *Tinker Air Force Base, Integrated Natural Resource Plan, Tinker AFB, Oklahoma*. October 2001. Transmitted to AMEC via the Internet (http://www.ext.tinker.af.mil/em/NatRes/INRMP_TOC.htm), 30 October 2006.

Tinker AFB. 2002a. *United States Air Force Environmental Assessment, Construction of Various Facilities within the South Forty Development Area at Tinker AFB, Oklahoma City, Oklahoma*. January 2002.

Tinker AFB. 2002b. *Storm Water Pollution Prevention Plan*. October 2002.

Tinker AFB. 2002c. *Site CG038, RCRA Facility Investigation Report*. February 2002.

Tinker AFB. 2004a. *Community Relations Plan for the Installation Restoration Program and Resource Conservation and Recovery Act*, Transmitted to AMEC via the Internet (http://wwwext.tinker.af.mil/em/), 27 November 2006.

Tinker AFB. 2004b. *OC-ALC Plan 19-2, Spill Prevention and Emergency Response Plan for Hazardous and Extremely Hazardous Material and Spill Prevention Control and Countermeasures Plan, Tinker Air Force Base, Oklahoma*. October 2004.

Tinker AFB. 2005a. *Tinker Air Force Base General Plan*. 2005.

Tinker AFB. 2005b. *Tinker Air Force Base Commander's Summary*. 2005.

Tinker AFB. 2005c. *Quality Program Plan for Evaluation of Lead Contamination Extent at The Old Skeet Range - Site CG038 Tinker Air Force Base, Oklahoma*. January 2005.

Tinker AFB. 2005d. Environmental Assessment Replacement of Medical Clinic Finding of No Significant Impact.

Tinker AFB. 2006a. *US Air Force Fact Sheet, 507th ARW*. Transmitted to AMEC via the Internet (http://www.ext.tinker.af.mil/em/), 8 August 2006.

Tinker Air Force Base (AFB). 2006b. Air Installation Compatible Use Zone Study. Tinker AFB, OK. August 2006.

Tinker AFB. 2006c. Personal Communication with LTC Edsel Frye, Operations Group Commander/507 ARW. November 2006.

Tinker AFB. 2006d. Noise Complaints. Personal Communication with Timothy Taylor, 72 ABW/CEVOE. December 2006.

Tinker AFB. 2006e. *Environmental Compliance Assessment and Management Program, FY 2006 Final Report*. 28 August 2006.

Tinker AFB. 2006f. Mishap Data. Personal Communication with Timothy Taylor, 72 ABW/CEVOE. December 2006.

Tinker AFB. 2006g. BASH Data. Personal Communication with Timothy Taylor, 72 ABW/CEVOE. December 2006.

Tinker AFB. 2006h. Draft Environmental Assessment Substation Six Finding of No Significant Impact.

Tinker AFB. 2006i. Draft Final Environmental Assessment Child Development Center Finding of No Significant Impact.

Tinker AFB. 2006j. Hazardous Materials. Personal Communication with Timothy Taylor, 72 ABW/CEVOE. December 2006.

Tinker AFB. 2007a. Hazardous Materials. Comments provided by Scott Bowen, 72 ABW/CEVOE. July 2007.

Tinker AFB. 2007b Draft *Integrated Natural Resources Management Plan (INRMP)*. Environmental Management Division, Tinker AFB, OK.

USACE. 2002. *Tinker Air Force Base Special Study, Oklahoma County, Oklahoma, US* Army Corp of Engineers Southwestern Division – Tulsa District, October 2002.

US Air Force (USAF). 1984. *Bird Avoidance for Military Low-Level Operations in the United States*. Prepared by Capt. R.J. DeFusco, CEVG Bird-Aircraft Strike Hazard (BASH) Team. Tyndall AFB, FL.

USAF. 1988. Air Force Bird Strike Report (1987). Prepared by Capt. R.J. DeFusco, Bird-Aircraft Strike Hazard (BASH) Team. Washington, DC.

USAF. 1992. Air Force Procedure for Predicting Noise Around Airbases: Noise Exposure Model (NOISEMAP) Technical Report, Report AL-TR-1992-0059.

USAF. 1995. OMEGA108R – Compute Flight Noise Measure Data for Military Aircraft. Developed by the University of Dayton Research Institute. Wright-Patterson AFB, OH.

USAF. 2001a. Air Force Instruction 91-204, Safety Investigations and Reports. Transmitted to AMEC via the Internet (http://afpubs.hq.af.mil).

USAF. 2001b. Safety Center. Transmitted to AMEC via the Internet (http://safety.kirtland.af.mil/AFSC/RDBMS/Flight/stats/aircraft_stats.html). December 2001.

USAF. 2002a. Flyover Noise Calculator. USAF AFRL/HECB. Wright-Patterson Air Force Base, OH. May.

