Final Environmental Impact Statement
Establishment and Operation of an Intelligence, Surveillance, Reconnaissance, and Strike Capability
Andersen Air Force Base, Guam
Volume I

Department of the Air Force
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Hickam Air Force Base, Hawaii
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FINAL
ENVIRONMENTAL IMPACT STATEMENT
ESTABLISHMENT AND OPERATION OF AN INTELLIGENCE, SURVEILLANCE, RECONNAISSANCE, AND STRIKE CAPABILITY
ANDERSEN AIR FORCE BASE, GUAM

VOLUME 1

DEPARTMENT OF THE AIR FORCE
PACIFIC AIR FORCES
HICKAM AIR FORCE BASE, HAWAII

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FINAL ENVIRONMENTAL IMPACT STATEMENT ESTABLISHMENT AND OPERATION OF AN INTELLIGENCE, SURVEILLANCE, RECONNAISSANCE, AND STRIKE CAPABILITY AT ANDERSEN AIR FORCE BASE, GUAM

Responsible Agency: Department of the Air Force, Headquarters, Pacific Air Forces, Hickam AFB, Hawaii.

Cooperating Agency: Department of the Navy.

Proposed Action: Establish and Operate an Intelligence, Surveillance, Reconnaissance, and Strike (ISR/Strike) capability at Andersen AFB (AFB), Guam.

Written comments and inquiries regarding this document should be directed to: Mr. Jonathan Wald, Chief, Conservation Resources, Unit 14007, APO, AP 96543-4007.

Abstract: The 2001 Quadrennial Defense Review (QDR) noted that the Asian region has become increasingly important to regional and United States security and directed the Air Force to expand basing in the western Pacific to increase its ability to respond quickly to defeat an adversary's military or political objectives. In response, the Air Force plans to locate the U.S. Pacific Command's ISR/Strike capability, in the western Pacific. Andersen AFB was identified as the installation best suited to host the ISR/Strike capability in a process driven by the 2001 QDR and a consideration of six installations in the Pacific Air Forces' area of responsibility.

Establishment of the ISR/Strike capability would begin in fiscal year (FY)07 and would be completed about 16 years later. Alternative A would establish the ISR/Strike capability by basing as many as 12 KC-135 aerial refueling aircraft and four Global Hawk RQ-4 unmanned aerial vehicles (Global Hawk) and support personnel at Andersen AFB. As many as 48 fighter aircraft (F-22 and F-15E) and six bomber aircraft (B-1, B-2, and B-52) and personnel would be rotated from bases in the 50 states. The Base population would increase by as many as 3,000 personnel when combining the additional military, Air Force civilian, contractor, and dependent personnel. Facility construction, addition, and alteration projects, including 190 family housing units and associated family housing support facilities, would occur to support the establishment and operation of the ISR/Strike capability.

Alternative B would establish the ISR/Strike capability by rotating as many as 48 fighter aircraft (F-22 and F-15E), 12 KC-135s, and six bombers (B-1, B-2, and B-52) and support personnel to Andersen AFB from bases in the 50 states, and basing four Global Hawks and associated support personnel. The Base population would increase by as many as 1,850 personnel. The type and number of facility construction, addition, and alteration projects associated with Alternative B would be similar to those for Alternative A. The 190 family housing units and associated family housing support facilities would not be constructed.

Under the No Action Alternative, the ISR/Strike capability would not be established. Environmental resources considered in the impact analysis were: noise; land use; air quality; infrastructure and utilities; biological resources; cultural resources; earth resources; groundwater resources; hazardous materials and waste; socioeconomic resources; airfield operations; and environmental justice. Compliance with coastal zone consistency is addressed under special regulatory guidelines and environmental review procedures.

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EXECUTIVE SUMMARY

ES 1 Introduction

The proposed action would establish an Intelligence, Surveillance, Reconnaissance, and Strike (ISR/Strike) operational capability in four phases over an approximate 16-year period in the western Pacific, beginning in fiscal year (FY)07. The ISR/Strike capability would consist of fighter, aerial refueling, bomber, unmanned aerial vehicle aircraft, and support personnel.

ES 2 Purpose of and Need for Action

The 2001 Quadrennial Defense Review (QDR) directed the Air Force to expand basing in the Pacific region with a regionally tailored, multifaceted force able to respond quickly when needed. In response, the Air Force proposes to locate the U.S. Pacific Command's ISR/Strike capability, aerial refueling aircraft, and support personnel in the western Pacific on Andersen Air Force Base (AFB) (the Base) on the Island of Guam. The ISR/Strike capability would allow more timely and effective response. The objective of the ISR/Strike capability would be to achieve pre-engagement battle space awareness, locate and identify critical adversary movement, achieve assured success through air dominance, and deliver decisive effects via persistent and precise application of air and space power. (The proposal to establish an ISR/Strike capability was developed prior to the 2005 Base Realignment and Closure Commission [BRAC] process, and the ISR/Strike capability is not part of the decisions from that process.) Andersen AFB was identified as the installation best suited to host the ISR/Strike capability in a process driven by the 2001 QDR and a consideration of six installations in the Pacific Air Forces' area of responsibility.

ES 3 Scope of the Environmental Review

The National Environmental Policy Act (NEPA) of 1969, as amended, requires federal agencies to consider environmental consequences in the decision-making process. The Air Force Environmental Impact Analysis Process (EIAP) is accomplished through adherence to the procedures set forth in Council on Environmental Quality regulations (40 Code of Federal Regulations [CFR] Part 1500), which were issued to implement NEPA, and 32 CFR, Part 989 (*Air Force Environmental Impact Analysis Process*). These federal regulations establish both the administrative process and substantive scope of the environmental impact evaluation designed to ensure that deciding authorities have a proper understanding of the potential environmental consequences of a contemplated course of action.

The Air Force is preparing this environmental impact statement (EIS) to determine the potential environmental consequences associated with establishment of the ISR/Strike capability at Andersen AFB. An EIS entitled *Military Training in the Marianas* (Marianas Training EIS) (USPACOM 1999) is incorporated by reference (consistent with 40 CFR §1502.21) and discussed, as required, in various sections of this EIS. The capability of Farallon de Medinilla (FDM) to support Air Force proposed operations and associated impacts post-ISR/Strike beddown would be ripe for evaluation in the upcoming Mariana Islands Range Complex EIS, which is expected to be completed in FY09 during operational phase Phase 0 (see ES 5). Analysis of the proposed ISR/Strike training operations at FDM is not possible at this time because the training requirements have not been finalized.

The establishment and operation of an ISR/Strike capability at Andersen AFB would take place in phases over a period of time spanning as many as 16 years. Because of the time span involved as well as other factors, overall only some aspects of the proposed action are currently ripe for decision because of incomplete information. Thus, the Air Force is preparing this EIS to focus on those issues now ripe for decision, which include all elements of the ISR/Strike capability except for items such as aircrew training (see ES 3.2), wastewater treatment, and landfill space. As previously mentioned, analysis for the aircrew training should be completed in FY09 when the Navy completes the Mariana Islands Range Complex EIS. Analysis of wastewater treatment could be finalized after the wastewater treatment plant permitting process is completed by the Government of Guam (GovGuam). Landfill analysis may be completed after the current Andersen AFB landfill study is completed in FY07 and when the GovGuam finalizes its landfill project. Because the ISR/Strike capability is planned for a 16-year implementation period, it is possible that details associated with the proposed action assessed in this EIS could change. Additional details may become available during the implementation period, or plans could change due to factors unforeseen during preparation of this EIS. The Air Force will prepare later supplements or analyses "tiered" from this document at the appropriate times to address subsequent actions or new information.

This EIS identifies, describes, and evaluates potential environmental impacts that may result from the proposed establishment and operation of an ISR/Strike capability at Andersen AFB, the No Action Alternative, and possible cumulative impacts from other past, present, and reasonably foreseeable future actions planned for Andersen AFB.

ES 3.1 Past, Present, and Reasonably Foreseeable Future Actions

The Air Force is aware of the potential moves of non-Air Force Department of Defense (DoD) units to Guam and the 2005 BRAC-directed realignment that affect DoD units on Guam. The proponent(s) for these actions will address them in separate NEPA documents, as appropriate, when sufficient details for an environmental analysis become available. The non-Air Force DoD units will be able to address their projects in NEPA documents that cumulatively look at all DoD projects planned for Guam, to include Air Force projects. At this time, specific information on the non-Air Force DoD moves such as the number(s) of personnel, the location(s) of the basing actions, the number(s) and type(s) of facilities that would be constructed, the timing and financing of the projects, and the type and location of training activities associated with these proposals, has not been detailed. Thus, it is not possible to analyze the cumulative impacts of the ISR/Strike proposal with the aforementioned proposed non-Air Force future actions.

The Air Force contacted the two Navy installations on Guam and GovGuam for details concerning their upcoming actions that should be considered for cumulative impact purposes. No actions were identified by the two Navy installations (Cruz 2005b) or GovGuam. However, a Notice of Intent to prepare an EIS was published July 29, 2005 for the Navy's Wharf Expansion project. This project, when added to other past, present, and reasonably foreseeable future actions, has no expected cumulative impact on this proposed action.

The 2005 BRAC-directed joint-basing operation at Andersen AFB determined that the Navy will be the lead DoD Service in command of military operations for all Services stationed on the Island of Guam, including military family housing. As a result, a joint Navy-Air Force Housing

Requirements and Market Analysis for almost the entire island is being accomplished and the results are not expected until early 2007. The joint analysis will determine military family housing requirements for the Air Force, Navy, and Marine Corps, and will take into account any mission change for the Navy, Air Force, and Marine Corps. The military family housing analysis will also consider whether the housing program is better managed by the DoD or under a privatization contractor. NEPA analysis will be accomplished for the military family housing initiative when sufficient information is available after the analysis is complete and the DoD management/privatized housing management decision is made. The Air Force currently estimates approximately 190 additional military family housing units would be necessary to support the ISR/Strike capability. Thus, construction and occupancy of an additional 190 military family housing units are assessed in this EIS.

ES 3.2 Aircrew Training

Bomber and fighter aircrews associated with ISR/Strike would have a requirement to accomplish weapons delivery training, and fighter aircrews would have a requirement for training such as air-to-air combat. Tanker and unmanned aerial vehicle (Global Hawk) aircrews do not have training events that require ranges or special use airspace. Takeoff and landing training for fighter, bomber, tanker, and Global Hawk aircrews associated with the proposed action in this EIS would be accomplished in the airspace allocated to the Andersen AFB air traffic control tower. The Air Force would use the Navy’s Northern Marianas Range Complex consisting of the FDM Range and the associated special use airspace for air-to-ground weapons and air-to-air training. The 206-acre range is located on an uninhabited island about 150 miles north of Guam. The advantages of using the FDM range are its ability to support live weapons training and its remoteness, which insulates it from encroachments by sea and air traffic, both of which permit the conduct of high value tactical strike training. Military training activities at the Range Complex were evaluated under NEPA in the Marianas Training EIS.

The Marianas Training EIS assessed Air Force activity that included sorties for rotational bombers at Andersen AFB on which a total of 7,344 live and inert bombs would be delivered annually. Between 5 and 612 live and inert weapons could be dropped each month, with lower numbers being more typical. Air Force bomber aircraft may conduct high-, medium-, and low-altitude bombing runs dropping conventional 500-, 750-, and 2,000-pound bombs; precision-guided munitions, and mines (USPACOM 1999). Approximately 45 percent of the FDM range sorties by bomber aircraft drop inert bombs only. In the 1998 biological opinion (BO), the training tempo and ordnance delivery included Air Force bombers flying up to 160 days per year, with up to two range sorties per day (320 annual sorties). According to the 2003 Target and Range Information Management System (TRIMS) data, the 23 Air Force sorties comprise about 4 percent of the total 516 annual sorties at FDM.

The types of weapons that would be released from the aircraft and the methods of delivery associated with the Andersen AFB rotational ISR/Strike bombers would be identical to that assessed for bomber aircraft in the Marianas Training EIS. The Air Force does not expect ISR/Strike bomber training to exceed the bomber training threshold (*i.e.*, release of 7,344 live and inert bombs) assessed in the Marianas Training EIS.

The Marianas Training EIS also assessed air-to-surface gunnery by Navy and Marine Corps fighter/attack aircraft *(e.g.*, F/A-18) practicing routine interdiction, strike, and close air support missions. These aircraft deliver bombs (mostly 500-pound bombs) from all altitudes and air-to-ground missiles to the southern end of the island. The Marianas Training EIS assessed an annual ordnance delivery of 4,940 weapons from Navy and Marine Corps aircraft to include about 80 missiles, 840 rockets, and 4,020 bombs (1,400 small [250 to 500 pounds], 1,240 large [1,000 to 2,000 pounds], and 1,380 inert bombs) (USPACOM 1999).

The ISR/Strike F-22 and F-15E aircraft would deploy munitions very similar to those delivered by Navy F/A-18s, which are assessed in the Marianas Training EIS. Additionally, the operating characteristics (*i.e*., airspeed and methods of ordnance delivery) of all three aircraft are very similar. Thus, the F-22s and F-15Es could be interchanged with the F/A-18s when considering the types of activities that were assessed for fighters in the Marianas Training EIS. Navy records for FY03 indicate that about 1,563 weapons were dropped on FDM by Navy, Marine Corps, and Air Force fighter aircraft. When subtracting the 1,563 weapons that were dropped in FY03 from the 4,940 that were assessed in the Marianas Training EIS, 3,337 weapons could be dropped annually by other FDM users such as the ISR/Strike fighters provided the actual FY03 data are representative for a typical year. The combined number of weapons that would be dropped annually on FDM by all users (*i.e*., Navy, Marine Corps, and Air Force) would not exceed the threshold of 4,940 bombs that was assessed in the Marianas Training EIS. Additionally, operations by ISR/Strike aircraft would comply with the previously mentioned mitigation restrictions associated with operations at FDM.

The Navy will be revising the Range Complex Master Plan for all ranges within the Mariana Islands under the Tactical Training Theater Assessment and Planning Program. The Navy will prepare the Mariana Islands Range Complex EIS in conjunction with the Master Plan process. The EIS is anticipated to be completed in July 2009, which coincides with Phase 0 of the ISR/Strike operational capability (see ES 5). The Navy would evaluate training by the Navy, Marine Corps, and Air Force for all the Mariana Islands military training areas, to include Air Force bomber and fighter training at the Navy-managed FDM range. The Navy will include ISR/Strike training as part of the proposed action in the Mariana Islands Range Complex EIS. The capability of FDM to support operations post-ISR Strike beddown would be ripe for evaluation in the Mariana Islands Range Complex EIS. Analysis of the proposed ISR/Strike training operations at FDM is not possible at this time because the training requirements have not been finalized. The Air Force sent a letter to the Navy requesting that the Air Force be a cooperating agency for preparation of the Mariana Islands Range Complex EIS. In this capacity, the Air Force will participate in the scoping process, develop information, and prepare analyses for which it has special expertise, and provide staff for interdisciplinary reviews.

ES 3.3 Interagency and Intergovernmental Coordination for Environmental Planning and Public Participation

Interagency and Intergovernmental Coordination for Environmental Planning

The Air Force notified federal and Government of Guam (GovGuam) agencies of the proposed action at the public scoping meeting conducted on June 9, 2005, and the Draft EIS was distributed to federal and GovGuam agencies for review on May 12, 2006. Seven agencies provided comments on the Draft EIS.

Public Participation

The Air Force published a notice of intent to prepare an EIS for the establishment of the ISR/Strike capability in the *Federal Register* on May 18, 2005. Newspaper ads announcing the public scoping meeting were published in the *Pacific Daily News* on May 21 and June 5, 6, and 8, 2005.

The Air Force published a notice that the Draft EIS was available for review in the *Federal Register* on May 12, 2006. Newspaper ads announcing the availability of the Draft EIS for review and the public hearing that was held on June 1, 2006 were published in the *Pacific Daily News* on May 12, 14, and 30, 2006. The electronic file of the Draft EIS was available on an internet web site, and copies of the Draft EIS were available to the public at the Nieves Flores Memorial Library, Hagatna, Guam.

A total of 39 persons attended the ISR/Strike Draft EIS Public Hearing, which was announced in the May 12, 14, and 30 newspaper advertisements. Three individuals provided oral comments, and two written comment sheets were received at the public hearing. Five organizations and six individuals provided comments at the public hearing and from review of the Draft EIS.

ES 4 Alternatives Formulation and Consideration

Andersen AFB was identified as the installation best suited to host the ISR/Strike capability in a process driven by the 2001 QDR (see ES 2) and a process that considered six potential locations in Pacific Air Forces' area of responsibility. By establishing the ISR/Strike capability at Andersen AFB, economy of force is preserved, costs are limited, and use of ISR and Strike assets is unrestricted for both peacetime and wartime. Subchapter 2.1 of this EIS contains a detailed description of the alternatives formulation and consideration process.

As a result of the location and status selection processes, two reasonable alternatives for Andersen AFB (Alternative A and Alternative B) with variations in the based and/or rotational status of aircraft and personnel were identified and are assessed in detail in this EIS.

To achieve the objective for the ISR/Strike capability mentioned in ES 2, Purpose of and Need for Action, the Air Force determined that the following four aircraft types and numbers of each aircraft type are needed for the ISR/Strike capability: 48 fighter (F-22 and F-15E); 12 tanker (KC-135); six bomber (B-1, B-2, and B-52); and four Global Hawk unmanned aerial vehicles.

The Air Force EIAP Instruction (32 CFR 989.8(d)) states: "…except in those rare instances where excused by law, the Air Force must always consider and assess the environmental impacts of the 'no action' alternative." Thus, the alternative of not establishing an ISR/Strike capability was also identified (*i.e.*, No Action Alternative) and is analyzed in detail in this EIS.

ES 5 Proposed Action

The ISR/Strike operational capability would be established at Andersen AFB in four operational phases, with the first phase beginning in FY07. The phases are the same for each alternative. Construction would begin in FY07 and occur over an approximate 16-year period. Initiation of construction activities prior to the initial operational capability established with arrival of the first aircraft in Phase 0 is necessary to ensure the required facilities are in place to support aircraft operations. Due to possible funding shifts, construction could be delayed and extended. The operational capability phases and the approximate years associated with the phases are:

- FY07-10, Phase 0;
- FY11-15, Phase 1;
- FY16-18, Phase 2; and
- FY19 and beyond, Phase 3.