USAF. 2002b. Air Force Safety Center, Aviation Safety Division. Transmitted to AMEC via the Internet (http://afsc.saia.af.mil/AFSC/ BASH/home.html).

USAF. 2006. *C-130 Hercules Fact Sheet*. Transmitted to AMEC via the Internet (http://www.af.mil/factsheets/factsheet.asp?fsID=92), 22 September 2006.

US Bureau of Economic Analysis (BEA). 2006. *Employment by Industry/Annual Earnings by Industry for Oklahoma County (2004)*. Transmitted to AMEC via the Internet (http://www.bea.doc.gov/bea/regional/reis/), 26 November 2006.

US Census Bureau. 2006. *2005 American Community Survey Data Profile Highlights*. Transmitted to AMEC via the Internet (http://factfinder.census.gov/home/saff/main.html?_lang=en), 22 November 2006.

US Department of Agriculture. 2003. *Soil Survey of Oklahoma County, Oklahoma*. Prepared by Natural Resources Conservation Service in cooperation with the Oklahoma Agricultural Experiment Station and the Oklahoma Conservation Commission, 2003.

US Department of Housing and Urban Development. 1991. *The Noise Guidebook.* Office of Community Planning and Development. Prepared by the Environmental Planning Division, Office of Environment and Energy. Washington, DC.

US Environmental Protection Agency (USEPA). 1973. *Impact Characterization of Noise Including Implications of Identifying and Achieving Levels of Cumulative Noise Exposure.* USEPA Report NTID 73.4. Washington, D.C.

US Environmental Protection Agency (US EPA). 2006b. Surf Your Watershed, Environmental Information on Watersheds. Transmitted to AMEC via the Internet (http://cfpub.epa.gov/surf/county.cfm), 09 November 2006.

US Fish and Wildlife Service (USFWS). 2006a. National Wetlands Inventory Maps. Transmitted to AMEC via the Internet (http://wetlandsfws.er.usgs.gov), 08 November 2006.

USFWS. 2006b. Oklahoma County Endangered Species List. Transmitted to AMEC Earth & Environmental via the Internet (http://www.fws.gov/ifw2es/EndangeredSpecies/lists/ListSpecies.cfm), 31 October 2006.

USFWS. 2006c. *Determination of Critical Habitat for the Whooping Crane*. Federal Register, Vol. 43, No. 94, 15 May 1978. Transmitted to AMEC via the Internet (http://www.fws.gov/cno/es/listing.html), 30 October 2006.

USFWS. 2006d. *Final Determination of Critical Habitat for the Arkansas River Basin Population of the Arkansas River Shiner (Notropis giradi)*; Final Rule. Federal Register, Vol. 70, No. 197, 13 October 2005. Transmitted to AMEC via the Internet (http://www.fws.gov/cno/es/listing.html), 30 October 2006.

US Geological Survey (USGS). 1997. National Water Summary on Wetland Resources. Transmitted to AMEC via the Internet (http://water.usgs.gov), 08 November 2006.

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 9
LIST OF PREPARERS

This report was prepared for, and under the direction of, the Air Force Center for Environmental Excellence by AMEC Earth and Environmental, Inc. Members of the professional staff are listed below:

Project Management

Aaron Goldschmidt, Program Manager

M.A. Geography

Marcie Martin, Project Manager

M.S. Environmental Management and Industrial Hygiene

Technical Analysts

Brian Cook

B.A. Biology

Richard Lounsbury, P.G.

B.S. Geology

Doug McFarling

B.A. Environmental Studies

Stephen Ochs

M.S. Chemical Engineering

Heather Rothbard

B.S. Botany

Leanna Struzziery

M.E.S.M. Environmental Science Management

Production

Jason Ramsey

GIS Technician

Angie Salaiz

Graphics

Paul Barbera

Graphics

Ellen Carroll

Word Processing

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX A

IICEP CORRESPONDENCE

THIS PAGE INTENTIONALLY LEFT BLANK

STATE OF OKLAHOMA, }
COUNTY OF OKLAHOMA } SS.

Affidavit of Publication

Gina Calame, of lawful age, being first duly sworn, upon oath deposes and says that he is the A.E. of The Oklahoma Publishing Company, a corporation, which is the publisher of the The Oklahoman which is a daily newspaper of general circulation in the State of Oklahoma, and which is a daily newspaper published in Oklahoma County and having paid general circulation therein; that said newspaper has been continuously and uninterruptedly published in said county and state for a period of more than one hundred and four consecutive weeks next prior to the first publication of the notice attached hereto, and that said notice was published in the following issues of said newspaper, namely:

June 5 on Fri. 7-6-07

DIANNAH FEATHERSTON NOTARY PUBLIC STATE OF OKLAHOMA #01004204 EXP. 4/01/09

Subscribed and sworn to before me this 11th day of July, 2007

Diannah Featherston
Notary Public

Gina Calame

My commission expires April 1, 2009

seum board member Lenny For more information call (405) 238-6300.

Public Notice

Tinker Air Force Base Invites Public Comment Environmental Assessments

Construction of the Far Field Range
Construction of Three-Bay Hangar
KC-135R Aircraft and 137th Airlift Wing Relocation

The United States Air Force has prepared three Environmental Assessments (EAs) which are available for public review and comment.

Pursuant to the Council on Environmental Quality (CEQ) regulations and in accordance with the National Environmental Policy Act and 32 Code of Federal Regulations (CFR) Part 989, Tinker Air Force Base has performed environmental assessments for the following proposed actions: Relocation of the Far Field Range, Construction of a Three-Bay Multi-Aircraft Hangar, and Re-Alignment Activities Associated with the KC-135R Aircraft and the 137th Airlift Wing Relocation.

No significant environmental effects have been identified through these EAs.

The public may submit written comments during a period of 14 days from the date of this notice. Comments should be mailed to the address below.

The final draft for the Environment Assessment is available to the public at the Tinker Information Repository located in the Midwest City Public Library, Reno at Midwest Boulevard, from 9:00a.m. to 9:00p. m., Monday thru Thursday; from 9:00 a.m. to 5:00 p.m., Friday and Saturday; and 1:00 to 5:00 p.m. on Sunday.

The public may submit written comments to the address below.

For more information, contact Brion Ockenfels, 72 ABW/PA

7460 Arnold Ave, Ste 127, Tinker AFB, OK 73145-3010

(405) 739-2027

T

On

" Burcha
their purc
Custome
Offer end
** With ap
Minimum

tion, delivery and fielding of additional aircraft every month. With more than 90 Raptors delivered to date, the F-22 program is running smoothly on all cylinders, according to Brig. Gen. C.D. Moore, 478th AESW commander.

"We're delivering Raptors to the warfighters, and we're pushing the first of four modernization upgrades to the field," Gen. Moore said. "It's been a banner year so far as we continue to deliver the world's only operational

support work in partnering arrangements with industry experts to ensure surge capacity and to comply with Congressional language.

In addition to managing deliveries, securing a multi-year procurement contract, and solidifying Raptor sustainment, 478th AESW officials are driving ongoing modernization efforts to add additional combat capabilities and upgrades to the F-22, encompassing both software and hardware changes.

Public Notice

Tinker Air Force Base Invites Public Comment
Environmental Assessments
Construction of the Far Field Range
Construction of Three-Bay Hangar
KC-135R Aircraft and 137th Airlift Wing Relocation

The United States Air Force has prepared three Environmental Assessments (EAs) which are available for public review and comment.

Pursuant to the Council on Environmental Quality (CEQ) regulations and in accordance with the National Environmental Policy Act and 32 Code of Federal Regulations (CFR) Part 989, Tinker Air Force Base has performed environmental assessments for the following proposed actions: Relocation of the Far Field Range, Construction of a Three-Bay Multi-Aircraft Hangar, and Re-Alignment Activities Associated with the KC-135R Aircraft and the 137th Airlift Wing Relocation.

No significant environmental effects have been identified through these EAs.

The public may submit written comments during a period of 14 days from the date of this notice. Comments should be mailed to the address below.

The final draft for the Environment Assessment is available to the public at the Tinker Information Repository located in the Midwest City Public Library, Reno at Midwest Boulevard, from 9:00a.m. to 9:00p.m., Monday thru Thursday; from 9:00 a.m. to 5:00 p.m., Friday and Saturday; and 1:00 to 5:00 p.m. on Sunday.

The public may submit written comments to the address below.

For more information, contact Brion Ockenfels, 72 ABW/PA

7460 Arnold Ave, Ste 127, Tinker AFB, OK 73145-3010

(405) 739-2027

APPENDIX B

NOISE

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B
NOISE

B.1 GENERAL

Noise, often defined as unwanted sound, is one of the most common environmental issues associated with aircraft operations. Of course, aircraft are not the only sources of noise in a rural surrounding, where noise from interstate and local roadway traffic, rail, industrial, and neighborhood sources also intrude on the everyday quality of life. Nevertheless, aircraft are readily identifiable to those affected by their noise and are typically singled out for special attention and criticism. Consequently, aircraft noise problems often dominate analyses of environmental impacts.

Sound is a physical phenomenon consisting of minute vibrations, which travel through a medium such as air, and are sensed by the human ear. Whether that sound is interpreted as pleasant (e.g., music) or unpleasant (e.g., aircraft noise) depends largely on the listener's current activity, past experience, and attitude toward the source of that sound. It is often true that one person's music is another person's noise.