The number of fighter and tanker aircraft and associated personnel would increase throughout the 16-year period beginning with Phase 1. The number of bomber and Global Hawk aircraft and associated personnel would remain constant throughout the implementation. As many as 70 ISR/Strike aircraft would be at Andersen AFB after full establishment.

All ISR/Strike activities at Andersen AFB would occur on the main base of the installation. Facility construction, addition, and alteration projects would occur to support ISR/Strike operational activities.

ES 5.1 Alternative A

Alternative A would base as many as 12 KC-135 tankers and four Global Hawks and personnel at Andersen AFB and rotate as many as 48 fighters (F-22 and F-15E) and six bombers (B-1, B-2, and B-52) and personnel from bases in the 50 states. Eighty percent of fighter operations would be accomplished by F-22 aircraft, and 20 percent would be accomplished by F-15Es. The percents of bomber operations would be: 10 percent B-2; 45 percent B-1; and 45 percent B-52. Construction activities would begin in FY07 and the final operational phase would occur in FY19, after which full ISR/Strike capability recurring aircraft operations would occur. When fully established, the ISR/Strike capability would increase Base population by as many as 3,000 personnel when combining the additional military, Air Force civilian, contractor, and dependent personnel. Facility construction, addition, and alteration projects would occur to support ISR/Strike establishment and operation activities. Alternative A also includes conservation measures to minimize and compensate for the effects of construction and operation activities on biological resources. Approximately 190 family housing units and associated family housing support facilities would be constructed. Average busy day airfield operations would increase from approximately 235 operations to as many as 397 operations.

ES 5.2 Alternative B

Alternative B is the same as Alternative A except that the following elements of Alternative A would not occur under Alternative B:

- The 12 KC-135 tankers and personnel would be rotational instead of based;
- The Base population would increase by as many as 1,850 personnel as opposed to the 3,000 under Alternative A;
- The 190 family housing units and associated family housing support facilities would not be constructed; and
- Average busy day airfield operations would increase from approximately 235 operations to as many as 381 operations.

ES 6 No Action Alternative

Under the No Action Alternative, the ISR/Strike capability would not be established. Andersen AFB would continue as a location from which as many as six bomber aircraft accomplish operations on a rotational basis. The Base would also continue to provide refueling, aircraft maintenance, and air cargo handling for transient military and civil transient aircraft. Construction projects would be those typically accomplished for individually programmed facility actions and operations and maintenance activities.

ES 7 Comparison of Environmental Effects of all Alternatives

Table ES-1 summarizes environmental impacts from Alternative A, Alternative B, and the No Action Alternative. As mentioned in ES 4, the Air Force determined that 48 fighters, 12 tankers, six bombers, and four Global Hawks would be necessary to meet the objective for the action. These numbers of aircraft represent the capability needed to meet the extreme condition to which the Air Force might be required to respond. There could be times when the numbers of fighters, tankers, and bombers could be less than 48, 12, and six aircraft, respectively. However, the greatest potential for impact to the environmental resources evaluated in this EIS would occur from the operation of 48 fighter, 12 tanker, six bomber, and four Global Hawk aircraft. The potential impacts associated with operation of reduced numbers of aircraft would be less than that from operation of the number of aircraft needed to meet the objective. Therefore, this EIS assesses the potential impacts from the operation of as many as 48 fighters, 12 tankers, six bombers, and four Global Hawks, and the personnel associated with these numbers of aircraft, after full ISR/Strike operational capability is established at Andersen AFB.

ES 8 Identification of the Preferred Alternative

The preferred alternative is Alternative A.

ES 9 Cumulative Actions and Impacts

The NEPA implementing regulations require analysis of impacts of not only the proposed action and alternatives (including a “No Action” Alternative), but also consideration of cumulative actions and cumulative impacts of Alternatives A and B with all past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. ES 3.1 describes additional discussion and consideration of other past, present, and reasonably foreseeable future actions.

This EIS considers the following Air Force-identified other actions and analyzes cumulative impacts in detail for the following actions:

- Facility construction projects identified through the routine base planning and development process, some of which are in progress (*e.g.*, water system upgrade) or would be initiated (*e.g.*, munitions storage igloo construction in FY06) before initiation of the ISR/Strike capability;
- Beginning in FY06, relocation of an Air Force Rapid Engineer Deployable Heavy Operational Repair Squadron Engineer, a Combat Communications squadron, and the Pacific Air Forces Silver Flag, Commando Warrior, and Combat Communications training programs to the Northwest Field area of Andersen AFB;

- Beginning in FY06, relocation of a Transportable Airlift Control Element unit and a Logistics Unit to Andersen AFB; and
- A Base population increase of 1,248 personnel as a result of the preceding other actions.

Table ES-2 summarizes the cumulative impacts.

Table ES-1 Summary of Environmental Impacts for Establishment of the ISR/Strike Capability

Noise

Alternative A

- 2,566 persons exposed to day-night average sound level (DNL) 65 decibels (dBA) and greater equate to about 6 percent of the persons who live within a 5-mile radius of the airfield.
- The nearby on-Base and an off-Base schools would continue to be exposed to noise from aircraft operations.
- The on-Base high school would be constructed to meet noise level reduction standards.
- Noise during an aircraft overflight could cause a decrease in speech intelligibility or cause the individuals to move closer together to be heard.
- Noise-induced hearing loss would not occur because individuals would not be exposed to noise for the duration at which loss could occur.
- New facilities and family housing would be constructed to achieve an indoor noise level of DNL 45 dBA or less.

Alternative B

- Noise modeling for Alternative B indicated there was no discernable difference in Alternative B noise contours and noise exposure when compared to Alternative A.

No Action Alternative

- 256 off-Base persons who would continue to be exposed to DNL 65 dBA and greater equate to 0.6 percent of the persons who live within a 5-mile radius of the airfield.

Land Use

Alternative A

- On-Base land use conflicts would not occur because land use categories in the General Plan were developed by considering the proposed ISR/Strike activities.
- Planned facilities would not interfere with existing procedures for access to non-Air Force land between Andersen AFB, the Pacific Ocean, and the Philippine Sea.
- Andersen AFB would provide the noise contours and land use sections of this EIS to local planning agencies to serve as an interim Air Installation Compatible Use Zone (AICUZ) report and would update the 2001 AICUZ Study to identify potential land use incompatibility from aircraft noise within 1 year after the completed mission change.
- Housing for construction workers who may temporarily relocate to Guam would be determined by GovGuam regulations.

Alternative B

- The summary for Alternative A applies to Alternative B.

No Action Alternative

- Routine facilities actions would be accomplished in accordance with the Base's General Plan.
- Andersen AFB would prepare an update to the 2001 AICUZ Report to identify potential land use incompatibility from aircraft noise.

Table ES-1 Summary of Environmental Impacts for Establishment of the ISR/Strike Capability (*continued*)

Infrastructure and Utilities

Alternative A

- Water consumption would be about 20 percent of system capacity.
- The wastewater treatment plant (WWTP) would operate at 82 percent of capacity. The Base would continue negotiating with the Guam Water Authority to determine the amount of wastewater the Base will be allowed to send to the WWTP.
- Electricity consumption would equate to approximately 4 percent of the Guam power Authority (GPA) generation capacity. Where practicable, facilities would be constructed in an energy-efficient and sustainable manner.
- The loss of the three wells that inject storm water into the aquifer should not present a problem because there are other nearby wells that are currently under capacity and to which storm water can be channeled. New designs that incorporate devices to increase ponding and retention (pre-treatment) would be implemented. New oil/water separator systems would also be required. Construction contractors would ensure an Environmental Protection Plan (EPP) is prepared, provided to Andersen AFB for submittal to Guam Environmental Protection Agency (Guam EPA), and approved before initiating activities.
- Based on current disposal rates, the Base landfill would reach capacity by December 2007, regardless of the Alternative A activities. A study is currently being conducted to investigate the possibility of vertically extending the current landfill for use beyond 2009. The study is scheduled for completion in January 2007. Thus, Andersen AFB plans to use the expanded on-Base landfill until 2009 or later if the current study supports expansion, and then use a permitted landfill. Although it is not known at this time which landfill would be used, there are three possible options: (1) the proposed GovGuam landfill after it becomes available in 2009-2010; (2) the on-Base landfill that would be constructed as an ISR/Strike project; and (3) the Navy landfill. Planning for the GovGuam and ISR/Strike landfills has not progressed to the point where the capacities or life spans are known. Therefore, quantitative analysis of the impact of the ISR/Strike project on the landfill cannot be accomplished. The Base would submit the permit application for Guam EPA coordination for the ISR/Strike landfill project. All green waste would continue to be segregated and collected for mulching, chipping, and composting or burned in small piles on site after obtaining a burning permit from the local fire department. Andersen AFB would continue its aggressive pollution prevention and recycling program to divert solid waste.
- Construction contracts would require the contractor to recycle construction and demolition debris to the maximum extent possible.
- The level of service (LOS) for the intersection of Arc Light Boulevard and Highway 1 and Route 9 at the Main Gate would be LOS C or better during the peak hours of traffic. At LOS C most experienced drivers are comfortable, roads remain safely below but efficiently close to capacity, and posted speed is maintained. Traffic at the intersection of the Commercial Gate and Route 9 would operate at LOS B or better. Some congestion and impingement of maneuverability occur at LOS B and two motorists might be forced to drive side by side, limiting lane changes.

Alternative B

- Water consumption would be about 17 percent of system capacity.
- The WWTP would operate at 82 percent of capacity. The negotiation analysis for Alternative A applies.
- Electricity consumption would equate to approximately 4 percent of the GPA generation capacity. The energy efficiency analysis for Alternative A applies.
- Alternative A storm water, landfill, pollution prevention, recycling, traffic discussions apply.

No Action Alternative

- Water consumption would be about 13 percent of the system capacity.
- The WWTP would continue to operate at 79 percent of capacity.
- The Base would continue to consume electricity at a rate that equates to about 4 percent of the GPA generation capacity.
- Storm water would be managed using existing procedures, and runoff would continue at existing rates.
- Based on current disposal rates, the Base landfill would reach capacity by December 2007. A study is currently being conducted to investigate the possibility of vertically extending the current landfill for use beyond 2009. The study should be completed in January 2007. Thus, Andersen AFB plans to use the expanded on-Base landfill until 2009 or later if the current study supports expansion, and then use a permitted landfill. Although it is not known at this time which landfill would be used, there are two possible options: (1) the proposed GovGuam landfill after it becomes available in 2009-2010; and (2) the Navy landfill. Planning for the GovGuam and ISR/Strike landfills has not progressed to the point where the capacities or life spans are known. Therefore, quantitative analysis of the impact of the ISR/Strike project on the landfill cannot be accomplished.
- The LOS for the intersection of Arc Light Boulevard and Highway 1 and Route 9 at the Main Gate would remain at LOS B during the peak hours of traffic.

Table ES-1 Summary of Environmental Impacts for Establishment of the ISR/Strike Capability (*continued*)

Biological Resources

Alternative A

- Approximately 74 hectares (183 acres) of vegetation would be removed for construction of the aircraft staging area (ASA) and Commercial Gate.
- Approximately 58 hectares (143 acres) of the 74 hectares can be considered suitable habitat for the listed species. This area amounts to 1.3 percent of the Refuge Overlay and Ritidian Unit of the Guam National Wildlife Refuge.
- Indirect effects from facility operation and construction include the loss of between 80 and 147 hectares (197 – 334 acres) of foraging habitat and between 101 and 147 hectares (249 – 363 acres) of foraging/nesting habitat for the various listed species considered in the EIS.
- Recreational hunting would no longer be allowed in the ASA due to safety and security reasons after the facility becomes operational.
- The potential for off-Base transport of the Brown tree snake (BTS) would be low through use of the procedures in the 36th Wing Instruction 32-7004, Brown Tree Snake Management, which ensures 100 percent inspection of all aircraft and cargo that depart the Base.
- Noise levels associated with increased aircraft overflights would incrementally increase over a multi-year period, and would occur over areas important to the Mariana fruit bat and Mariana crow.
- With the exception of the Mariana fruit bat, the proposed action may affect, but not adversely affect, populations of existing species as well as recovery of species populations. One known Mariana fruit bat foraging area would be removed; however, no adverse modifications to species habitat associated with the proposed action would occur. The effects determination for the proposed action is based on the following assumptions:
    - Existing conditions for listed species within habitat areas of the Refuge Overlay continue to degrade. Excessive ungulate pressure prevents recruitment of emergent canopy species within forested areas, while BTS predation limits recovery of listed species.
    - The size of the areas subject to clearing is relatively small in comparison to available habitat.
    - Noise from aircraft overflights would affect Mariana fruit bat and Mariana crow recovery efforts, as well as current populations. Based on current literature and field observations, habituation to an incremental increase of overflights would be expected. Further, adverse effects that do become apparent due to aircraft operations would initiate modifications to aircraft ground tracks and profiles over sensitive areas through an adaptive management strategy. This adaptive management strategy would involve multi-year monitoring of noise effects using up-to-date standards for acoustical studies on sensitive species that would affect operational changes.
- Implementation of the conservation measures described in Chapter 2 would reverse the continued degradation of approximately 200 hectares (494 acres) of important habitat, and therefore, contribute to the recovery of listed species. Many of the conservation measures correspond directly to management needs identified as critical recovery actions in the U.S. Fish and Wildlife Service (USFWS) recovery plans for listed species. Additionally, the conservation measures would effectively manage areas of higher quality habitat for listed species. Therefore, the species may utilize the better-quality habitat that would be effectively enhanced by the conservation measures, rather than the relatively lower-quality habitat currently present at Andersen main.
- Formal consultation with USFWS under Section 7 of the Endangered Species Act (ESA) resulted in the issuance of a Biological Opinion (BO), which concluded that the ISR/Strike project is not likely to jeopardize the continued existence of the Mariana fruit bat, Mariana crow, Micronesian kingfisher, Guam rail, or other off-site species listed under the ESA. An incidental take statement, as part of the BO, anticipates the harm of one Mariana fruit bat, mortality of 21 fruit bats on Guam, mortality of 36 fruit bats on Rota, and the harassment of two colonies. This determination is based on the conservation measures associated with Alternative A, as well as Air Force commitments to non-discretionary measures in the BO that seek to minimize disturbance, injury, and death to Mariana fruit bats due to the ISR/Strike project. Take is not anticipated for the other species considered in the analysis of this EIS.

Table ES-1 Summary of Environmental Impacts for Establishment of the ISR/Strike Capability (*continued*)

Alternative B

- The summary for Alternative A applies to Alternative B.

No Action Alternative

- No land clearing would occur northwest of the runways at Andersen main, and there would be no reduction in land identified as the Guam National Wildlife Refuge Overlay.
- Plant and animal species resources, which include threatened and endangered species, would not change from current conditions
- Natural resources would continue to be managed by the Base's Integrated Natural Resources Management Plan

Groundwater Resources

Alternative A

- Water withdrawal from the aquifer would be about 7 percent of the daily water withdrawn from the aquifer.
- The use of erosion control techniques would minimize the potential for groundwater contamination. Base personnel would continue to monitor all construction activity and require an environmental protection plan that identifies the actions necessary to reduce or preclude surface contamination from entering the storm water injection wells.

Alternative B

- Water withdrawal from the aquifer would be about 6 percent of the daily water withdrawn from the aquifer.
- The erosion control and monitoring discussion for Alternative A applies.

No Action Alternative

- Water withdrawal from the aquifer for Base activities is about 6 percent of total daily water withdrawal from the aquifer.
- The use of erosion control techniques minimizes the potential for groundwater contamination.

Earth Resources

Alternative A

- New facilities would be constructed to ensure structural stability due to the potential for seismic activity on Guam.
- Erosion control measures identified in the EPP that would be prepared and implemented by the construction contractor would minimize erosion. Local government clearances from the Department of Agriculture, Department of Parks and Recreation, and the Guam Historic Preservation Office would be obtained prior to commencement of earthmoving activities.

Alternative B

- The summary for Alternative A applies to Alternative B.

No Action Alternative

- Use of the erosion control measures identified in the Base's Stormwater Pollution Prevention Plan minimizes erosion.

Hazardous Materials and Waste

Alternative A

- Contractors would manage hazardous waste and hazardous materials in accordance with Andersen AFB, local, and federal guidance, and would be responsible for the storage, treatment, disposal, and transportation off-Guam of any hazardous waste and hazardous materials that has an expired shelf life, is outdated, unopened, and/or unused.
- It is not likely that new hazardous waste streams would occur because of the similarity between the aircraft that currently operate from the Base and those expected with Alternative A. The existing hazardous waste management processes and procedures should accommodate the waste generated under Alternative A. However, Andersen AFB would increase the 90-day waste storage capacity because the volume of hazardous waste would increase with the addition of as many as 70 aircraft.
- The construction contractor would coordinate with Andersen AFB and would be responsible for handling and disposal of any Installation Restoration Program (IRP)-related material, including a site that is built on top of a known IRP or military munitions response site that has not been completed under the remedial action process.
- Construction projects would not hinder access to current IRP sites, areas of concern, other contaminated areas, monitoring wells, and remedial systems for sampling and operation and maintenance activities.
- Average daily jet fuel consumption would equate to about 0.1 percent of the Base's fuel storage capacity.

Alternative B

- The summary for Alternative A applies to Alternative B.

No Action Alternative

- Hazardous media and the IRP would continue to be managed using current procedures and guidance.

Table ES-1 Summary of Environmental Impacts for Establishment of the ISR/Strike Capability (*continued*)

Cultural Resources

Alternative A

- The Air Force completed the Section 106 process with the Guam State Historic Preservation Office (GSHPO) and accomplished cultural resource surveys in the previously unsurveyed area in which ISR/Strike facilities would be constructed. A report of findings and management recommendations for these properties was submitted to the GSHPO. Based on review of the Executive Summary of the cultural resources inventory, the GSHPO responded that "further archaeological investigation on prehistoric sites at ISR/Strike will not provide any new information about the project area, but such an investigation will only be redundant to what we already know about the project."

Alternative B

- The summary for Alternative A applies to Alternative B.

No Action Alternative

- Cultural resources would continue to be managed in accordance the Base's Integrated Cultural Resources Management Plan (ICRMP).

Socioeconomic Resources

Alternative A

- Base population would increase by an overall 3,000 persons when considering military personnel and dependents.
- Construction of on-Base family housing units and dormitories would accommodate the additional personnel.
- Off-Base population would temporarily increase due to construction activities because as many as 1,800 skilled U.S. workers from elsewhere in the U.S. would be necessary due to the shortage of local labor on Guam.
- Additional housing for skilled U.S. workers from elsewhere in the U.S. would need to be augmented and supplied from alternative housing sources.
- The addition of as many as 440 elementary/middle school students to the existing enrollment would exceed the school capacity by about 218 students. The addition of as many as 110 high school students would exceed the school capacity by about 95 students. One of the ISR/Strike projects would construct a Department of Defense Education Activity (DoDEA) high school, which would accommodate the additional high school students. Vacated space in the existing high school could be used to accommodate the additional elementary/middle school students. The addition of personnel would increase wages paid, business sales, and income to the local economy.

Alternative B

- Base population would increase an overall 1,850 persons.
- Use of the current inventory of on-Base family housing units and construction of dormitories would accommodate the additional personnel. Dormitories would be constructed to accommodate additional unaccompanied personnel.
- Off-Base population would temporarily increase due to construction activities because as many as 1,600 skilled U.S. workers from elsewhere in the U.S. would be necessary.
- The addition of as many as 70 elementary/middle school students to the existing enrollment would expand the student population, but not exceed capacity. The addition of as many as 20 high school students would exceed the school capacity by about five students. The ISR/Strike DoDEA high school project would accommodate the additional high school students.
- The summary for off-Base housing for skilled U.S. workers from elsewhere in the U.S., wages, business sales, and income for the local economy for Alternative A applies.

No Action Alternative

- There would be no change to the population, housing, education, or economic conditions.

Airfield Operations, Aircraft Safety, and Bird/Wildlife Aircraft Strike Hazard

Alternative A

- The airfield could accommodate the approximate 45 percent increase in aircraft operations.
- Additional arrival, departure, and closed pattern flight tracks and related air traffic control procedures would be added to Runway 06Left/24Right for use by the ISR/Strike fighter aircraft.
- The aircraft flight profiles associated with the ISR/Strike aircraft would not be affected by, nor would they affect, the restrictions that limit aircraft overflight of Munitions Storage Area 1, Mariana crow territories, and the Mariana fruit bat colony.
- The probability is low that an aircraft involved in an accident at or around the Andersen AFB airfield would strike a person or structure on the ground.
- Approximately four annual bird/wildlife aircraft strikes would occur. It is unlikely any of these bird/wildlife aircraft strike incidents would result in an aircraft accident, involve injury to aircrews or to the public, or damage to property (other than the aircraft).
- Flight regimes of the Mariana crow and Mariana fruit bat and the altitudes of aircraft provide sufficient separation so strikes with aircraft would not occur.

Alternative B

- The airfield could accommodate the approximate 41 percent increase in aircraft operations.
- The summary for Alternative A applies to Alternative B.

No Action Alternative

- The existing air traffic control procedures accommodate the 85,734 annual airfield operations.
- The existing conditions for aircraft safety and bird/wildlife aircraft strike hazards would continue because there would be no change in the type and level of airfield operations.

Environmental Justice

Alternative A

- Alternative A would not result in any environmental impacts to low-income or minority populations which are disproportionately high or adverse when compared to impacts to the general population. Alternative A would not cause adverse impacts to human health or the environment of neighboring populations. No disproportionately high or adverse effects to minority and low-income populations in the Andersen AFB area would occur because significant environmental impacts would not result.

Alternative B

- The summary for Alternative A applies to Alternative B.

No Action Alternative

- Disproportionately adverse effects to minority and low-income populations would not occur.

Table ES-2 Summary of Cumulative Impacts

Resource	Cumulative Impacts
Noise	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. Receptors in the vicinity of ISR/Strike and other action facility construction projects could include persons within 100 feet of noise emanating from equipment operating simultaneously at two construction sites. Construction noise would be temporary, would occur only during daytime, and would cease when the project was completed.
Land Use	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. As with Alternative A, the other facility actions would be accomplished in accordance with the Andersen AFB General Plan. Facility construction and use would be consistent with land use plans and programs identified in the General Plan. None of the other facilities that would be constructed would interfere with existing access to non-Air Force land between Andersen AFB, the Pacific Ocean, and the Philippine Sea. Existing access procedures would be continued.
Air Quality	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. None of the construction emissions or the full ISR/Strike capability and other action recurring emissions cause a violation of federal standards. A General Conformity Rule Conformity Determination would not be required.
Infrastructure and Utilities	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. Water consumption would be about 20 percent of system capacity. The WWTP would operate at 82 percent of capacity. The Base would continue negotiating with the GWA to determine the amount of wastewater the Base will be allowed to send to the Northern WWTP. Electricity use would equate to about 4 percent of the GPA generation capacity. The additional impervious cover would equate to a 19 percent increase, and the amount of storm water runoff could increase accordingly. The loss of wells that inject stormwater into the aquifer should not present a problem because there are other nearby wells that are currently under capacity and to which stormwater can be channeled. New designs that incorporate devices to increase ponding and retention (pre-treatment) would be implemented. New oil/water separator systems would also be required. Construction contractors would ensure an EPP is prepared, provided to Andersen AFB for submittal to Guam EPA, and approved before initiating activities. It is estimated the landfill would reach 100 percent capacity by December 2007, regardless of Alternative A and other action activities. A study is currently being conducted to investigate the possibility of vertically extending the current landfill for use beyond 2009. The study is scheduled to be completed in January 2007. Thus, Andersen AFB plans to use the expanded on-Base landfill until 2009 or later if the current study supports expansion, and then use a permitted landfill. Although it is not known at this time which landfill would be used, there are three possible options: (1) the proposed GovGuam landfill after it becomes available in 2009-2010; (2) the on-Base landfill that would be constructed as an ISR/Strike project; and (3) the Navy landfill. Planning for the GovGuam and ISR/Strike landfills has not progressed to the point where the capacities or life spans are known. Therefore, quantitative analysis of the impact of the ISR/Strike project on the landfill cannot be accomplished. The Base would submit the permit application for Guam EPA coordination for the ISR/Strike landfill project. All green waste would continue to be segregated and collected for mulching, chipping, and composting. Andersen AFB would continue its aggressive pollution prevention and recycling program to divert solid waste. One of the other action projects would construct a waste-to-energy (WTE) plant at Andersen AFB. Construction and operation of the facility would reduce the amount of material that would be land filled. It is not possible to determine at this time how much solid waste could be diverted to the WTE plant because planning for the plant has not been initiated. Contracts issued for construction activities would require the contractor to recycle construction and demolition debris to the maximum extent possible. The LOS for the intersection of Arc Light Boulevard and Highway 1 and Route 9 at the Main Gate would be LOS C or better during the peak hours of traffic. Traffic at the intersection of the Commercial Gate and Route 9 would operate at LOS B or better.

Table ES-2 Summary of Cumulative Impacts (*continued*)

Resource	Cumulative Impacts
Biological Resources	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. Under Alternative A and other actions, 122.7 hectares (303.2 acres) of vegetated land would be subject to removal, which represents 2.7 percent of the Refuge Overlay and the Ritidian Unit of the Guam National Wildlife Refuge. Removal of habitat for ungulates and exotic predators would displace these species into adjacent habitats. The cumulative effects of noise on Mariana fruit bats and Mariana crows include periodic noise events from training activities in Northwest Field, as well as an incremental increase in aircraft overflights at Andersen main. No action of Alternative A or other actions would affect Area 50, or the proposed Habitat Management Unit (HMU); therefore, recovery efforts would not be affected. Because clearing activities and noise events occur in areas suitable for foraging and roosting/nesting for the Mariana fruit bat, Mariana crow, and potential habitat for recovery of other species, cumulative actions may affect listed species. Construction associated with the ASA would impact a known female Mariana fruit bat foraging area. Therefore, clearing for the ASA would represent an adverse effect. This forest removal would not jeopardize the continued existence of the Mariana fruit bat or adversely modify overall habitat. Conservation measures of Alternative A and other actions, however, reduce adverse effects. Under Alternative A and other actions, 336 hectares (830 acres) would be subject to ungulate exclosure fencing and ungulate depredation hunting. Of these 336 hectares (830 acres), Area 50 (22 hectares or 54 acres) and the new HMU (60 hectares or 148 acres) would be subject to exotic predator control with suitable exotic predator exclosure fencing. Conservation measures seek to create alternative habitat for Mariana fruit bats and Mariana crows by outplanting of foraging plots within exclosure areas. BTS control would be put into place at Pati Point, along with the 36th Wing Instruction 32-7004 (100 percent inspection of outbound flights). Pursuant to §7 of the Endangered Species Act, the foreseeable cumulative effects would not result in any demonstrable adverse consequences.
Groundwater Resources	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. Water withdrawal from the aquifer would increase by 1.15 percent and the resulting withdrawal would be 7 percent of the daily water withdrawn from the aquifer. The use of erosion control techniques and monitoring storm water during construction and after the projects are completed would minimize the potential for groundwater contamination.
Earth Resources	The types of construction activities associated with the other actions would be nearly identical to those for Alternative A. Therefore, the discussion and analysis for Alternative A applies to the cumulative impact analysis.
Hazardous Materials and Waste	The construction contractor for other projects would be required to comply with the regulatory requirements identified for the No Action Alternative and Alternative A. Although some of the other actions may be adjacent to a project site under the No Action Alternative and Alternative A, use of regulatory requirements identified for these alternatives would minimize the potential for cumulative impacts. When completed, activities at the other facilities would be managed in accordance with applicable environmental plans and policies.
Cultural Resources	The ISR/Strike project is one of a number of other planned projects involving construction on Andersen AFB. The potential for cumulative impacts from the ISR/Strike and other actions is minimal based on the distance between project sites, especially for the Northwest Field project. Additionally, the Air Force accomplished the Section 106 process for the Northwest Field project. The potential for cumulative impacts between the ISR/Strike projects and other projects would be prevented or minimized through implementation of the procedures identified in the Andersen AFB ICRMP. When combining the other actions with the ISR/Strike project through the consultation process, no cumulative adverse effects on significant cultural resources, including visual resources, would occur.

Table ES-2 Summary of Cumulative Impacts (*continued*)

Resource	Cumulative Impacts
Socioeconomic Resources	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. On-Base population would increase by 4,248 personnel when considering military personnel, dependents, and students undergoing training. Off-Base population would temporarily increase for the duration of the construction activities because importing as many as 2,080 contract workers would be necessary due to the shortage of local labor on Guam. Nearly all the inventory of 484 off-Base housing units would be needed to meet the shortfall of 474 on-Base family housing units. The addition of as many as 765 elementary/middle school students to the existing enrollment would exceed the school capacity by about 543 students. The addition of as many as 185 high school students to the existing enrollment would exceed the school capacity by about 170 students. The ISR/Strike DoDEA high school project would accommodate the additional high school students. Vacated space in the existing high school should be able to accommodate the additional elementary/middle school students. Should additional space be needed, portable buildings similar to those used by public school districts could be used to alleviate overcrowding. Employment generated by construction activities would result in wages paid, and increase expenditures for local and regional services and supplies during construction. The addition of 1,100 personnel authorizations would result in an increase in wages paid, business sales, and income to the local and regional economy.
Airfield Operations, Aircraft Safety, and Bird/Wildlife Aircraft Strike Hazard	None of the other actions proposed at Andersen AFB include aircraft basing or airfield operations. Therefore, no cumulative airfield operations, aircraft safety, or bird/wildlife aircraft strike impacts would occur.
Environmental Justice	None of the other actions would have the potential for off-Base noise. Establishment and operation of the ISR/Strike capability, when combined with other planned projects, would not contribute cumulative impacts to minority or low-income populations in the area.

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APPENDICES

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ACRONYMS AND ABBREVIATIONS

$\mu g/m^3$	microgram(s) per cubic meter
36 WI 32-7004	36th Wing Instruction 32-7004, *Brown Tree Snake Management*
AFB	Air Force Base
AFI	Air Force Instruction
AGE	aerospace ground equipment
AGL	above ground level
AICUZ	Air Installation Compatible Use Zone
ANSI	American National Standards Institute
AOC	area of concern
APE	area of potential effects
APZ	accident potential zone
AQCR	air quality control region
ASA	aircraft staging area
ATCAA	air traffic control assigned airspace
ATSDR	Agency for Toxic Substances and Disease Registry
BA	biological assessment
BAI	backup aircraft inventory
BASH	Bird/Wildlife Aircraft Strike Hazard
bgs	below ground surface
BO	Biological Opinion
BOD_5	5-day biochemical oxygen demand
BRAC	Base Realignment and Closure Commission
BSP	Bureau of Statistics and Plans
BTS	brown tree snake
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CITS	Combat Information Transport System
CNMI	Commonwealth of the Northern Mariana Islands
CRMA	cultural resource management area
CY	cubic yard
CZ	clear zone
CZMA	Coastal Zone Management Act
DAWR	Guam Department of Agriculture Division of Aquatic and Wildlife Resources
dB	decibel
dBA	A-weighted sound level measured in decibels
DNL	day-night average sound level
DoD	Department of Defense
DoDEA	Department of Defense Education Activity
DRMO	Defense Reutilization Marketing Office

EA	environmental assessment
EIAP	environmental impact analysis process
EIFS	Economic Impact Forecast System
EIS	environmental impact statement
EO	executive order
EOD	explosives ordnance disposal
EPP	Environmental Protection Plan
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDM	Farallon de Medinilla
FICON	Federal Interagency Committee on Noise
FICUN	Federal Interagency Committee on Urban Noise
ft^2	square foot
FY	fiscal year
GBU	Guided Bomb Unit
GBU	guided bomb unit
GCMP	Guam Coastal Management Program
GNWR	Guam Natural Wildlife Refuge
GOV	government-owned vehicle
GovGuam	Government of Guam
GPA	Guam Power Authority
gpd	gallons per day
gpm	gallons per minute
GPS	global positioning system
Guam EPA	Guam Environmental Protection Agency
GWA	Guam Waterworks Authority
HAP	hazardous air pollutant
HMU	habitat management unit
HSC-25	Helicopter Combat Support Squadron 25
HUD	United States Department of Housing and Urban Development
ICRMP	Integrated Cultural Resources Management Plan
IICEP	Interagency and Intergovernmental Coordination for Environmental Planning
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
ISR	intelligence, surveillance, and reconnaissance
JDAM	Joint Direct Attack Munition
kV	kiloVolt
kWH	kiloWatt-hours
L_{max}	maximum sound level
LOS	level of service
Marianas Training EIS	*Military Training in the Marianas Environmental Impact Statement*

mgd	million gallons per day
MILCON	military construction
MOA	military operations area
MOU	Memorandum of Understanding
MSA	munitions storage area
MSL	mean sea level
MSW	municipal solid waste
MTR	military training range
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NLR	noise level reduction
NM	nautical mile
NOI	notice of intent
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
O&M	operations and maintenance
PAA	primary assigned aircraft
PACAF	Pacific Air Forces
pCi/L	picoCuries per liter
PL	public law
POV	privately owned vehicle
ppm	parts per million
PSD	prevention of significant deterioration
QDR	Quadrennial Defense Review
RAIF	resource adverse impact footprint
RCRA	Resource Conservation and Recovery Act
RED HORSE	Rapid Engineer Deployable Heavy Operational Repair Squadron Engineer
RTV	rational threshold value
SDB	Small Diameter Bomb
SEL	sound exposure level
GSHPO	Guam State Historic Preservation Office
SWMU	solid waste management unit
SWPPP	Storm Water Pollution Prevention Plan
T&E	threatened and endangered
TALCE	Transportable Airlift Control Element
the Base	Andersen AFB
TMDL	Total Maximum Daily Loads
tpd	tons per day
tpy	tons per year
TRIMS	Training Range Information Management System

U.S.	United States
UCLA	University of California at Los Angeles
UIC	underground injection control
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USC	U.S. Code
USDA	U.S. Department of Agriculture
USDOC	U.S. Department of Commerce
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
WTE	waste-to-energy
WWTP	wastewater treatment plant

GLOSSARY

Administrative Record	A record of all documents (hard copies, electronic files, briefing charts, files, photographs, or other documents and records) relied upon in preparing a NEPA document. The administrative record documents the proponent's consideration of all relevant and reasonable factors and should include evidence of diverging opinions and criticisms of the proposed action or its reasonable alternatives.
Air Pollutant	Generally, an airborne substance that could, in high enough concentrations, harm living things or cause damage to materials. From a regulatory perspective, an air pollutant is a substance for which emissions or atmospheric concentrations are regulated or for which maximum guideline levels have been established due to potential harmful effects on human health and welfare.
Air Quality	The cleanliness of the air as measured by the levels of pollutants relative to standards or guideline levels established to protect human health and welfare. Air quality is often expressed in terms of the pollutant for which concentrations are the highest percentage of a standard.
Aquifer	A water-bearing bed or layer of permeable rock, sand, or gravel capable of yielding large amounts of water.
Area of Potential Effect	A term used in Section 106 to describe the area in which historic resources may be affected by a federal undertaking.
Baseline	The existing environmental conditions against which impacts of the proposed action and its alternatives can be compared.
Best Management Practices	Resource management decisions and/or actions that are based on the latest professional and technical standards for the protection, enhancement, and rehabilitation of natural and cultural resources.
Biological Assessment	The gathering and evaluation of information on proposed endangered and threatened species and critical habitat and proposed critical habitat. Required when a management action potentially conflicts with endangered or threatened species, the biological assessment is the way federal agencies enter into formal consultation with the Fish and Wildlife Service and describe a proposed action and the consequences to the species the action would affect.
Biological Oxygen Demand BOD_5	The amount of dissolved oxygen consumed in five days by biological processes breaking down organic matter.
Coastal Zone	Lands and waters adjacent to the coast that exert an influence on the uses of the sea and its ecology, or whose uses and ecology are affected by the sea.
Code of Federal Regulations (CFR)	Document that codifies all rules of the executive departments and agencies of the federal government. It is divided into fifty volumes, known as titles. Title 40 of the CFR (referenced as 40 CFR) lists all environmental regulations.
Comment Period	Time provided for the public to review and comment on a proposed EPA action or rulemaking after publication in the Federal Register.
Community	An assemblage of plant and animal populations in a common spatial arrangement.