The measurement and human perception of sound involves two basic physical characteristics – intensity and frequency. Intensity is a measure of the acoustic energy of the sound vibrations and is expressed in terms of sound pressure. The higher the sound's pressure, the more energy carried by the sound and the louder the perception of that sound. The second important physical characteristic is frequency, which is the number of times per second the air vibrates or oscillates. Low-frequency sounds are characterized as rumbles or roars, while high-frequency sounds are typified by sirens or screeches.

The loudest sounds which can be detected comfortably by the human ear, have intensities that are 1 trillion times higher than those of sound that cannot be detected by humans. Because of this vast range, any attempt to represent the intensity of sound using a linear scale becomes very unwieldy. As a result, a logarithmic unit known as the decibel (dB) is used to represent the intensity of a sound. Such a representation is called a sound level.

A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above about 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels.

Because of the logarithmic nature of the dB unit, sound levels cannot be added or subtracted directly and are somewhat cumbersome to handle mathematically. However, some simple rules of thumb are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. Thus, for example:

$$60 \text{ dB} + 60 \text{ dB} = 63 \text{ dB}, \text{ and}$$
$$80 \text{ dB} + 80 \text{ dB} = 83 \text{ dB}.$$

The total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

60.0 dB + 70.0 dB = 70.4 dB.

Because the addition of sound levels behaves differently than that of ordinary numbers, such an addition is often referred to as "dB addition" or "energy addition." The latter term arises from the fact that what we are really doing when we add dB values is first converting each dB value to its corresponding acoustic energy, then adding the energies using the normal rules of addition, and finally converting the total energy back to its dB equivalent.

An important facet of dB addition arises later when the concept of time-average sound levels is introduced to explain Day-Night Average A-Weighted Sound Level (L_{dn}). Because of the logarithmic units, the time-average sound levels are dominated by the louder levels, which occur during the averaging period. As a simple example, consider a sound level, which is 100 dB and lasts for 30-seconds, followed by a sound level of 50 dB which also lasts for 30-seconds. The time-average sound level over the total 60- second period is 97 dB, not 75 dB.

Sound frequency is measured in terms of cycles per second (cps), or hertz (Hz), which is the preferred scientific unit for cps. The normal human ear can detect sounds over a wide range of frequencies. However, not all frequencies in this range are heard equally well by the human ear which is most sensitive to frequencies in the 1,000 to 4,000 Hz range. In measuring community noise, this frequency dependence is taken into account by adjusting the very high and low frequencies to approximate the human ear's lower sensitivity to those frequencies. This is called "A-weighting" and is commonly used in measurements of community environmental noise.

Sound levels measured using A-weighting are referred to as A-weighted sound levels while sound levels measured without any frequency weighting are referred to as sound levels. However, since most environmental impact analysis documents deal only with A-weighted sound levels, the adjective "A-weighted" is often omitted, and A-weighted sound levels are referred to simply as sound levels. In some instances the author will indicate that the levels have been A-weighted by using the abbreviation dB, for decibel. As long as the use of A-weighting is understood to be used, there is no difference implied by the terms "sound level" and "A-weighted sound level" or by the units dB and dBA. In this document all sound levels are A-weighted sound levels and the adjective "A-weighted" has been omitted.

Sound levels do not represent instantaneous measurements but rather averages over short periods of time. Two measurement time periods are most common – one second and one-eighth of a second. A measured sound level averaged over one second is called a slow response sound level; one averaged over one-eighth of a second is called a fast response sound level. Most environmental noise studies use slow response measurements, and the adjective "slow response" is usually omitted. It is easy to understand why the proper descriptor "slow response A-weighted sound level" is usually shortened to "sound level" in environmental impact analysis documents.

B.2 NOISE METRICS

A "metric" is defined as something "of, involving, or used in measurement." As used in environmental noise analyses, a metric refers to the unit or quantity, which quantitatively measures the effect of noise on the environment. Noise studies have typically involved a confusing proliferation of noise metrics as individual researchers have attempted to understand and represent the effects of noise. As a result, past literature describing environmental noise abatement has included many different metrics.

Recently, however, various federal agencies involved in environmental noise mitigation have agreed on common metrics for environmental impact analysis documents, and both the Department of Defense and the Federal Aviation Administration (FAA) have specified those which should be used for federal aviation noise assessments. These metrics are as follows.

B.2.1 Maximum Sound Level

The highest A-weighted sound level measured during a single event in which the sound level changes value as time goes on (e.g., an aircraft overflight) is called the maximum A-weighted sound level (ALM) or maximum sound level, for short.

B.2.2 Sound Exposure Level

Individual time-varying noise events have two main characteristics – a sound level which changes throughout the event and a period of time during which the event is heard. Although the maximum sound level, described above, provides some measure of the intrusiveness of the event, it alone does not completely describe the total event. The period of time during which the sound is heard is also significant. The Sound Exposure Level (SEL) combines both of these characteristics into a single metric.