GLOSSARY (*continued*)

Cooperating Agency	Any Federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment.
Council on Environmental Quality	Established under Title II of NEPA to develop Federal agency-wide policy and regulations for implementing the procedural provisions of NEPA, resolve interagency disagreements concerning proposed major Federal actions, and to ensure that Federal agency programs and procedures are in compliance with NEPA.
Critical Habitat	Habitat essential to the conservation of an endangered or threatened species that has been designated as critical by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures outlined in the Endangered Species Act and its implementing regulations (50 CFR 424).
Cultural Resource	The fragile and nonrenewable remains of human activity that are found in historic districts, sites, buildings, and artifacts and that are important in past and present human events.
Cumulative Impacts or Effects	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time
Emission	Pollution discharged into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities; from residential chimneys; and from motor vehicle, locomotive, or aircraft exhausts.
Endangered Species	Any species that is in danger of extinction throughout all or a significant portion of its range
Environmental Assessment (EA)	A concise public document that serves to : Briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact. Aid an agency's compliance with the Act when no environmental impact statement is necessary. Facilitate preparation of a statement when one is necessary.
Environmental Impact Statement (EIS)	The detailed statement required by section 102(2)(C) of NEPA which an agency prepares when its proposed action significantly affects the quality of the human environment
Environmental Justice	The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development and enforcement of environmental laws, regulations, and policies.
Finding of No Significant Impact (FONSI)	A document by a Federal agency briefly presenting the reasons why an action, not otherwise excluded, will not have a significant effect on the human environment and for which an Environmental Impact Statement therefore will not be prepared. It shall include the environmental assessment or a summary of it and shall note any other environmental documents related to it.

GLOSSARY (*continued*)

Geographic Information System	A computer system that enables a person to process natural resources and a variety of other spatially referenced data collected from various surveys and inventories. High quality color maps and management documents can be conveniently produced and manipulated and used for data and inventory management, education, and a variety of planning purposes.
Groundwater	Water that has percolated downward from the ground surface through the soil pores.
Guam State Historic Preservation Officer	The official who (among other duties) consults with federal agencies during Section 106 review. The SHPO administers the national historic preservation program at the state level, reviews National Register nominations, and maintains file data on historic properties that have been identified but not yet nominated. Agencies seek the views of the appropriate SHPO(s) while identifying historic properties and assessing effects of an undertaking on historic properties.
Habitat	The natural abode of a plant or animal, including all biotic, climatic, and soil factors affecting life.
Habitat Management Unit	A tract of land established for biological resources studies.
Hazardous	Substances that are potentially harmful to human health or the environment. *Hazardous Wastes* - A compound or compounds remaining for disposal or reclamation after use or after release to the environment.
Integrated Cultural Resources Management Plan (ICRMP)	A plan that defines the process for the management and protection of cultural resources on military installations.
Integrated Natural Resources Management Plan (INRMP)	A plan written to provide an overall framework and approach for managing, monitoring, protecting, and utilizing natural resources on military installations. These plans typically use an ecosystem-based approach to support sustainable military use of installation lands, while protecting and enhancing resources for multiple use, sustainable yield, and biodiversity.
Landfill	A waste management unit at which waste is discharged in or on land for disposal.
Lead Agency	The agency or agencies preparing, or taking primary responsibility for preparing, the Environmental Impact Statement.
Level of Service (LOS)	A qualitative measure describing operational conditions within a traffic stream, based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience.
Mitigation	Lessening the effects to natural or cultural resources caused by implementation of projects or activities that result in adverse impacts. Mitigation can include limiting the magnitude of the action; repairing, rehabilitating, or restoring the affected resource; avoiding the effect altogether; reducing or eliminating the effect over time by preservation and maintenance operations during the life of the action; and/or compensating for the effect by providing substitute resources or environments.

GLOSSARY (*continued*)

National Environmental Policy Act (NEPA)	The federal law, going into effect on January 1, 1970, that established a national policy for the environment and requires federal agencies (1) to become aware of the environmental ramifications of their proposed actions, (2) to fully disclose to the public proposed federal actions and provide a mechanism for public input to federal decision making , and (3) to prepare environmental impact statements for every major action that would significantly affect the quality of the human environment.
National Historic Preservation Act (NHPA)	The basic legislation of the national historic preservation program that established the Advisory Council on Historic Preservation and the Section 106 review process.
National Pollutant Discharge Elimination System (NPDES)	A process for controlling the amount of pollution discharged into waters by requiring polluters to obtain NPDES permits from the states involved and to comply with discharge standards. The NPDES is mandated by the Federal Water Pollution Control Act Amendments.
National Register of Historic Places	The official list, established by the Historic Preservation Act of 1966, of the Nation's cultural resources worthy of preservation. The National Register lists archeological, historic, and architectural properties (districts, sites, buildings, structures, and objects) nominated for their local, state, or national significance by state and federal agencies and approved by the National Register Staff. The National Register is maintained by the National Park Service.
Natural Resources	All elements of nature and their environments of soil, air, and water. Those consist of two general types: earth resources, which consist of the nonliving resources such as minerals, water, and soil components and biological resources, which consist of living resources such as plants and animals.
NEPA Process	The objective analysis of an action to determine the degree of its environmental impact on the natural and physical environment; alternatives and mitigation that reduce that impact; and full and candid presentation of the analysis to, and involvement of, the interested and affected public. NEPA process may also be referred to generally as environmental review.
No Action alternative	Under NEPA, an alternative that provides a benchmark for comparison, enabling decision-makers to compare the magnitude of the environmental effects of the various alternatives.
Notice of Intent (NOI)	The NOI describes the proposed action, possible alternatives, and the proposed NEPA scoping process. It states the name and address of a person within GSA who can answer questions about the proposed action and EIS.
Proposed Action	The alternative that the Lead Agency believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors.

GLOSSARY (*continued*)

Record of Decision (ROD)	A public document signed by the agency decision maker at the time of a decision. The ROD states the decision, alternatives considered, the environmentally preferable alternative or alternatives, factors considered in the agency's decision, mitigation measures that will be implemented, and a description of any applicable enforcement and monitoring programs.
Scoping	An early and open process for determining the scope of issues to be addressed in an environmental impact statement and for identifying the significant issues related to a proposed action. Scoping may involve public meetings; field interviews with representatives of agencies and interest groups; discussions with resource specialists and managers; and written comments in response to news releases, direct mailings, and articles about the proposed action and scoping meetings.
Section 106 Compliance	The requirement of Section 106 of the National Historic Preservation Act that any project funded, licensed, permitted, or assisted by the Federal Government be reviewed for impacts to significant historic properties and that the State Historic Preservation Officer and the Advisory Council on Historic Preservation be allowed to comment on a project.
Section 7 Consultation	The requirement of Section 7 of the Endangered Species Act that all federal agencies consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service if a proposed action might affect a federally listed species or its critical habitat.
Solid Waste	Any non-hazardous garbage, refuse or sludge, which is primarily solid, but could also include portions of liquid, semi-solid or contained gaseous material resulting from residential, industrial, commercial, agricultural, mining operations, and community activities.
Storm Water Pollution Prevention Plan	Developed and implemented to address specific storm water discharge concerns for construction sites.
Threatened Species	Any plant or animals species likely to become endangered within the foreseeable future throughout all or a part of its range and designated by the U.S. Fish and Wildlife Service under the Endangered Species Act.
Ungulates	Hoofed animals, including ruminants but also horses, tapirs, elephants, rhinoceroses, and swine.
Vegetative Community	An assemblage of plant populations in a common spatial arrangement.
Wetlands	Areas that are inundated or saturated by surface or ground water often and long enough to support and under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions.

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CHAPTER 1
PURPOSE OF AND NEED FOR ACTION

This chapter provides a statement of the purpose and need for action and the scope of the environmental review.

1.1 PURPOSE OF AND NEED FOR ACTION

The 2001 Quadrennial Defense Review (QDR) noted that the Asian region has become increasingly important to regional and United States (U.S.) security in recent years. In response, the Department of Defense's (DoD) new planning construct calls for maintaining regionally tailored forces, forward stationed and deployed in the Asian theater. This action would assure allies and friends, counter coercion, and deter aggression against the U.S., its forces, allies, and friends. A multifaceted approach requires forces and capabilities that provide the President with a wider range of military options to discourage aggression or any form of coercion. In particular, it places emphasis on peacetime forward deterrence in critical areas of the world. It requires enhancing the future capability of forward deployed and stationed forces, coupled with global intelligence, strike, and information assets, in order to deter aggression or coercion with only modest reinforcement from outside the theater. One of the goals of reorienting the global posture is to render forward forces capable of swiftly defeating an adversary's military and political objectives with only modest reinforcement.

U.S. forces currently lack sufficient access to Asia. The U.S. military has insufficient bases, facilities, pre-positioned equipment, coalition arrangements, and other assets needed for operations along the Asian crescent from Southeast Asia northward to Okinawa and Japan. For example, withdrawal from the Philippines in the early 1990s left the U.S. military with no major air and naval bases in Southeast Asia. Additionally, in Asia, the large American presence in Korea and Japan may be rendered obsolete if Korean reconciliation ends the heightened threat of war with North Korea.

The 2001 QDR directed the Air Force to expand basing in the Pacific region with a regionally tailored, multifaceted force able to respond quickly to defeat an adversary's military and political objectives. In response, the Air Force proposes to locate intelligence, surveillance, and reconnaissance (ISR), strike, and aerial refueling aircraft and personnel in the western Pacific as part of the U.S. Pacific Command's ISR/Strike capability (ISR/Strike). The ISR/Strike capability would be able to respond more timely and effectively. The objective of the ISR/Strike capability would be to achieve pre-engagement battle space awareness, locate and identify critical adversary moves, achieve assured success through air dominance, and deliver decisive effects via persistent and precise application of air and space power. (The proposal to establish an ISR/Strike capability was developed prior to the 2005 Base Realignment and Closure Commission [BRAC] process, and the ISR/Strike capability is not part of the decisions from that process).

Andersen Air Force Base (AFB), Guam was identified as the installation best suited to host the ISR/Strike capability in a process driven by the 2001 QDR and a consideration of six installations in the Pacific Air Forces' area of responsibility. An additional process considered whether the status of the aircraft and personnel associated with the ISR/Strike capability should be permanently based or rotated, or a combination of the two options.

1.2 SCOPE OF THE ENVIRONMENTAL REVIEW

The National Environmental Policy Act (NEPA) of 1969, as amended, requires federal agencies to consider environmental consequences in the decision-making process. The President's Council on Environmental Quality (CEQ) issued regulations to implement NEPA that include provisions for both the content and procedural aspects of the required environmental analysis. The Air Force Environmental Impact Analysis Process (EIAP) is accomplished through adherence to the procedures set forth in CEQ regulations (40 Code of Federal Regulations [CFR] Part 1500) and 32 CFR Part 989 (*Air Force Environmental Impact Analysis Process*). These federal regulations establish both the administrative process and substantive scope of the environmental impact evaluation designed to ensure that deciding authorities have a proper understanding of the potential environmental consequences of a contemplated course of action. The Air Force is preparing this Environmental Impact Statement (EIS) to determine the potential environmental consequences associated with the establishment of the ISR/Strike capability at Andersen AFB (the Base). The EIS entitled *Military Training in the Marianas* (Marianas Training EIS) (USPACOM 1999) is incorporated by reference (consistent with 40 CFR §1502.21) and discussed, as required, in various sections of this EIS. The capability of Farallon de Medinilla (FDM) to support Air Force proposed operations and associated impacts post-ISR/Strike beddown would be ripe for evaluation in the Mariana Islands Range Complex EIS, which is anticipated to be completed in FY09 during operational phase Phase 0 (see Subchapter 2.2). Analysis of the proposed ISR/Strike training operations at FDM is not possible at this time because the training requirements have not been finalized.

The establishment of the operational capability operation of ISR/Strike at Andersen AFB would take place in phases over a period of time spanning as many as 16 years. Because of the time span involved as well as other factors, overall only some aspects of the proposed action are currently ripe for decision because of incomplete information. Thus, the Air Force is preparing this EIS to focus on those issues now ripe for decision, which include all elements of the ISR/Strike capability except for items such as aircrew training (see Subchapter 1.2.2), wastewater treatment, and landfill space. As previously mentioned, analysis for the aircrew training should be completed in FY09 when the Navy completes the Mariana Islands Range Complex EIS. Analysis of wastewater treatment could be finalized after the wastewater treatment plant permitting process is completed by the Government of Guam (GovGuam). Landfill analysis may be completed after the current Andersen AFB landfill study is completed in FY07 and when the GovGuam finalizes its landfill project. Because the ISR/Strike capability is planned for a 16-year implementation period, it is possible that details associated with the proposed action assessed in this EIS could change. Additional details may become available during the implementation period, or plans could change due to factors

Draft EIS Comment: The DEIS does not analyze the "departure of personnel and aircraft from the installations that would be the source for the personnel and aircraft that would be part of the ISR/Strike capability." …the DEIS states merely that analysis of the impacts would be carried out by the "losing organization(s)." This is a classic case of segmentation….

Response: Analysis of the locations from which the ISR/Strike aircraft would be sourced (*e.g.*, where the aircraft originate) is not within the scope of this EIS and has no relationship to the choice of ISR/Strike basing alternatives or the impacts associated with the proposed action and alternatives. The aircraft and personnel required for the proposed ISR/Strike at Andersen AFB would, for the most part, rotate from various bases in the continental U.S. on a temporary basis, and the specific "source" bases may change from time to time. Aircraft that would make up the ISR/Strike capability were individually based at their home stations under separate NEPA analyses and decision-making processes.

unforeseen during preparation of this EIS. The Air Force will prepare later supplements or analyses "tiered" from this document at the appropriate times to address subsequent actions or new information.

This EIS identifies, describes, and evaluates potential environmental impacts that may result from the proposed establishment of an ISR/Strike capability at Andersen AFB, the No Action Alternative, and possible cumulative impacts from other past, present, and reasonably foreseeable future actions planned for the Base and any other agency (federal or non-federal) or person. This EIS also identifies required environmental permits and consultations relevant to establishment of the ISR/Strike capability. As appropriate, the affected environment and environmental consequences of the proposed action and No Action Alternative may be described in site-specific (*e.g*., biological resources) or regional (*e.g*., air quality) terms. Finally, the EIS identifies possible mitigation measures to prevent or minimize environmental impacts.

Draft EIS Comment: Discussion of the "no action" alternative…..fails to assess continued operation of the units at their current installations.

Response: The No Action Alternative does not require the analysis of "continued operations" at the home stations of ISR/Strike aircraft. Should the ISR/Strike proposal not move forward, the aircraft that a part of the ISR/Strike capability would continue to operate under previously completed NEPA analyses and related Air Force decisions.

The following environmental resources are assessed in the EIS: noise; land use; air quality; infrastructure and utilities (to include water, wastewater, storm water, energy, solid waste, and transportation); biological resources; cultural resources; earth resources; groundwater resources; hazardous materials and waste; socioeconomic resources; airfield operations (to include aircraft safety and bird/wildlife-aircraft strike hazard [BASH]); and environmental justice. Coastal zone consistency is addressed under special regulatory guidelines and environmental review procedures. This EIS assesses both the impacts that could occur during establishment of the ISR/Strike capability and from recurring activities after the ISR/Strike capability establishment is complete.

Draft EIS Comment: Though mentioned briefly (**pg 1-3**) the relocation of 8,000 Marines from Japan to Guam emphasizes the need to reevaluate the cumulative effects of all projects in the foreseeable future.

Therefore, we recommend that the Air Force wait to finalize the Draft EIS until this information is available so that the cumulative impacts can be adequately addressed.

The amount of area to be affected by all actions could increase significantly further impeding the recovery of T&E species.

Response: The Air Force has declined to wait two years to modify the analysis in the EIS as suggested by the commenter because Subchapter 1.2.1 already describes the unavailability of the information needed to assess the cumulative impacts of the other action identified in the comment. The Air Force would be required to fully evaluate the cumulative effects (or impacts) of related proposed actions, *e.g*., Marines moving to Guam from Japan, that can be meaningfully evaluated. However, any plans the Marines may have to move from Japan to Guam have not been settled and are still under development. Additional planning and programming is needed regarding the relocation of Marines to Guam, and it will be about two years before the environmental assessment for the relocation of the Marines is complete. Consequently, the Air Force would expect the Marine Corps to capture the cumulative impacts (or effects) of their proposed actions along with this proposed action in their separate environmental assessment when their actions are fully vetted and known. The Air Force recognizes there has been speculation in the press regarding the potential Marine Corps move to Guam. However, Air Force and Marine Corps discussions have indicated that these stories are only speculation and nothing has been finalized.

The ISR/Strike operational capability would be established in four phases and the number of aircraft and people would increase over an approximate 16-year period. The potential for impacts would be less during the early phases of ISR/Strike capability implementation than in the later phases or after full establishment when recurring activities occur. The full ISR/Strike capability recurring condition represents the most environmentally extreme condition that could occur during and after ISR/Strike implementation. Therefore, analysis for environmental resources is based on the level of activities that would occur from the recurring operations beginning after the ISR/Strike capability is fully established.

1.2.1 Past, Present, and Reasonably Foreseeable Future Actions

The Air Force is aware of the potential moves of non-Air Force DoD units to Guam and the 2005 BRAC-directed realignment that affect DoD units on Guam. The proponent(s) for these actions will address them in separate NEPA documents, as appropriate, when sufficient details for an environmental analysis become available. The non-Air Force DoD units will be able to address their projects in NEPA documents that cumulatively look at all DoD projects planned for Guam, to include Air Force projects. At this time, the specific information on the proposed non-Air Force DoD moves such as the number(s) of personnel, the location(s) of the basing actions, the number(s) and type(s) of facilities that would be constructed, the timing and financing of the projects, and the type and location of training activities associated with these proposals has not been detailed. Thus, it is not possible to analyze the cumulative impacts of the ISR/Strike proposal with the aforementioned proposed non-Air Force future actions.

The Air Force contacted the two Navy installations on Guam and Government of Guam (GovGuam) for details concerning their upcoming actions that should be considered for cumulative impact purposes. No actions were identified by the two Navy installations (Cruz 2005b) or GovGuam. However, a Notice of Intent to prepare an EIS was published July 29, 2005 for the Navy's Wharf Expansion project. This project, when added to other past, present, and reasonably foreseeable future actions, has no expected cumulative impact on this proposed action.