SEL is a logarithmic measure of the total acoustic energy transmitted to the listener during the event. Mathematically, it represents the sound level of the constant sound that would, in one second, generate the same acoustic energy, as did the actual time-varying noise event. Since aircraft overflights usually last longer than one second, the SEL of an overflight is usually greater than the ALM of the overflight.

Note that SEL is a composite metric, which represents both the intensity of a sound level and its duration. It does not directly represent the sound level heard at any given time, but rather provides a measure of the net impact of the entire acoustic event. It has been well established in the scientific community that SEL measures this impact much more reliably than just the A-weighted sound level.

Because the SEL and the ALM are both A-weighted sound levels expressed in dBs, there is sometimes confusion between the two, so the specific metric used should be clearly stated.

B.2.3 Day-Night Average A-Weighted Sound Level

Time-averaged sound levels are measurements of sound levels, which are averaged over a specified length of time. These levels provide a measure of the average sound energy during the measurement period.

For the evaluation of community noise effects, and particularly aircraft noise effects, the L_{dn} is used. L_{dn} averages aircraft sound levels at a location over a complete 24-hour period, with a 10 dB adjustment added to those noise events which take place between 10:00 PM and 7:00 AM (local time). This 10 dB "penalty" represents the added intrusiveness of sounds which occur during normal sleeping hours, both because of the increased sensitivity to noise during those hours and because ambient sound levels during nighttime are typically about 10 dB lower than during daytime hours.

L_{dn} provides a single measure of overall noise impact, but does not provide specific information on the number of noise events or the individual sound levels, which occur during the day. For example, a L_{dn} of 65 dB could result from a few very noisy events, or many quieter events during the 24-hour period.

As noted earlier for SEL, L_{dn} does not represent the sound level heard at any particular time, but rather represents the total sound exposure. Scientific studies and social surveys, which have been conducted to determine community annoyance to all types of environmental noise, have found the L_{dn} to be the best measure of that annoyance. Its use is endorsed by the following scientific communities (American National Standards Institute 1980, 1998; United States (US) Environmental Protection Agency [USEPA] 1972; and Federal Interagency Committee on Noise [FICON] 1980, 1992).

Attitudinal surveys about aircraft noise have been conducted in different countries to find the percentages of groups of people who express various degrees of annoyance when exposed to different levels of L_{dn}. The results of these surveys are remarkably consistent. Synthesis of Social Surveys of Noise Annoyance (Schultz 1978) was published in 1978. A more recent study has reaffirmed the results found in the 1978 study (Fidell et al 1991). In general, correlation coefficients of 0.85 to 0.95 are found between the percentages of groups of people highly annoyed and the level of average noise exposure. The correlation coefficients for the annoyance of individuals are relatively low, however, on the order of 0.5 or less. This is not surprising, considering the varying personal factors which influence the manner in which individuals react to noise. Nevertheless, the findings of these and other studies substantiate that community annoyance to aircraft noise is represented quite reliably using L_{dn}.

This relation between community annoyance and time-average sound level also has been confirmed for infrequent aircraft noise events. Community Reactions to Helicopter Noise (Acoust 1991) reported the reactions of individuals in a community to daily helicopter overflights correlated quite well with the daily time-average sound levels over this range of numbers of daily noise events.

The use of L_{dn} has been criticized recently as not accurately representing community annoyance and land-use compatibility with aircraft noise. Much of that criticism stems from a lack of understanding of the basis for the measurement or calculation of L_{dn}. One frequent criticism is based on the inherent feeling that people react more to single noise events and not as much to "meaningless" time-average sound levels.

In fact, a time-average noise metric, such as L_{dn}, takes into account both the noise levels of all individual events which occur during a 24-hour period and the number of times those events occur. As described briefly above, the logarithmic nature of the dB unit causes the noise levels of the loudest events to control the 24-hour average.

As a simple example of this characteristic, consider a case in which only one aircraft overflight occurs in daytime during a 24-hour period, creating a sound level of 100 dB for 30 seconds. During the remaining 23-hours, 59-minutes, and 30 seconds of the day, the ambient sound level is 50 dB. The L_{dn} for this 24-hour period is 65.5 dB. Assume, as a second example that ten such 30-second overflights occur in daytime hours during the next 24-hour period, with the same ambient sound level of 50 dB during the remaining 23-hours and 55-minutes of the day. The L_{dn} for this 24-hour period is 75.4 dB. Clearly, the averaging of noise over a 24-hour period does not ignore the louder single events and tends to emphasize both the sound levels and number of those events. This is the basic concept of a time-averaged sound metric such as L_{dn}.