The 2005 BRAC-directed joint-basing operation at Andersen AFB determined that the Navy will be the lead DoD Service in command of military operations for all Services stationed on the Island of Guam, including military family housing. As a result, a joint Navy-Air Force Housing Requirements and Market Analysis for almost the entire island is being accomplished and the results are not expected until early 2007. The joint-analysis will determine military family housing requirements for the Air Force, Navy, and Marine Corps, and will take into account any mission change for the Navy, Air Force, and Marine Corps. The military family housing analysis will also consider whether the housing program is better managed by the DoD or under a privatization contractor. NEPA analysis will be accomplished for the military family housing initiative when sufficient information is available after the analysis is complete and the DoD management/privatized housing management decision is made. The Air Force currently estimates approximately 190 additional military family housing units would be necessary to support the ISR/Strike capability. Thus, construction and occupancy of an additional 190 military family housing units are assessed in this EIS.

1.2.2 Aircrew Training

Bomber and fighter aircrews associated with ISR/Strike would have a requirement to accomplish weapons delivery training, and fighter aircrews would have a requirement for training such as air-to-air combat. Tanker and Global Hawk aircrews do not have training events that require ranges or special use airspace. Takeoff and landing training for fighter, bomber, tanker, and Global Hawk aircrews associated with the proposed action in this EIS would be accomplished in the airspace allocated to the Andersen AFB air traffic control tower. Weapons delivery training is accomplished on a range and air-to-air combat training is accomplished in special use airspace (*e.g.*, military operations area [MOA], restricted area, air traffic control assigned airspace [ATCAA], or warning area) established for military training. Thus, the Air Force should have access to a range and special use airspace at which those ISR/Strike fighter and bomber aircrews could accomplish training while deployed.

Farallon de Medinilla Range

The Navy is responsible for and operates the FDM Range and the associated Northern Marianas Range Complex. Farallon de Medinilla, an uninhabited island about 150 miles north of Guam, is owned by the Commonwealth of the Northern Mariana Islands (CNMI) and is leased by the Navy. The advantages of FDM are its ability to support live weapons training, and its remoteness insulates it from sea and air traffic encroachments permitting conduct of high value tactical strike training. The Navy's COMNAVMARIANAS organization, which is located on Guam, is the controlling and scheduling authority for Navy-owned and controlled training areas in the Mariana Islands. COMNAVMARIANAS schedules the training at the bombing range on FDM and within the restricted airspace (R-7201) associated with the range. The Navy maintains the bombing range on FDM in accordance with environmental agreements with the CNMI. This 206-acre range complex is currently used by the Air Force for air-to-ground weapons and air-to-air training.

Draft EIS Comment: The DEIS fails to satisfy NEPA's mandate to take a hard look at the environmental consequences of the Air Force's proposed course of action. Initially, it contains no analysis whatsoever of potential impacts associated with "training range and airspace utilization" by the scores of fighters and bombers the Air Force proposes to deploy to Andersen, despite the Air Force's concession that they "may ultimately be relevant to significant adverse environmental impacts."

Response: The Air Force recognizes its responsibility to analyze the impacts of future impacts associated with its decision making relative to training range utilization. The Air Force is deferring its decisions on potential range utilization issues to a future decision point when those matters will be "ripe" for decision. Those future training decisions will be based on a Navy EIS (of which the Air Force is a cooperating agency) that will fully evaluate military training operations in the Mariana Islands.

The Navy will be revising the Range Complex Master Plan for all ranges within the Marianas Islands under the Tactical Training Theater Assessment and Planning Program Associated with the Master Plan revision. The Navy will prepare a Marianas Islands Range Complex EIS, which is anticipated to be available during approximately Phase 0 of the ISR/Strike operational capability with completion estimated to be in July 2009. That EIS will assist in defining how the Air Force's ISR Strike aircraft will train after rotations from home units begin.

It is worth reiterating that ISR Strike aircraft personnel will receive the majority of their required training before departing their home station. Although there will be some training associated with the ISR Strike aircraft, training is a secondary issue to the operational prerogatives established in various Department of Defense and Air Force strategic plans for ISR Strike basing on Guam

The Air Force has clarified its intent with respect to range utilization in its discussion of Aircrew Training in Section 1.2.2 and other related sections of the FEIS.

Military training activities at the Range Complex were environmentally assessed under NEPA in the Marianas Training EIS (USPACOM 1999). The Biological Opinion (BO) and Conference Report, Military Training in the Marianas on January 4, 1999, defers to the BO issued April 6, 1998. In the BO, the United States Fish and Wildlife Service (USFWS) accepted the Navy's projected incidental take of no more than one nest of green sea turtles per nesting season, one megapode per year, and one Mariana fruit bat per year as a result of the ordnance delivery on FDM. The USFWS concurred with the Navy's determination that the level of anticipated take is not likely to result in jeopardy to the green sea turtle, hawksbill sea turtle, Micronesian megapode, Mariana fruit bat, and Tinian monarch, or destruction or adverse modification of critical habitat.

For mitigation, the Navy agreed to restrict its impact zone to the central interior portion and/or southern tip of the island and western cliff faces to the maximum extent possible. In addition, the Navy agreed to prohibit the use of cluster bombs in training on FDM. The DoD agreed to report the taking within one month if the take of megapodes and Mariana fruit bats occurred as a result of their training activities. Present and proposed use of FDM would continue to follow these mitigation measures.

The Marianas Training EIS assessed Air Force activity that included sorties for rotational bombers at Andersen AFB on which a total of 7,344 live and inert bombs would be delivered annually. Between 5 and 612 live and inert weapons could be dropped each month, with lower numbers being more typical. Air Force bomber aircraft may conduct high-, medium-, and low-altitude bombing runs dropping conventional 500-, 750-, and 2,000-pound bombs; precision-guided munitions, and mines (USPACOM 1999). Approximately 45 percent of the FDM range sorties by bomber aircraft drop inert bombs only. In the 1998 BO, the training tempo and ordnance delivery included Air Force bombers flying up to 160 days per year, with up to two range sorties per day (320 annual sorties). According to the 2003 Target and Range Information Management System (TRIMS) data, the 23 Air Force sorties comprise about 4 percent of the total 516 annual sorties at FDM (TRIMS 2004).

The types of weapons that would be released from the aircraft and the methods of delivery associated with the Andersen AFB rotational ISR/Strike bombers would be identical to that assessed for bomber aircraft in the Marianas Training EIS. The Air Force does not expect ISR/Strike bomber training to exceed the bomber training threshold (*i.e.*, release of 7,344 live and inert bombs) assessed in the Marianas Training EIS.

The Marianas Training EIS also assessed air-to-surface gunnery by Navy and Marine Corps fighter/attack aircraft (*e.g.*, F/A-18) practicing routine interdiction, strike, and close air support missions. These aircraft deliver bombs (mostly 500-pound bombs) from all altitudes and air-to-ground missiles to the southern end of the island. The Marianas Training EIS assessed an annual ordnance delivery of 4,940 weapons from Navy and Marine Corps aircraft to include about 80 missiles, 840 rockets, and 4,020 bombs (1,400 small [250 to 500 pounds], 1,240 large [1,000 to 2,000 pounds], and 1,380 inert bombs) (USPACOM 1999).

The ISR/Strike F-22 and F-15E aircraft would deploy munitions very similar to those delivered by Navy F/A-18s, which are assessed in the Marianas Training EIS. Additionally, the operating characteristics (*i.e.*, airspeed and methods of ordnance delivery) of all three aircraft are very similar. Thus, the F-22s and F-15Es could be interchanged with the F/A-18s when considering the types of activities that were assessed for fighters in the Marianas Training EIS. Navy records for FY03 indicate that about 1,563 weapons were dropped on FDM by Navy, Marine Corps, and Air Force fighter aircraft. When subtracting the 1,563 weapons that were dropped in FY03 from the 4,940 that were assessed in the Marianas Training EIS, 3,337 weapons could be dropped annually by other FDM users such as the ISR/Strike fighters provided the actual FY03 data are representative for a typical year. The combined number of weapons that would be dropped annually on FDM by all users (*i.e.*, Navy, Marine Corps, and Air Force) would not exceed the threshold of 4,940 bombs that was assessed in the Marianas Training EIS. Additionally, operations by ISR/Strike aircraft would comply with the previously mentioned mitigation restrictions associated with operations at FDM.

The Navy will be revising the Range Complex Master Plan for all ranges within the Mariana Islands under the Tactical Training Theater Assessment and Planning Program. The Navy will prepare the Mariana Islands Range Complex EIS in conjunction with the Master Plan process. The EIS is anticipated to be completed in July 2009, which coincides with Phase 0 of the ISR/Strike operational capability (see Subchapter 2.2). The Navy would evaluate training by the Navy, Marine Corps, and Air Force for all the Mariana Islands military training areas to include Air Force bomber and fighter training at the Navy-managed FDM range. The Navy will include ISR/Strike training as part of the proposed action in the Mariana Islands Range Complex EIS. The capability of FDM to support operations post-ISR Strike beddown will be ripe for evaluation in the Mariana Islands Range Complex EIS. Analysis of the proposed ISR/Strike training operations at FDM is not possible at this time because the training requirements have not been finalized. The Air Force sent a letter to the Navy requesting that the Air Force be a cooperating agency for preparation of the Mariana Islands Range Complex EIS (see Appendix A). In this capacity, the Air Force will participate in the scoping process, develop information and prepare analyses for which it has special expertise, and provide staff for interdisciplinary reviews.

1.2.3 Interagency and Intergovernmental Coordination for Environmental Planning and Public Participation

Interagency and Intergovernmental Coordination for Environmental Planning

Air Force Instruction (AFI) 32-7060, *Interagency and Intergovernmental Coordination for Environmental Planning*, provides the procedures to comply with applicable federal, state, and local directives for Interagency and Intergovernmental Coordination for Environmental Planning (IICEP). The Air Force notified federal and GovGuam agencies of the proposed action under IICEP guidance. Appendix A contains the IICEP documentation for the proposed action.

The Air Force distributed the Draft EIS to federal and GovGuam agencies for review. Appendix B contains the transmittal letter and comments from review of the Draft EIS. Seven agencies provided comments on the Draft EIS.

Public Participation

The *Air Force Environmental Impact Analysis Process* (32 CFR 989) sets forth the public involvement process for the EIAP. Public involvement is accomplished to allow citizens and interested parties the opportunity to participate in the EIAP. The Air Force published a notice of intent (NOI) to prepare an EIS for the establishment of the ISR/Strike capability in the *Federal Register* on May 18, 2005. (The NOI reflected preparation of an EIS for the Global Strike Task Force. The scope of the document and title were changed, respectively, to an EIS and ISR/Strike capability after the public scoping meeting to more accurately describe the mission associated with the proposed action.) Newspaper ads announcing the public scoping meeting conducted on June 9, 2005 were published in the *Pacific Daily News* on May 21 and June 5, 6, and 8, 2005. Appendix B contains copies of public participation documentation, including responses from interested organizations and individuals. Table 1.2-1 lists the resource areas identified by agencies and the public as a result of the IICEP and scoping processes.

Table 1.2-1 Summary of Environmental Comments by Resource Area from Scoping

Resource Area
Noise
Concern for disturbance to T&E Species
Land Use
Surrounding Land Use
Military Family Housing
Infrastructure and Utilities
Availability of Infrastructure and Utilities to Surrounding Landowners
Biological Resources
Public Hunting Program
Threatened and Endangered Species Recovery (Flora and Fauna)
Brown Tree Snake Control and Interdiction
Recommendation for Vegetation Survey
Recommendation for Analysis of Cumulative Impacts on Habitat Fragmentation
Concern for Air Force Commitment to Goals of Integrated Natural Resources Management Plan
Cultural Resources
Plan for Handling Cultural Resources found During Construction
Groundwater Resources
Water Supply
Water Quality
Socioeconomic Resources
Economics of Constructing Housing to Accommodate Increase in Military Families

The Air Force published a notice that the Draft EIS was available for review in the *Federal Register* on May 12, 2006. Newspaper ads announcing the availability of the Draft EIS for review and the public hearing that was held on June 1, 2006 were published in the *Pacific Daily News* on May 12, 14, and 30, 2006. Appendix B contains copies of public hearing documentation, including responses from interested organizations and individuals, and the list to which copies of the Draft EISs were mailed. Additionally, the electronic file of the Draft EIS was available on an internet web site that was publicized in the advertisements in the *Pacific Daily News*. Copies of the Draft EIS also were available to the public at the Nieves Flores Memorial Library, Hagatna, Guam. The public also had the opportunity to obtain additional information or to request copies of the Draft EIS by contacting Mr. Jonathan Wald, Chief, Conservation Resources, Unit 14007, APO, AP 96543-4007. Appendix B contains comments from the three organizations and three individuals that provided comments on the Draft EIS.

The ISR/Strike Draft EIS Public Hearing was from 4:00 p.m. to 7:00 p.m. on June 1, 2006 in the Hilton Guam in Hagatna, Guam. A total of 39 persons attended the public hearing: 13 agency representatives, three elected officials from the Guam Legislature, three from organizations, eight community members, and 12 Air Force and associated contractors (see Table 1.2-2).

Table 1.2-2 Summary of Public Hearing Attendance

Type	Description		Number of Attendees	Subtotal
Government Agencies	Federal	Federal Aviation Administration	**1**	**3**
		United States Fish and Wildlife Service	**1**	
		Navy	**1**	
	GovGuam	GDAWR/Agriculture	**6**	**10**
		Guam Environmental Protection Agency	**1**	
		Port Authority	**1**	
		Bureau of Statistics and Planning/Coastal Resources Management Program	**2**	
Guam Legislature			**3**	**3**
Organizations	Chammoro Cultural Development and Research Institute		**1**	**3**
	Intergraph		**2**	
Community Members			**8**	**8**
Air Force and Contractor			**12**	**12**
			Total	**39**

The public hearing presented project information and provided attendees the opportunity to provide both oral and written comments. The following summarizes the comments by the three individuals who chose to provide oral comments.

- Concern for the safety of the people of Guam with regards to military buildup on Guam and that his family was not duly compensated for land condemnation by the U.S. Government in the acquisition of Andersen AFB lands.
- Comments in favor of the project and appreciation for reuse of developed land on Andersen AFB for the project to the maximum extent possible.
- Comments regarding preservation of cultural resources.

Two written comment sheets were received at the public hearing. One commenter indicated support for the project and the other comment suggested that construction projects be monitored for cultural resources.

A total of 18 agencies, organizations, and individuals provided comments at the public hearing and from review of the Draft EIS. Table 1.2-3 summarizes the comments received on the Draft EIS. Each comment was reviewed and considered and the Air Force prepared responses (Appendix B). Text boxes throughout this EIS contain selected comments submitted on the Draft EIS and the response to the respective comment. The comments from agencies, organizations, and individuals also provided input for changes and clarification of this Final EIS.

Table 1.2-3 Summary of Environmental Comments by Resource Area from the Public Hearing and Review of the Draft Environmental Impact Statement

Resource Area
Noise
Noise mitigation for schools
Aircraft noise from Alternative B
Land Use
Changes to the Air Installation Compatible Use Zone program
Infrastructure and Utilities
Ensure that wastewater disposal systems and storm water control comply with Guam Environmental Protection Agency regulations
Landfill issues
Wastewater treatment
Biological Resources
Loss of habitat due to clearing activities and human disturbance
Effect of noise on T&E species
Equipping the Wildlife Management Specialist to implement functions listed in conservation measures
Ungulate eradication and control
Interdiction of BTS on departing aircraft and cargo and BTS control
Commitment to conservation measures
Location at which family housing units would be constructed
Identification of organisms of concern as foreign invaders
Cultural Resources
Archaeological and historic resources
Groundwater Resources
Protection of the aquifer
Hazardous Materials and Wastes
Ensure project does not delay clean up of contaminated sites
Socioeconomic Resources
Socioeconomic resources, to include housing costs
Resource Area
Cumulative Impacts
Cumulative impacts from past, present, and reasonably foreseeable future actions
Regulatory Requirements
Adequacy of environmental impact analysis relative to NEPA, CEQ regulations, and Air Force environmental impact analysis process guidance
Impact analysis for the airspace and range that would be used for aircrew training

1.2.4 Clarifications and Changes in the Final Environmental Impact Statement

The Final EIS is a revision of the Draft EIS. The clarifications and enhancements in this Final EIS are based on changes resulting from comments on the Draft EIS from agencies, organizations, and individuals (see Appendix B). Other changes are based on modifications to the details associated with the proposed action and updates to other information (*e.g.*, a traffic study accomplished in June 2006).

- Subchapter 1.2.2 was revised concerning the fighter aircrew training in the FDM Range Complex.
- Implementation of the ISR/Strike capability as assessed in the Draft EIS would begin in FY07, with full ISR/Strike operations recurring after FY19 instead of FY16. Construction activities would still begin in FY07; however, the construction period would be 16 years instead of 8 years.
- The first phase of the ISR/Strike establishment in the Draft EIS was identified as "Initial Operating Capability" and the first phase in this Final EIS is now referred to as "Phase 0;" however, there are still four implementation phases. Although there is no difference between the year in which the ISR/Strike establishment would begin (*i.e.*, FY07), the years in which the phases would begin and end differ due to the extension of the implementation schedule.
- The selection standards (see Subchapter 2.1.1.1) were revised to better summarize the selection standards for alternatives process.
- The discussion related to the application of selection standards to location alternatives (see Subchapter 2.1.3.1) were expanded to better explain how Andersen AFB is the installation best suited to host the ISR/Strike capability.
- There are no differences between the Draft and Final EISs regarding the numbers of personnel or aircraft associated with each of the four phases. Aircraft and personnel would arrive at Andersen AFB sometime in Phase 0 (*i.e*. FY07-10).
- A figure was added that graphically compares the aircraft noise exposure for Alternatives A and B.
- The location of the combat arms training and management facility location was added to Figure 2.4-2.
- Subchapter 2.4.3 was revised to state that the Transportable Airlift Control Element and Logistics unit training would be accomplished within existing facilities.
- The conservation measure in Subchapter 2.2.1.2 concerning ungulate exclosure fencing was expanded by adding the factors that were considered when developing the fence lines for the exclosure.
- Subchapter 3.2 was revised to better explain how the Air Installation Compatible Use Zone (AICUZ) program works.
- Subchapters 2.2.1.1 and 4.1.1.1 were expanded to state that all new on-Base residential and public use buildings would be designed and constructed to comply with noise level reduction standards.
- The adaptive management conservation measure in Subchapter 2.2.1.2 was expanded to include information on an adaptive management working group.
- Text was added to Subchapter 2.2.1 explaining how flying operations are scheduled.
- The annual air emissions from construction were recalculated based on a 16-year period.

- The mitigation for socioeconomic resources related temporary housing quarters (construction camp) for imported contract laborers was eliminated. However, the concept for housing these individuals was changed from establishing a camp in an area in which there is no infrastructure or utilities to a site that could use existing utility systems that have verifiable existing utility capacities.
- The number of fighter, tanker, and bomber aircraft could be as many as 48, 12, and 6 aircraft, respectively, instead of a definite 48, 12, and 6 aircraft. The number of Global Hawks is the same in the Draft and Final EISs.
- The Section 7 consultation under the Endangered Species Act (ESA) was completed and the Final EIS refers to the USFWS BO resulting from that process.
- Table 4.5-4, which reflected direct habitat loss, was updated to reflect direct and indirect habitat loss as determined by the USFWS in the BO. Analysis in Subchapter 4.5.1.3 was revised to align with the revision of Table 4.5-4.
- Subchapter 4.5.1.2 was expanded to state that Andersen AFB would use Armed Forces Pest Management Board guidance for reducing feral/stray cat populations.
- Subchapter 4.5.1.4, which summarizes the Incidental Take Statement from the BO, was added.
- Text was added to Subchapter 4.5.4, Biological Resources Mitigation, referring to the terms and conditions of the BO which is in Appendix E.
- The Section 106 consultation under the *National Historic Preservation Act* of 1966 was completed and the Final EIS reflects the Guam State Historic Preservation Officer (GSHPO) concurrence with ISR/Strike project.
- GovGuam, Bureau of Statistics and Plans concurred that the ISR/Strike is consistent with the Guam Coastal Management Program (GCMP) and the Final EIS reflects this consultation process.
- The 190 family housing units proposed under the ISR/Strike project would be constructed in a previously disturbed unforested area of the base. Additionally, Subchapters 2.2.1.1 and 4.10.1.2 were expanded to state that the housing units and dormitories would be constructed on a phased schedule that mirrors increases in the number of personnel.
- Information on the distribution of bird/wildlife-aircraft strikes by altitudes at airports was added to Subchapter 3.11.3.
- The traffic analysis for the intersection of Arc Light Boulevard and Highway 1 and Route 9 and the proposed intersection of the new Commercial Gate and Route 9 was revised based on data from a June 2006 traffic study.
- Analysis in Subchapter 4.4.1.1 was expanded to state that facilities that would be constructed would have low-flow water saving devices.
- The landfill analysis was revised to reflect the three options the Air Force could use for the long-term. Additionally, text was added to state that Andersen AFB would submit a permit application and coordinate the landfill project with GovGuam.

- Wastewater analysis was revised concerning pre-treatment prior to entry into the sewer system. Additionally, text was added to Subchapter 3.4.2 summarizing current Base wastewater management practices.
- Text was added to state that the Air Force would meet the goals of the executive order for *Greening the Government through Efficient Energy Management* and the memorandum of understanding concerning *Federal Leadership in High Performance and Sustainable Buildings*.
- The hazardous waste analysis was expanded by quantifying the amount of hazardous waste.
- The analysis for school enrollment was revised.
- The Air Force will be a cooperating agency in the preparation of COMPACFLT's Mariana Islands Range Complex EIS.

1.2.5 Applicable Regulatory and Permit Requirements

To comply with NEPA, the planning and decision-making process for actions proposed by federal agencies involves a study of other relevant environmental statutes and regulations and permit requirements. The NEPA process, however, does not replace procedural or substantive requirements of other environmental statutes and regulations. It addresses them collectively in the form of an environmental assessment or EIS, which enables the decision-maker to have a comprehensive view of major environmental issues and requirements associated with the proposed action. According to CEQ regulations, the requirements of NEPA must be integrated "with other planning and environmental review procedures required by law or by agency so that all such procedures run concurrently rather than consecutively."

Clean Water Act

The *Clean Water Act of 1977* and the *Water Quality Act of 1987* (33 U.S. Code [USC] 1251, *et seq*., as amended) established federal policy to restore and maintain the chemical, physical, and biological integrity of the nation's waters and, where attainable, to achieve a level of water quality that provides for the protection of fish, shellfish, wildlife, and recreation in and on the water.

Numerous construction projects would be accomplished to establish the ISR/Strike capability. Construction contractors would prepare and implement an Environmental Protection Plan (EPP). The contractor would provide the EPP to Andersen AFB for submittal to Guam Environmental Protection Agency (Guam EPA).

New facilities that have washracks would have oil/water separators designed into wastewater disposal systems.

Plan review for expansion of drinking water systems would be required by the Guam EPA. The water distribution systems, including water storage tanks and water line connections must be inspected for compliance to meet Guam and U.S. Safe Drinking Water Standards.

Biological Resources

The Endangered Species Act (16 USC 1531, *et seq*.) requires federal agencies that fund, authorize, or implement actions to avoid jeopardizing the continued existence of federally listed threatened or endangered species, or destroying or adversely affecting their critical habitat. Federal agencies must evaluate the effects of their actions through a set of defined procedures, which can include preparation of a biological assessment and formal consultation with the USFWS.

The Air Force initiated coordination with the USFWS under Section 7 of the ESA on March 22, 2005 by requesting consultation and conference with the USFWS. The USFWS's June 30, 2005 response to the May 18, 2005 notice in the Federal Register identified the endangered plant *Serianthes nelsonii* and endangered Mariana crow and threatened Mariana fruit bat as occurring on Andersen AFB. The response also noted that the Base contains habitat identified as essential to the recovery of the endangered Guam Micronesian kingfisher, endangered Guam rail, Mariana crow, and Mariana fruit bat. The response also noted concern with brown tree snake (BTS) (*Boiga irregularis*) control and interdiction. The USFWS also recommended that the Air Force include a vegetation survey of the areas that may be affected by the proposed action. The Air Force provided results of the vegetation survey to the USFWS on August 25, 2005 as an attachment to a letter that also requested informal consultation. A biological assessment (BA) was prepared and submitted to the USFWS on March 22, 2006 in support of formal consultation under the ESA. (Appendix E contains copies of the correspondence mentioned in this paragraph and the BA, which was supplemented in June 2006 in response to USFWS' request for additional information.) The formal consultation period began May 22, 2006. The Air Force and USFWS met to discuss the project and associated issues on August 1, 2006. The USFWS prepared a BO on October 3, 2006 in response to the BA (USFWS 2006) (see Appendix E).

Each plant species is initially referred to by its full scientific name, and thereafter by its genus name in the text of this EIS. For the few genera with more than one species present, the full scientific name is used throughout. Throughout the text, animal species are referred to by the English common name. Additionally, area and distance for biological resources are presented in the metric system, while area and distance for other resources are presented in the English system.

Cultural Resources

The *National Historic Preservation Act* of 1966, as amended (NHPA) (16 USC 470, *et seq.*) provides the principal authority used to protect historic resources, establishes the National Register of Historic Places (NRHP), and defines in Section 106, the requirements for federal agencies to consider the effects of an action on properties on or eligible for inclusion on the NRHP. *Protection of Historic and Cultural Properties* (36 CFR Part 800 [1986]) provides an explicit set of procedures for federal agencies to meet their obligation under the NHPA, including inventorying of resources and consultation with state historic preservation offices. *The Archaeological Resources Protection Act of 1979* (16 USC 470, *et seq.*) ensures that federal agencies protect and preserve archaeological resources on federal or Native American lands, and establishes a permitting system to allow legitimate scientific study of such resources.

In compliance with Section 106 of the NHPA and Protection of Historic and Cultural Properties, the Air Force initiated coordination with the GSHPO in a letter received by the GSHPO on March 23, 2005. The Air Force sent an additional request for a consultation letter to the GSHPO on July 26, 2005. The letter also stated that the Air Force will conduct an archaeological review for the area of potential effect (APE); a work plan and research design will be submitted if any additional field work is required; and the Air Force will submit a letter of concurrence/non-concurrence based on the finding of the archaeological review. In a September 14, 2005 letter, the GSHPO mentioned that most of Andersen AFB main base has been developed and little archaeological sites are expected. The letter did state there are some buildings/structures that have been evaluated as “significant” under the NRHP criteria and that the Air Force buildings/structures that would be demolished are not historically significant. The GSHPO provided comments to the research design for the cultural resources inventory survey in an April 14, 2006 letter. A May 8, 2006 from the GSHPO to Andersen AFB stated that the final research design sufficiently addressed comments identified in the April 14, 2006 letter. (Appendix D contains copies of the correspondence mentioned in this paragraph.)

Draft EIS Comment: …the document does not show the locations of sites from archaeological surveys conducted on the base over the past years, or discuss possible impacts due to their proximity to the proposed actions.

Response: FEIS was improved and modified by updating Subchapters 1.2.5 and 4.9.1 of the FEIS to reflect the completion of a cultural resources survey and are part of the survey, as well as the concurrence from the GSHPO that no further archaeological work will be necessary.

The Air Force, with the assistance from the GSHPO, accomplished a Section 106 review process that included a survey to identify and record significant historical, architectural and archaeological sites in the ISR/Strike area. An Executive Summary for Cultural Resources Inventory, which contains the findings of the survey and management recommendations, was forwarded to the GSHPO on September 6, 2006. (Appendix D contains the Executive Summary.) Based on review of the Executive Summary, the GSHPO responded in an October 3, 2006 letter (see Appendix D) that “further archaeological investigation on prehistoric sites at ISR/Strike will not provide any new information about the project area, but such an investigation will only be redundant to what we already know about the project.”

Environmental Justice

In Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, the President instructed each federal agency to make “...achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.”

Coastal Zone Management

Federal Activity in or affecting a coastal zone requires preparation of a Coastal Zone Management Consistency Determination in accordance with the federal *Coastal Zone Management Act* (CZMA) of 1972 (Public Law [PL] 92-583, as amended (PL 94-370). The CZMA was passed to preserve, protect, develop and, where possible, restore or enhance the nation’s natural coastal zone resources. Administration of the CZMA for Guam has been delegated to GovGuam, Bureau of Statistics and Plans (BSP).

The GCMP is an expression of Guam policy to guide the use, protection, and development of land and ocean resources within the Guam costal zone. The “coastal zone” of Guam includes all non-federal property on the island, including offshore islands and submerged lands and waters extending seaward to a distance of 3 nautical miles. While federal lands are excluded from the coastal zone, federal agency activities, regardless of location, must be consistent with the GCMP to the maximum extent practicable per Coastal Zone Act Reauthorization Amendments (PL 101-508), 15 CFR Part 930.

Andersen AFB submitted a Coastal Zone Management Assessment form to the BSP, the lead agency for the GCMP, for the federal agency consistency review on August 30, 2006. The BSP, in a September 22, 2006 letter, concurred that the ISR/Strike project will be undertaken in a manner consistent with the objectives and enforceable policies of the GCMP to the maximum extent practicable and in accordance with PLs 92-583 and 94-370. Appendix A contains the Coastal Zone Management Assessment form and the BSP response letter.

Air Quality

The *Clean Air Act* (CAA) (42 USC 7401-7671g) establishes federal policy to protect and enhance the quality of the nation's air resources to protect human health and the environment. The CAA requires that adequate steps be implemented to control the release of air pollutants and prevent significant deterioration in air quality. The 1990 amendments to the CAA require federal agencies to determine the proposed actions with respect to state implementation plans for attainment of air quality goals.

Title V of the CAA amendments of 1990 requires most large source emitters and some smaller sources to obtain a permit called a Title V operating permit. An operating permit is a legally enforceable document that permitting authorities issue to air pollution sources after the source has begun to operate. Most Title V permits are issued by state and local permitting authorities. The purpose of Title V permits is to reduce violations of air pollution laws and improve enforcement of those laws.

Under 40 CFR Part 69, Guam has a conditional exemption from implementing the Title V operating permit program and, except for major sources of hazardous air pollutants (HAP), Title V operating permit applications are not required for major sources on Guam. Major sources other than major HAP sources, are subject to Guam's alternate permit regulations. The United States Environmental Protection Agency (USEPA) recently issued a final rule, promulgated at 71 *Federal Register 9716* (February 27, 2006), approving Guam's alternate permitting regulations in lieu of a Title V operating permit program.

Guam EPA encourages all new proposed dwellings, dormitory, classrooms, and offices on Andersen AFB be designed as Radon Resistant New Construction Buildings because these facilities would be constructed over limestone topography known to emit unsafe levels of radon gas.

Noise

Land Use guidelines established by the United States Department of Housing and Urban Development (HUD) and findings of the Federal Interagency Committee on Noise (FICON) recommend acceptable levels of noise exposure for land use.

Land Use

Air Force Instruction 32 7063, *Air Installation Compatible Use Zone (AICUZ) Program*, provides guidance to air bases and local communities in planning land uses compatible with airfield operations. The AICUZ program describes existing aircraft noise and flight safety zones on and near Air Force installations with a flying mission.

Aircraft Safety and Bird/Wildlife Aircraft Strike Hazard

Air Force Instruction 91-202, *The U.S. Air Force Mishap Prevention Program*, establishes mishap prevention program requirements (including the BASH program), assigns responsibilities for program elements, and contains program management information.

Hazardous Materials and Waste

Hazardous materials are those substances defined by the United States Department of Transportation (USDOT) (49 CFR 105.5). The Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (42 USC 6901, *et seq.*), further amended by the Hazardous and Solid Waste Amendments of 1984, defines hazardous waste. In general, both hazardous materials and hazardous waste include substances that, because of their quantity, concentration, physical, chemical, or infectious characteristics, may present substantial danger to public health or welfare or to the environment when released or otherwise improperly managed. The *Resource Conservation and Recovery Act* Subtitle C (40 CFR Parts 260 through 270 and 280) regulations are administered by the USEPA and are applicable to management of hazardous waste. Hazardous waste must be handled, stored, transported, disposed, or recycled in accordance with those regulations.

Clearing and Grading

The proposed activities involving clearing and grading would require Guam EPA permits, including Agency permit fees where applicable. An EPP would be required for clearing and grading activities. Storm water best management practices and erosion control measures would be implemented for construction and post-construction phases. Vegetative waste should be composted, mulched, and diverted from the waste stream going to the landfill. Prior to commencement of earthmoving activities, local government clearances from the Department of Agriculture, Department of Parks and Recreation, and the GSHPO must also be obtained.

Storm Water Management

The Guam EPA requires that all storm water, up to the 20-year, 24-hour storm event, be addressed on site of the proposed facilities. Permits for and upgrades to storm water management systems would be required to accommodate the large expected increases to the flows and decreases to quality of storm water. New expansion construction and upgrades to air strips, parking areas, or other impervious surfaces should have management controls consistent with GovGuam's legally applied Stormwater Management practices.

Wetlands

Executive Order 11990, *Protection of Wetlands*, directs Federal agencies to avoid adverse impacts associated with the destruction or modification of wetlands and avoid direct or indirect support of development in wetlands when practicable alternative exists. Agencies are to minimize wetland loss/degradation and preserve/enhance beneficial values of wetlands. No wetlands areas were identified in a non-jurisdictional wetlands survey of Andersen AFB that was conducted in August 1995 (Andersen AFB 2003c). Therefore, wetlands are not assessed in this EIS.

Floodplains

Executive Order 11988, *Floodplain Management*, directs Federal agencies to prevent adverse impacts associated with the occupancy and modification of floodplains and with the direct or indirect support of floodplain development. Agencies are to reduce risk of flood loss, minimize impact of floods on human safety, health and welfare, and restore and preserve the natural beneficial values of floodplains. No floodplains have been identified on Andersen AFB (Andersen AFB 2005c); therefore, floodplains are not assessed in this EIS.

Farmland Protection

The Farmland Protection Policy Act (7 USC Section 4201) is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. It assures that—to the extent possible—federal programs are administered to be compatible with state, local units of government, and private programs and policies to protect farmland. Because all Andersen AFB land is held for national defense purposes under 7 USC Section 4208(b) and 7 CFR Part 658.3(b), the Base is exempt from the requirement to consider the adverse effect of federal programs on the protection of farmland and other requirements found in the Act. Therefore, farmland is not assessed in this EIS.

CHAPTER 2
ALTERNATIVES INCLUDING PROPOSED ACTION

The proposed action would establish an ISR/Strike operational capability in four phases over an approximate 16-year period at Andersen AFB, beginning in FY07. Construction would begin in FY07 and occur over an approximate 16-year period. The ISR/Strike capability would consist of fighter, aerial refueling, bomber, unmanned aerial vehicle aircraft, and support personnel. Numerous facilities would be constructed as part of the proposed action. Establishment of the ISR/Strike operational capability could be accomplished through one of the two action alternatives (Alternative A and Alternative B).

This chapter discusses the following: alternatives formulation and consideration; a description of the action alternatives analyzed in detail; a description of the No Action Alternative; past, present, and reasonably foreseeable future actions for Andersen AFB during the time period associated with establishment of the ISR/Strike capability; and identification of the preferred alternative.

2.1 ALTERNATIVES FORMULATION AND CONSIDERATION

The NEPA and its implementing regulations (CEQ regulations) require not only an analysis of the proposed action, but also of "all reasonable alternatives" to the proposed action, including a No Action Alternative. CEQ regulations allow for eliminating alternatives from detailed study and require an EIS to discuss the reasons that an alternative was eliminated. The Air Force EIAP (32 CFR Part 989) provides a process for determining "reasonable" alternatives (thus requiring analysis) and a process based on reasonable selection standards for eliminating from detailed analysis alternatives determined not to be "reasonable."

"Reasonable" alternatives are those that meet the underlying purpose and need for the proposed action (see Subchapter 1.1) that would cause a reasonable person to inquire further before choosing a particular course of action. The Air Force also must consider reasonable alternatives raised during the scoping process or suggested by others, as well as combinations of alternatives. The Air Force need not analyze highly speculative alternatives, such as those requiring a major, unlikely change in law or governmental policy. If the Air Force identifies a large number of reasonable alternatives, it may limit alternatives selected for detailed environmental analysis to a reasonable number of examples covering the full spectrum of alternatives (32 CFR Part 989.8(b)).