B.2.4 Onset Rate-adjusted Monthly Day-Night Average A-Weighted Sound Level

The onset rate-adjusted monthly day-night average, A-weighted sound level (L_{dnmr}) has been developed specifically for Military Operations Areas (MOAs), Military Training Routes (MTRs), and Ranges by the USAF under direction of the Armstrong Aerospace Medical Research Laboratory (AAMRL). This metric is currently the approved MTR/MOA/Range noise metric for the armed services and has been designed to account for the unique noise environment of MTRs/MOAs/Ranges which involves relatively irregular and infrequent events (i.e., flight operations).

Individual low-altitude events are also different from typical community noise sources because of the rapid onset rate that can create "startle" effects. The L_{dnmr} is similar to the noise metric that averages A-weighted sound levels over a 24-hour period (L_{dn}) in that it is an averaged metric with a 10-dB penalty for events occurring between 10:00 PM and 7:00 AM. However, L_{dnmr} represents an average for an entire month, utilizing the highest monthly sortie activity, and includes an additional 0- to 11-dB penalty to compensate for the "startle" effect of a low-altitude overflight.

Air Force planning policy calls for the interpretation of L_{dn} (L_{dn} is a noise metric that averages A-weighted sound levels over a 24-hour period, with an additional 10-dB penalty added to noise events occurring between 10:00 p.m. and 7:00 a.m.) in terms of land use compatibility and the probability of highly annoying ground-based noise receptors. The Air Force further recommends that the L_{dnmr} values along MTRs/MOAs/Ranges be applied to the same interpretive criteria. The

calculation of L_{dnmr} results in noise levels that equal or exceed L_{dn}. This is accomplished by assessing the rapid onset penalty to aircraft operating on MTRs/MOAs/Ranges.

For the purpose of this analysis, an operation is defined as a randomized flight pattern occurring within the boundaries of a designated MOA. The noise evaluation is based on the frequency of average daily flight operations, and the type of mission flown by each of the military aircraft assessed.

B.3 NOISE EFFECTS

B.3.1 Hearing Loss

Noise-induced hearing loss is probably the best defined of the potential effects of human exposure to excessive noise. Federal workplace standards for protection from hearing loss allow a time-average level of 90 dB over an 8-hour period, or 85 dB averaged over a 16-hour period. Even the most protective criterion suggests a time-averaged sound level of L_{dn} 70 dB over a 24-hour period. Since it is unlikely that airport neighbors will remain outside their homes 24-hours per day for extended periods of time, and there is little possibility of hearing loss below a L_{dn} of 75 dB, this protection level is extremely conservative.

B.3.2 Nonauditory Health Effects

Nonauditory health effects of long-term noise exposure, where noise may act as a risk factor have never been found to occur at levels below those which protect against noise-induced hearing loss. Most studies attempting to clarify such health effects have found that noise exposure levels established for hearing protection will also protect against any potential nonauditory health effects, at least in workplace conditions. The best scientific summary of these findings is contained in the lead paper at the National Institute of Health Conference on Noise and Hearing Loss, held on 22-24 January 1990 in Washington, D.C.

> The nonauditory effects of chronic noise exposure, when noise is suspected to act as one of the risk factors in the development of hypertension, cardiovascular disease, and other nervous disorders, have never been proven to occur as chronic manifestations at levels below these criteria (an average of 75 dB for complete protection against hearing loss for an eight-hour day). At the recent (1988) International Congress on Noise as a Public Health Problem, most studies attempting to clarify such health effects did not find them at levels below the criteria protective of noise-induced hearing loss, and even above these criteria, results regarding such health effects were ambiguous. Consequently, one comes to the conclusion that establishing and enforcing exposure levels protecting against noise-induced hearing loss would not only solve the noise-induced hearing loss problem but also any potential nonauditory health effects in the work place. (Von Gierke 1990; parenthetical wording added for clarification.)

Although these findings were directed specifically at noise effects in the work place, they are equally applicable to aircraft noise effects in the community environment. Research studies regarding the nonauditory health effects of aircraft noise are ambiguous at best, and often contradictory. In addition, even those studies which purport to find such health effects use time-averaged noise levels of 75 dB and higher for their research.

For example, in an often-quoted paper, two University of California at Los Angeles (UCLA) researchers apparently found a relationship between aircraft noise levels under the approach path to Los Angeles International Airport (LAX) and increased mortality rates among the exposed residents by using an average noise exposure level greater than 75 dB for the "noise-exposed" population (Meacham et al 1979). Nevertheless, three other UCLA professors analyzed those same data and found no relation between noise exposure and mortality rates (Frericks et al 1980).

As a second example, two other UCLA researchers used this same population near LAX to show a higher rate of birth defects in 1970-1972 when compared with a control group residing away from the airport (Jones et al 1978). Based on this report, a separate group at the US Center for Disease Control performed a more thorough study of populations near Atlanta's Hartsfield International Airport for 1970-1972 and found no relation in their study of 17 identified categories of birth defects to aircraft noise levels above 65 dB (Edmonds et al 1979).