The Air Force may expressly eliminate alternatives from detailed analysis based on reasonable selection standards (*e.g.*, operational, technical, or environmental standards suitable to a particular project). The Air Force may develop written selection standards to firmly establish what is a "reasonable" alternative for a particular project, but it must not so narrowly define these standards that it unnecessarily limits considerations to the proposal initially favored by proponents (32 CFR Part 989.8(c)).

2.1.1 Selection Standards for Alternatives

Two separate processes were accomplished as part of the action to establish an ISR/Strike capability in the Pacific area. The first process considered location, and the second process considered whether or not the aircraft and personnel associated with the ISR/Strike capability should be permanently based or in a rotational status.

2.1.1.1 Selection Standards for Location Alternatives

A viable location for the ISR/Strike capability for the Pacific region, must:

A. Be on U.S. territory to allow implementation of procedures for security protection of forces;

B. Allow all elements of the ISR/Strike capability to be on one installation;

C. Allow deployed aircraft to reach areas of conflict in East Asia and return to the same base in the required response time;

D. Allow bomber aircraft to reach areas of conflict without additional airlift assets;

E. Allow Global Hawk aircraft, which are not capable of being refueled in flight, to return to the installation at which they are based;

F. Have adequate existing airfield infrastructure (*e.g.*, runways, aircraft parking, and associated airfield support systems) that would allow for additional aircraft operations without interfering with existing operations; and

G. Have adequate base operating support or weapon storage areas that would allow for 30-day continuous airfield operations without constant logistical re-supply from air or sea.

2.1.1.2 Selection Standards for Aircraft and Personnel Status Alternatives

The two aircraft and personnel status alternatives, based or rotational, are described below.

Basing includes permanently placing aircraft and personnel at a location. Personnel authorizations are established at the location and facilities are provided to support the personnel and aircraft. Dependents may be authorized to accompany based personnel.

Under the rotational concept, aircraft and personnel temporarily relocate from the installation at which they are permanently based to the rotational location. The aircraft and personnel are at the rotational location on a temporary basis until they are replaced by the next group of rotational aircraft and personnel. The rotational location is not authorized support facilities at the same level as those for permanently based aircraft, nor does it receive an increase in personnel authorizations. Dependents are not authorized to accompany rotational personnel. These basing and rotational concepts apply throughout this EIS.

The decision concerning the status for aircraft and personnel at the ISR/Strike location should consider the degree to which the selected alternative:

- Meets the operational objective of the ISR/Strike capability (see Subchapter 1.1);
- Impacts the overall Air Force structure for fighter, tanker, bomber, and Global Hawk aircraft and personnel; and
- Impacts the Air Force's overall ability to support worldwide DoD operational requirements.

The objective of the ISR/Strike capability is to achieve pre-engagement battle space awareness, locate and identify critical adversary moves, achieve assured success through air dominance, and deliver decisive effects via persistent and precise application of air and space power. The Air Force determined that the following four aircraft types and the numbers of each aircraft type are needed to meet the objective for the ISR/Strike capability: 48 fighter (F-22s and F-15Es); 12 tanker (KC-135s); six bomber (B-1s, B-2s, and B-52s); and four Global Hawk RQ-4 aircraft. Thus, the Air Force did not consider alternatives with varying numbers of each of the four aircraft types.

The 48 fighters, 12 tankers, six bombers, and four Global Hawks would be necessary to meet the objective for the action. These numbers of aircraft represent the capability needed to meet the extreme condition to which the Air Force might be required to respond. There could be times when the numbers of fighters, tankers, and bombers could be less than 48, 12, and 6 aircraft, respectively. However, the greatest potential for impact to the environmental resources evaluated in this EIS would occur from the operation of 48 fighter, 12 tanker, six bomber, and four Global Hawk aircraft. The potential impacts associated with operation of reduced numbers of aircraft would be less than that from operation of the number of aircraft needed to meet the objective. Therefore, this EIS assesses the potential impacts from the operation of as many as 48 fighters, 12 tankers, six bombers, and four Global Hawks, and the personnel associated with these numbers of aircraft, after full ISR/Strike operational capability is established at Andersen AFB.

Three Global Hawks would be Primary Assigned Aircraft (PAA), and one would be Backup Aircraft Inventory (BAI). PAAs are needed to accomplish the unit's assigned mission; BAIs allow the organization to maintain its required number of aircraft and operational capability when an aircraft is not available.

2.1.2 Identification of Location and Aircraft and Personnel Status Alternatives

2.1.2.1 Location Alternatives

In addition to the No Action Alternative, the Air Force identified installations with airfields on the following islands in the Pacific Air Forces (PACAF) Area of Responsibility as potential locations for the ISR/Strike capability:

Iwo Jima;
Saipan;
Diego Garcia;
Wake Island;
Hawaii; and
Guam.

2.1.2.2 Aircraft and Personnel Status Alternatives

The combinations of aircraft types and status options combine to total 48 different alternatives. Alternatives include, but are not limited to the following combinations:

- Base all four aircraft types and personnel;
- Base fighter, tanker, and bomber aircraft and personnel; rotate Global Hawks and personnel;

- Base fighter and tanker aircraft and personnel; rotate bomber and Global Hawks and personnel;
- Base fighter aircraft and personnel; rotate tanker, bomber, and Global Hawks and personnel;
- Base tanker and bomber aircraft; rotate fighter and Global Hawks and personnel;
- Base tanker and Global Hawk aircraft and personnel; rotate fighter and bomber aircraft and personnel;
- Base bomber and Global Hawk aircraft and personnel; rotate fighter and tanker aircraft and personnel;
- Rotate all four aircraft types and personnel;
- Rotate fighter, tanker, and bomber aircraft and personnel; base Global Hawks and personnel;
- Rotate fighter and tanker aircraft and personnel; base bomber and Global Hawk aircraft and personnel;
- Rotate fighter aircraft and personnel; base tanker, bomber, and Global Hawk aircraft and personnel.

2.1.3 Application of Selection Standards to the Location and Aircraft and Personnel Status Alternatives Considered

2.1.3.1 Application of Selection Standards to Location Alternatives Considered

The Air Force compared each possible location for the ISR/Strike capability in Subchapter 2.1.2.1 with the selection standards in Subchapter 2.1.1.1. Table 2.1-1 summarizes the selection process and the following discussion explains how the selection standards were applied to eliminate locations not considered “reasonable” from detailed analysis.

The use of wartime strike aircraft (long range fighters and/or bombers) operating from foreign lands is constrained by American senior military leaders from supporting and achieving national military objectives. Iwo Jima and Diego Garcia are located on foreign soil and would require a negotiated use by wartime commanders and, therefore, do not make sense for basing purposes. Japan’s national policy is to have a military capability to defend its borders and not have any offensive capability. Therefore, Iwo Jima and Diego Garcia were eliminated from further consideration.

Guam, Hawaii, and Wake Island do not have the political restrictions, such as those in Iwo Jima or Diego Garcia, that could impede U.S. military moves. Japan is defensive operations only versus a “strike” force that would be considered offensive operations. “Permission” to launch from a foreign country versus U.S. territory could have significant impacts to our national security. If on foreign territory, our host nation may not agree with U.S. on the crisis response. Even worse, our host country may side with those threatening our national security. Since Guam is a U.S. territory, third nation consultation for ISR/Strike establishment and operation would not be required.

Table 2.1-1 Application of Selection Standards to Location Alternatives

Selection Criteria	Iwo Jima	Saipan	Diego Garcia	Wake Island	Hawaii	Guam
A. Be on U.S. territory		✓		✓	✓	✓
B. Allow all elements of ISR/Strike to be on one installation					✓	✓
C. Allow deployed aircraft to reach areas of conflict and return to the same base		✓		✓		✓
D. Allow bomber aircraft to reach areas of conflict without additional airlift assets			✓		✓	✓
E. Allow Global Hawk aircraft to return to the installation at which they are based	✓ [1]	✓				✓
F. Have adequate existing airfield infrastructure			✓		✓[2]	✓
G. Have adequate base operating support or weapon storage areas			✓		✓ [3]	✓

1. *Japan's national policy is to have military capability to defend its borders and not have any offensive capability; therefore, Iwo Jima was eliminated from further consideration for strike capabilities.*
2. *Hawaii has adequate airfield infrastructure; however commercial operations would interfere with the military operations of ISR/Strike.*
3. *Hawaii has weapons storage areas; however any additional buildup is limited due to proximity distance required for weapon storage loading and unloading.*

Intelligence, Surveillance, and Reconnaissance aircraft and support equipment such as the Global Hawk are national assets that are high demand/low density (for support) for supporting worldwide military requirements. Rarely do these national assets operate apart from other military support infrastructures. An exception is at austere forward operating locations with a very high level of security and support. As a matter of security, support infrastructure, the military principle of economy of force, and operating cost, national ISR assets are usually located at main operating bases throughout the world.

Neither Hawaii nor Wake Island can provide the military principle of economy of force, a reasonable operating cost, or the necessary unrestricted use of either national ISR assets or strike aircraft within a reasonable distance from their intended wartime operating locations.

Although bases on Hawaii have weapons storage areas, the ability to support increased capability such as that associated with ISR/Strike is limited due to the distance between weapon storage loading and unloading. Although Hawaii has adequate airfield infrastructure, the commercial aircraft operations would interfere with the ISR/Strike operations.

Splitting the ISR/Strike assets (*i.e.*, the tankers, fighters, bombers, Global Hawks) across two or more beddown locations would increase the footprint of the support facilities. Andersen

AFB has pre-positioned support facilities prepared to service rotational bombers, fighters, and tankers. By placing some assets on Andersen AFB and other assets at another location, the combined footprint of areas required to support the ISR/Strike mission would be exponentially increased. Increasing the footprint, in turn, increases the summed environmental impacts across all locations utilized. For example, construction of duplicate facilities (*e.g.*, security protection, aircraft maintenance, *etc*.) would be required because facilities at a single location are shared by more than one element of the ISR/Strike capability, thereby increasing the overall cost. Also, the element of surprise would be reduced if ISR/Strike aircraft are launched from two locations.

A new, emerging war on terror paradigm recognizes Guam's geographic importance as the U.S. territory closest to global hotspots of U.S. concern in Asia and the Middle East. Andersen AFB is ideally situated in the Western Pacific to provide easy reach to key regional strategic destinations. From Guam, combat aircraft would be within easy striking range of the region’s likely potential hot spots, yet far enough from adversaries’ missile-launch sites to limit the likely effects of such strikes. Guam is outside the short and medium ballistic missile range of Asian countries.

When discussing U.S. operations in the Pacific region, the concept of "tyranny of distance" is often used to describe the limits of military involvement in the region. "Tyranny of distance" is a military term describing the long distances forces must travel across the Pacific from the U.S. to reach operational targets. Locating the forces nearer to the targets increases the element of surprise and reduces operational constraints (*e.g*., the number of aerial refuelings and length of duty for the aircrew).

Figure 2.1-1 shows the notional effective range for the Global Hawk operating from Andersen AFB. Although it depicts only notional Global Hawk range, the effective range concept for the Global Hawk in the figure applies to the other three aircraft types in the ISR/Strike capability. Locating the ISR/Strike capability further east would reduce the effective range for each of the aircraft types.

For the reasons in the preceding paragraphs, Andersen AFB was identified as the installation best suited to host the ISR/Strike capability in a process driven by the 2001 QDR (see Subchapter 1.1) and a process that considered six potential locations in Pacific Air Forces area of responsibility. By establishing the ISR/Strike capability at Andersen AFB, economy of force is preserved, costs are limited, and use of both the ISR and Strike assets is unrestricted for both peacetime and wartime.

2.1.3.2 Application of Selection Standards to Aircraft and Personnel Status Alternatives Considered

As stated in Subchapter 2.1, 32 CFR Part 989.8(b) states that “Reasonable alternatives are those that meet the underlying purpose and need for the proposed action….” The guidance also states: “If the Air Force identifies a large number of reasonable alternatives, it may limit alternatives selected for detailed environmental analysis to a reasonable number of examples covering the full spectrum of alternatives.”

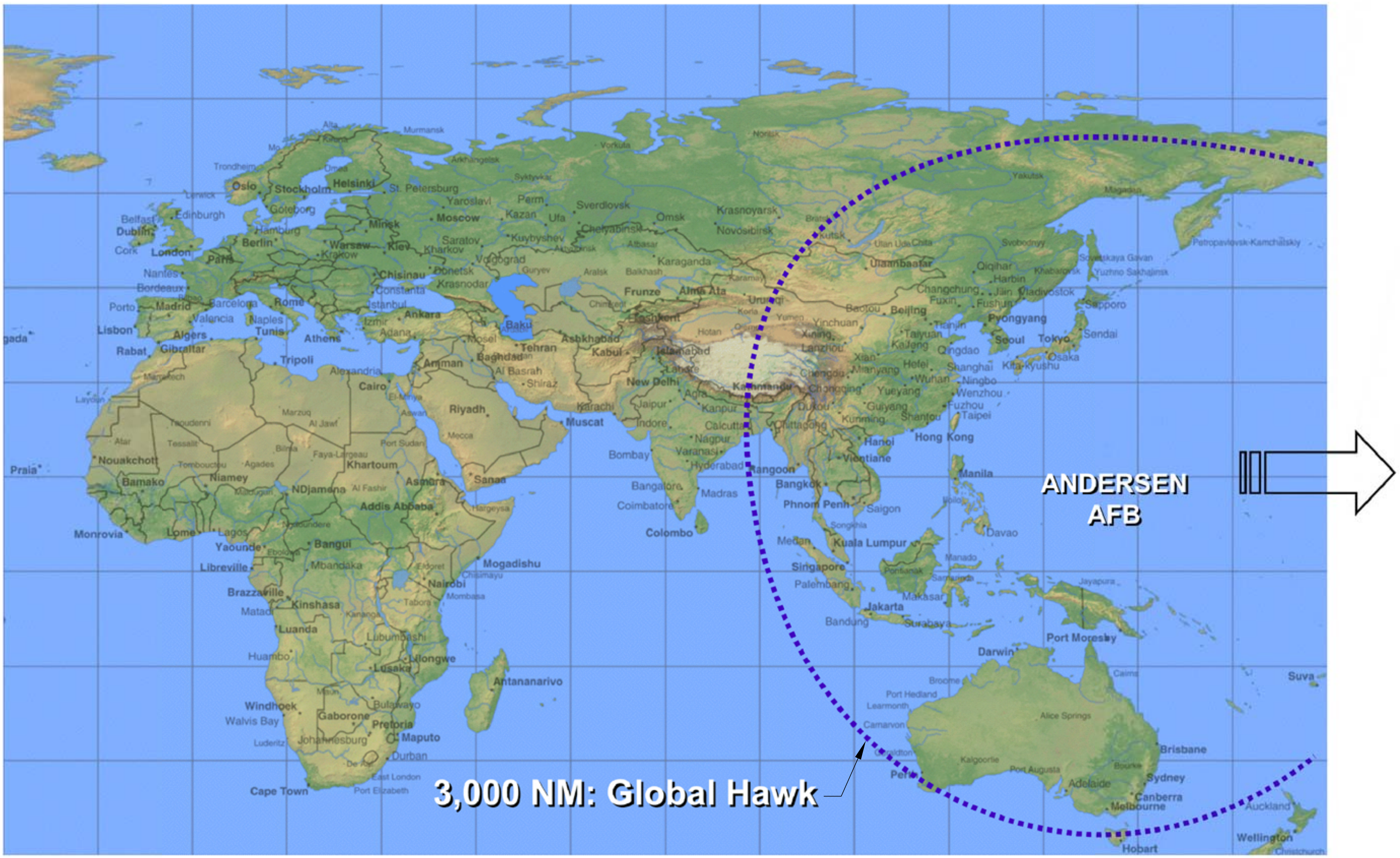

Figure 2.1-1

Area of Global Hawk Coverage Associated with Basing at Andersen AFB

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Based on the guidance in the previous paragraph and the selection standards stated in Subchapter 2.1.1.2, the Air Force decided that aircraft and personnel status could best be accomplished through one of two alternatives that are analyzed in detail in this EIS. Analyzing additional alternatives within the range of the 48 potential alternatives identified in Subchapter 2.1.2.2 would not change the spectrum of analysis because the four specific aircraft types and a set number of each type are needed for the ISR/Strike capability (see Subchapter 2.1.1.2) and are included in each potential alternative. The specific details (*i.e.*, number of aircraft, levels and types of flying training activity, number of personnel, and the types and number of facilities) associated with the two alternatives analyzed in detail differ little from the 46 other possible alternatives because the numbers and types of aircraft needed for the ISR/Strike capability would be very similar for each alternative. Likewise, each of the alternatives is very similar in terms of aircrew training.

2.1.4 No Action Alternative

The Air Force EIAP (32 CFR 989.8(d)) states: “Except in those rare instances where excused by law, the Air Force must always consider and assess the environmental impacts of the ‘no action’ alternative.” Thus, the alternative of not establishing an ISR/Strike capability was also identified (No Action Alternative) and is analyzed in detail in this EIS.

2.2 PROPOSED ACTION

The proposed action would establish an ISR/Strike operational capability in four phases over a 16-year period through one of the two action alternatives (Alternative A and Alternative B). The phases are the same for each alternative. Construction would begin in FY07 and occur over an approximate 16-year period. Initiation of construction activities prior to the initial operational capability established with arrival of the first aircraft in Phase 0 is necessary to ensure the required facilities are in place to support aircraft operations. Construction is subject to Congressional funding. Due to possible funding shifts, construction could be delayed and extended. The operational capability phases and the approximate years associated with the phases are:

- FY07-10, Phase 0;
- FY11-15, Phase 1;
- FY16-18, Phase 2; and
- FY19 and beyond, Phase 3.

The number of fighter (F-22 and F-15E) and tanker (KC-135) aircraft and associated personnel would increase throughout the 16-year period. The number of bomber (B-1, B-2, and B-52) and Global Hawk aircraft and personnel would remain constant throughout the implementation. As many as 70 ISR/Strike aircraft would be at Andersen AFB after full establishment.

All ISR/Strike activities at Andersen AFB would occur on the main base of the installation. Facility construction, addition, and alteration projects would occur to support ISR/Strike operational activities.