In summary, there is no scientific basis for a claim that potential health effects exist for aircraft time-average sound levels below 75 dB.

B.3.3 Annoyance

The primary effect of aircraft noise on exposed communities is one of annoyance. Noise annoyance is defined by the USEPA as any negative subjective reaction on the part of an individual or group (USEPA 1972). As noted in the discussion of L_{dn} (Section 4.4.1.2) community annoyance is best measured by that metric.

It is often suggested that a lower L_{dn}, such as 60 or 55 dB, be adopted as the threshold of community noise annoyance for airport environmental analysis documents. While there is no technical reason why a lower level cannot be measured or calculated for comparison purposes, a L_{dn} of 65 dB:

1. Provides a valid basis for comparing and assessing community noise effects;
2. Represents a noise exposure level which is normally dominated by aircraft noise and not other community or nearby highway noise sources; and
3. Reflects the FAA's threshold for grant-in-aid funding of airport noise mitigation projects.

The US Department of Housing and Urban Development also established a L_{dn} standard of 65 dB for eligibility for federally guaranteed home loans.

B.3.4 Speech Interference

Speech interference associated with aircraft noise is a primary cause of annoyance to individuals on the ground. The disruption of routine activities such as radio or television listening, telephone use, or family conversation gives rise to frustration and irritation. The quality of speech communication is also important in classrooms, offices, and industrial settings and can cause fatigue and vocal strain in those who attempt to communicate over the noise. Research has shown that "whenever intrusive noise exceeds approximately 60 dB indoors, there will be interference with speech communication" (FICON 1992). A steady A-weighted background sound level of 60 dB will produce 93 percent intelligibility; that of 70 dB will produce 66 percent intelligibility; and that of 75 dB will produce 2 percent intelligibility (USEPA 1972).

B.3.5 Sleep Interference

Sleep interference may be measured in either of two ways. "Arousal" represents actual awakening from sleep, while a change in "sleep stage" represents a shift from one of four sleep stages to another stage of lighter sleep without actual awakening. In general, arousal requires a somewhat louder noise level than does a change in sleep stage.

A recent analysis sponsored by the US Air Force summarized 21 published studies concerning the effects of noise on sleep (Pearsons et al 1989). The analysis concluded that a lack of reliable studies in homes, combined with large differences among the results from the various laboratory studies and the limited in-home studies, did not permit development of an acceptable accurate assessment procedure. The noise events used in the laboratory studies and in contrived in-home studies were presented at much higher rates of occurrence than would normally be experienced in the home. None of the laboratory studies was of sufficiently long duration to determine any effects of habituation, such as that which would occur under normal community conditions.

Nevertheless, some guidance is available in judging sleep interference. The USEPA identified an indoor L_{dn} of 45 dB as necessary to protect against sleep interference (USEPA 1972). Since typical dwelling units provide a sound level reduction of 20 dB, an outdoor noise level of L_{dn} 65 dB would cause minimal interference with sleep.

The FICON (FICON 1992) reviewed the sleep disturbance issue and presented an Air Force-developed sleep disturbance dose-response prediction curve, based on data from Analyses of the Predictability of Noise-Induced Sleep Disturbance (Pearsons et al 1989), as an interim tool for analysis of potential sleep disturbance. This interim curve shows that for an indoor SEL of 65 dB, approximately 15 percent or less of those exposed would be awakened.

B.3.6 Noise Effects on Domestic Animals and Wildlife

Animal species differ greatly in their responses to noise. Each species has adapted, physically and behaviorally, to fill its ecological role in nature, and its hearing ability usually reflects that role. Animals rely on their hearing to avoid predators, obtain food, and communicate with and attract other members of their species. Aircraft noise may mask or interfere with these functions.

Secondary effects may include nonauditory effects similar to those exhibited by humans – stress, hypertension, and other nervous disorders. Tertiary effects may include interference with mating and resultant population declines.

There are many scientific studies available regarding the effects of noise on wildlife and some anecdotal reports of wildlife "flight due to noise". Few of these studies or reports include any reliable measures of the actual noise levels involved.

In the absence of definitive data on the effect of noise on animals, the Committee on Hearing, Bioacoustics, and Biomechanics of the National Research council has proposed that protective noise criteria for animals be taken to be the same as for humans (National Academy of Sciences 1977).

B.3.7 Effects of Noise-Induced Vibration on Structures and Humans

The sound from aircraft overflight travels from the exterior to the interior of the house in one of two ways: through the solid structural elements and directly through the air. The sound transmission starts with noise impinging on the wall exterior. Some of this sound energy will be reflected away and some will make the wall vibrate. The vibrating wall radiates sound into the airspace, which in turn sets the interior finish surface vibrating, with some of the energy lost in the airspace. This surface then radiates sound into the dwelling interior. Vibrational energy also bypasses the air cavity by traveling through the studs and edge connections.

Normally, the most sensitive components of a structure to airborne noise are the windows and, infrequently, the plastered walls and ceilings. An evaluation of the peak sound pressure impinging on the structure is normally sufficient to determine the possibility of damage. In general, sound levels above 130 dB (peak sound pressure for window breakage) may be of more concern than other frequencies. Conservatively, only sounds lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (Von Gierke et al 1991).

In terms of average acceleration of wall or ceiling vibration, the thresholds for structural damage (International Organization for Standardization [ISO] 1989) are:

- 0.5 m/s/s – threshold of risk of damage to sensitive structures (i.e. ancient monuments); and
- 1.0 m/s/s/ - threshold of risk of damage to normal dwellings (i.e. houses with plaster ceilings and walls).

Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations, or "rattle", of objects within the dwelling – hanging pictures, dishes, plaques, and bric-a-brac. Loose windowpanes may also vibrate noticeably when exposed to high levels of noise, causing homeowners to fear breakage. In general, such noise-induced vibrations occur at sound levels above those considered normally compatible with residential

land use. Thus, noise levels compatible for residential land use, i.e. below L_{dn} 65 dB, would not cause significant secondary noise-induced vibrations.

In the assessment of vibrations on humans, the following factors determine if a person will perceive and possibly react to building vibrations:

- Type of excitation: steady state, intermittent, or impulsive vibration;
- Frequency of the excitation. ISO 2631-2 (ISO 1989) recommends a frequency range of 1 to 80 Hz be used for assessing the effect of vibration on humans;
- Orientation of the body with respect to the vibration;
- The use of the occupied space; and
- Time of day.

B.3.8 Noise Effects on Terrain

It has been suggested that noise levels associated with low-flying aircraft may affect the terrain under the flight path by disturbing fragile soil or snow structures, especially in mountainous areas, causing landslides or avalanches. There are no known instances of such effects, and it is considered improbable that such effects will result from routine, subsonic aircraft operations.

B.3.9 Noise Effects on Historical and Archaeological Sites

Because of the potential for increased fragility of structural components of historical buildings and other historical sites, aircraft noise may effect such sites more severely than newer, modern structures. Again, there are few scientific studies of such effects to provide guidance for their assessment.

One study involved the measurements of sound levels and structural vibration levels in a superbly restored plantation house, originally built in 1795, and now situated approximately 1,500 feet from the centerline at the departure end of Runway 19L at Washington Dulles International Airport. These measurements were made in connection with the proposed scheduled operation of the supersonic Concorde aircraft at Dulles (Wesler 1977). There was a special concern for the building's windows, since roughly half of the 324 panes were original. No instances of structural damage were found. Interestingly, despite the high levels of noise during Concorde takeoffs, the induced structural vibration levels were actually less than those induced by touring groups and vacuum cleaning.

As noted above for the noise effects of noise-induced vibrations on normal structures, assessments of noise exposure levels for normally compatible land uses should also assist in protecting historic and archaeological sites from structural damage caused by aircraft noise.

Table B-1 provides more detailed definitions of noise-related terms used above.

Table B-1. Definition of Noise-Related Terms

Term	Definition of Noise-Related Terms
A-weighted	A system utilizing a filter to de-emphasize the very low and very high frequency components of sound in a manner similar to the frequency response of the human ear.
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ration of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).
dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted.
Day-night noise level (L_{dn})	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 2200 and 0700 hours. In general, an L_{dn} value of 65 dB is the noise level at which residential land use compatibility becomes questionable for structures with average or below average acoustic insulation.
L_{dnmr}	The onset-rate adjusted monthly day-night average A-weighted sound level. This metric was developed by the Armstrong Aerospace Medical Research Laboratory.
Equivalent noise level (L_{eq})	A single value of sound level for any desired duration, which includes *all* of the time-varying sound energy in the measurement period. The major virtue of the Equivalent Sound Level is that it correlates reasonably well with the effects of noise on people, even for wide variations in environmental sound levels and time patterns. It is used when only the durations and levels of sound, and not their time of occurrence (day or night), are relevant. It is easily measurable by available equipment. It also is the basis of a measurement descriptor of the total outdoor noise environment, the *Day-Night Sound Level* (L_{dn}).
Ambient noise level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Sound Exposure Level	The sound exposure level is a measure of the physical energy of the noise event which takes into account both intensity (loudness) and duration. The SEL is based on the A-weighted sound level above a specified threshold which is at least 10 dB below the maximum value measured during the noise event and is expressed as the 1-sec energy averaged equivalent sound level (L_{eq}1 sec).

Source: FICON 1992