Andersen AFB is located at the northern end of the U.S. Territory of Guam, which is the southernmost and largest of the islands within the Mariana Islands archipelago. Guam is approximately 3,600 miles west southwest of Hawaii, and 1,550 miles southeast of Japan. Figure 2.2-1 indicates the location of Guam, and Figure 2.2-2 shows Andersen AFB and the Base's Northwest Field. Part of Andersen AFB is within the Guam National Wildlife Refuge Overlay, most of which is contained in Northwest Field. The Overlay is managed by the Air Force for protection of wildlife in cooperation with the USFWS.

The 36th Wing is the host unit at Andersen AFB. The major tenant units include the 734th Air Mobility Support Squadron, Navy Helicopter Sea Combat Squadron 25 (HSC-25), 750th Space Squadron, and the Guam Air National Guard. The primary mission of Andersen AFB is to maintain the manpower infrastructure to provide support for tactical and strategic peacetime, contingency, and wartime deployment and employment operations, strategic airlifts, transient support, and staging operations.

2.2.1 Description of Alternative A

At full implementation and operation, the ISR/Strike capability under Alternative A would base as many as 12 KC-135s and four Global Hawks and personnel at Andersen AFB and rotate as many as 48 fighters (F-22 and F-15E) and six bombers (B-1, B-2, and B-52) and personnel from bases within the 50 states. The ISR/Strike aircraft, when added to the 14 HSC-25 helicopters currently based at Andersen AFB, would increase the number of based and rotational aircraft to as many as 84. The rotational period for aircraft and personnel would be 120 days.

Table 2.2 -1 summarizes the number of aircraft by aircraft type and the personnel changes for the operational phases. The Base population could increase to as many as 8,900 personnel if as many as 3,000 additional personnel associated with Alternative A would be added to the current population of 5,900 persons (Andersen AFB 2004a). The 3,000 personnel include military, Air Force civilian, contractor, and dependent personnel.

It is expected that as many as 650 permanently assigned personnel would be at Andersen AFB for 2 to 3 years at a time. Based on a 3-year assignment duration, about 220 of the permanently assigned personnel and associated dependents would depart Andersen AFB each year. These individuals would travel to and from Guam and Andersen AFB by commercial air carrier flights that use Guam International Airport. The majority of household goods belonging to the permanently assigned personnel would be shipped as cargo in ships. Thus, there could be an additional approximate 220 household goods shipments each year requiring BTS inspection. Small portions of household goods for each assigned person and dependents would be shipped as air freight on routine cargo movement flights from Andersen AFB.

Based on three rotations per year and 48 fighter aircraft, six bomber aircraft, and 1,250 personnel per rotation, it is estimated that 324 flights and 3,750 personnel would rotate to/from Andersen AFB annually. One hundred sixty-two of the rotational fighter and bomber flights would be departures from Andersen AFB. Rotational personnel would travel to and from Andersen AFB by contract commercial aircraft. Approximately 32 flights would be required to transport these personnel to and from the Base, 16 of which would be departures from Andersen AFB. There would be a combined 194 aircraft departures related to aircraft rotations, or an average of less than one aircraft each day, requiring BTS inspection.

Table 2.2-1 Aircraft and Personnel Associated with Alternative A

	Phase			
	Phase 0	**Phase 1**	**Phase 2**	**Phase 3**
Number of Aircraft				
Based				
Tanker	6	12	12	12
Global Hawk	4	4	4	4
Rotational				
Fighter	12	24	24	48
Bomber	6	6	6	6
Total	**28**	**46**	**46**	**70**
Number of Personnel				
Permanent				
Tanker	300	550	550	550
Global Hawk	50	50	50	50
Support	50	50	50	50
Subtotal	400	650	650	650
Rotational				
Fighter	300	500	500	900
Bomber	350	350	350	350
Subtotal	650	850	850	1,250
Total	**1,050**	**1,500**	**1,500**	**1,900**
Number of Permanent Personnel Accompanied by Dependents, not Accompanied by Dependents, and Dependents				
Unaccompanied	100	200	200	200
Accompanied	300	450	450	450
Dependents	750	1,100	1,100	1,100
Summary of Additional Personnel Resulting from Alternative A				
Permanent	400	650	650	650
Rotational	650	850	850	1,250
Dependents	750	1,100	1,100	1,100
Total	**1,800**	**2,600**	**2,600**	**3,000**
Resulting Base Population by Combining Alternative A Population with Current Base Population				
Alternative A	1,800	2,600	2,600	3,000
Current Population	5,900	5,900	5,900	5,900
Total	**7,700**	**8,500**	**8,500**	**8,900**

Note: The data in the Number of Personnel section of the table reflect military, Air Force civilian, and contractor personnel. Number of dependents is based on an average of 2.5 dependents per accompanied individual and rounded to the nearest 50. The number of fighter, tanker, and bomber aircraft and personnel reflect an "as many as" condition.

Equipment and other items necessary to support rotational aircraft operations would be retained at the Base from rotation to rotation, thereby minimizing the need for flights to move equipment to and from Andersen AFB in conjunction with the rotational aircraft. Rotational personnel would bring only personal effects which could be accommodated as baggage on the aircraft on which the individuals travel.

Aircraft Operations

Table 2.2-2 lists the projected annual and average daily airfield operations for the ISR/Strike aircraft at Andersen AFB under Alternative A and reflects the total recurring airfield operations condition after the ISR/Strike capability is fully established. Operations for the ISR/Strike aircraft include mission arrivals and departures as well as training sortie arrivals and departures, and closed pattern operations. The following paragraphs describe mission and training sorties for each ISR/Strike aircraft type that would be at Andersen AFB under Alternative A. Table 2.2-3 lists the annual number of sorties, average sortie duration, and annual flying hours for ISR/Strike aircraft.

Table 2.2-2 Alternative A Annual and Average Daily Airfield Operations

	Arrival and Departure Operations		Closed Pattern Operations		Total Operations	
Aircraft	**Annual**	**Avg. Daily**	**Annual**	**Avg. Daily**	**Annual**	**Avg. Daily**
ISR/Strike Aircraft						
Fighter						
F-22	5,530	23.04	16,589	69.12	22,119	92.16
F-15E	1,382	5.76	4,147	17.28	5,529	23.04
Fighter Subtotal	6,912	28.80	20,736	86.40	27,648	115.20
KC-135	1,920	8.00	5,760	24.00	7,680	32.00
Global Hawk	440	2.00	220	1.00	660	3.00
Bomber						
B-1	432	1.80	864	3.60	1,296	5.40
B-2	96	0.40	192	0.80	288	1.20
B-52	432	1.80	864	3.60	1,296	5.40
Bomber Subtotal	960	4.00	1,920	8.00	38,868	12.00
Subtotal ISR/Strike Aircraft	10,232	42.80	28,636	119.40	38,868	162.20
Other Military	25,144	68.88	59,648	163.42	84,792	232.30
Transient Civil	942	2.58	0	0.00	942	2.58
Total	**36,318**	**114.26**	**88,284**	**282.82**	**124,602**	**397.08**

Note: See Table 2.3-1 for detailed transient military and civil aircraft for the baseline condition. Fighter, tanker, and bomber operations are based on 240 days per year of operations and the Global Hawk operations are based on 220 days per year. An airfield operation is the single movement or individual portion of a flight in the airfield airspace environment, such as one departure (takeoff), one arrival (landing), or one transit through the airport traffic area. The airfield airspace environment typically is referred to as airspace allocated to the air traffic control tower and includes the airspace within an approximate 5-mile radius of the airfield and up to 2,500 feet above ground level. A low approach or a missed approach consists of two airfield operations, i.e., one arrival and one departure. A closed pattern consists of two airfield operations (i.e., one takeoff and one landing accomplished as a touch and go). The minimum number of airfield operations for one sortie is two operations, one takeoff (departure) and one landing (arrival). The ISR/Strike operations represent the operations associated with as many as 48 fighter, 12 KC-135, and six bomber aircraft.

Table 2.2-3 Annual Sorties, Average Sortie Duration, and Annual Flying Hours for ISR/Strike Aircraft

Aircraft	Annual Sorties	Average Sortie Duration	Annual Flying Hours
F-22	2,765	1.50	4,148
F-15E	691	1.84	1,271
KC-135	960	4.46	4,282
Global Hawk	220	35.00	7,700
B-1	216	5.00	1,080
B-2	48	5.19	249
B-52	216	7.00	1,512

Sources: Parsons 2005; Ostil 2006b.

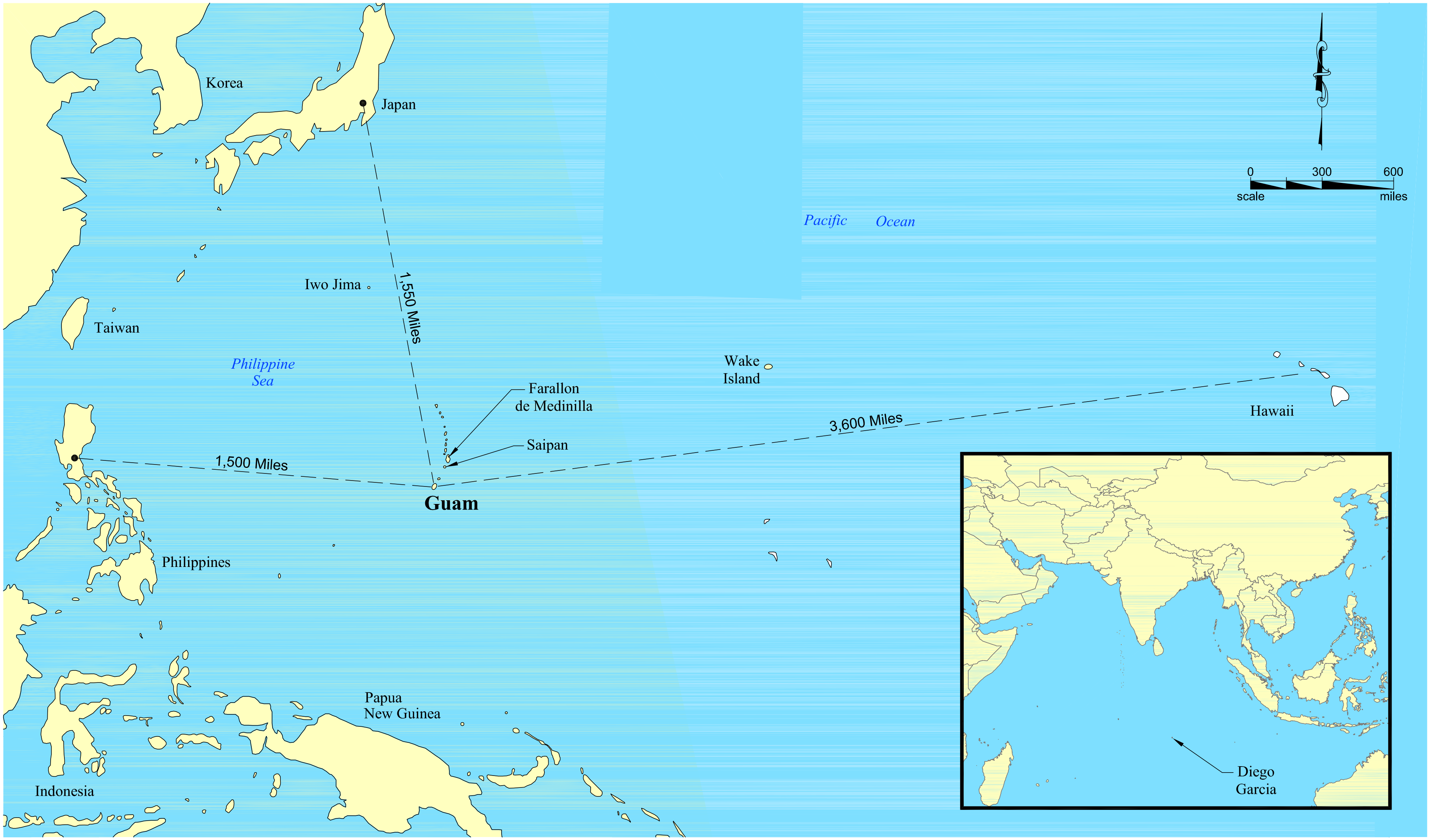

Figure 2.2-1

Location of Guam

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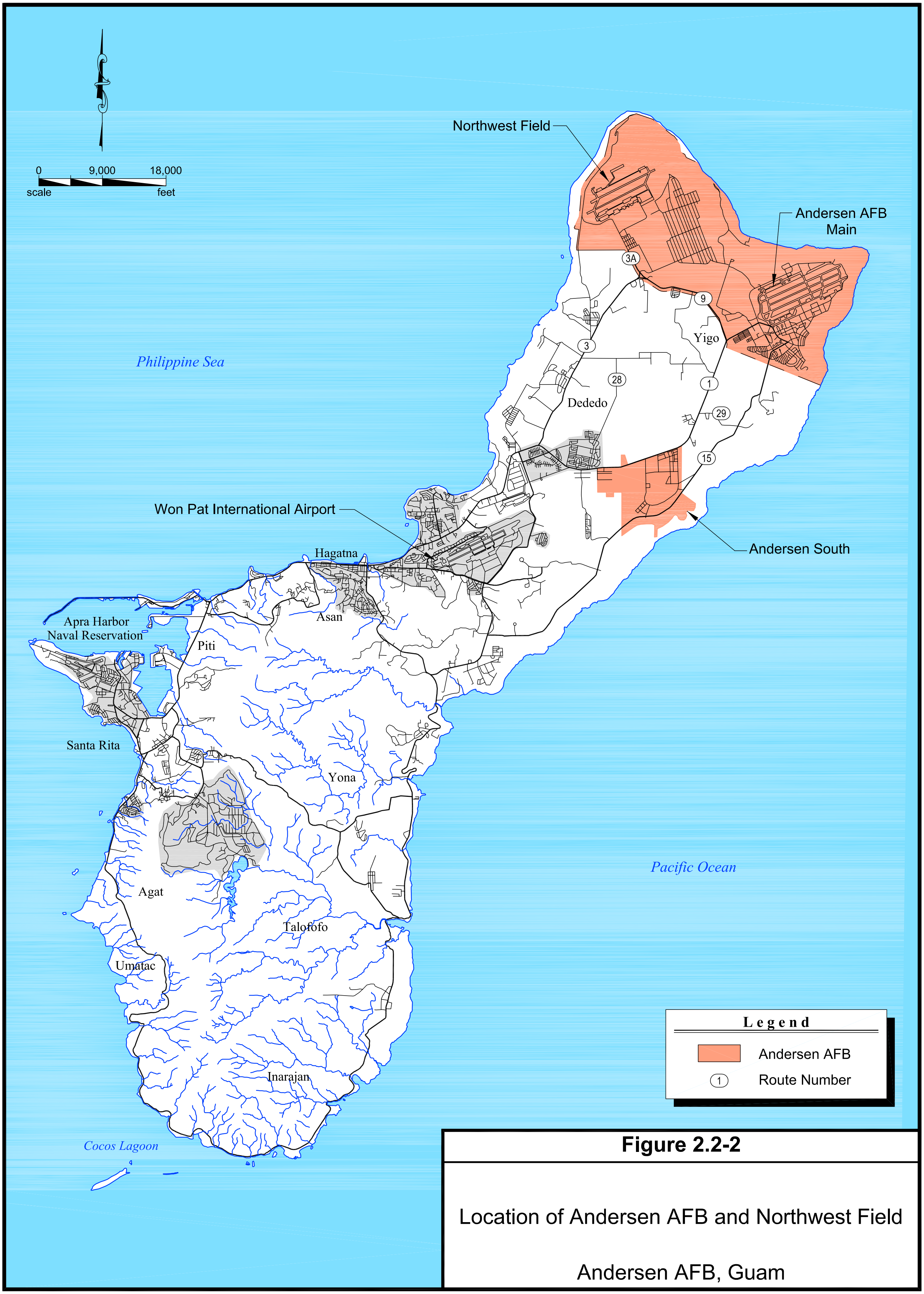

Figure 2.2-2

Location of Andersen AFB and Northwest Field

Andersen AFB, Guam

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The Air Force balances the potential for noise disturbance with the overall training needs when scheduling flight operations. In this respect, if at all possible, the Air Force avoids operations during times when the potential for noise disturbance is greater (*i.e.*, between 10:00 p.m. and 7:00 a.m.). However, there are times when flight operations cannot be avoided when the potential for noise disturbance is greater due to operational necessity and the need to conduct training during that time.

Draft EIS Comment: It would be helpful if the flight increases occur at appropriate times of the day in consideration to the nearby community.

Response: The rationale for not accomplishing operations during the "appropriate" times of the day was added to the Aircraft Operations section of Subchapter 2.2.1.

Fighter. Flights would occur 240 days per year. Each of the 48 rotational fighter aircrews would fly 72 sorties per year, for a total of 3,456 annual sorties, or an average of 14.4 sorties per flying day. Eighty percent of the fighter operations would be accomplished by F-22 aircraft and 20 percent would be accomplished by F-15Es. About 30 percent of the training sorties would be accomplished after dark. For the purpose of meeting this requirement, darkness ranges between 30 minutes after sunset to 30 minutes before sunrise. It is estimated that about 5 percent of the sorties and airfield operations flown during darkness (*i.e.*, 5% of 30%, or 1.5%) would occur between 10:00 p.m. and 7:00 a.m., the period known as "environmental nighttime" (referred to as "nighttime" in this EIS). Environmental nighttime receives special consideration for noise analysis because it represents a period when the effects of aircraft noise on people are accentuated.

The F-22 and F-15E aircraft would conduct numerous training activities to fulfill mission requirements. Table 2.2-4 describes the projected F-22 and F-15E training events, airspace type that can be used for training, and the time aircraft would be in the airspace. F-22 training flights would closely match those performed by operational F-15E aircraft in terms of nature and duration. The F-22 would fly 1.5 to 2.0 hour-long missions, including takeoff, transit to and from the range/training airspace (*i.e.*, FDM), training activities, closed pattern events at the airfield, and landing. Depending on the distance and type of training activity, the F-22 and F-15E could spend 20 to 60 minutes in a training airspace. On occasion during an exercise, the F-22 and F-15E may spend up to 90 minutes in one or a set of airspace units. The F-22 and F-15E would conduct a majority of training in the ATCAAs and Warning Area 517 around Guam and FDM. A Warning Area is military training airspace off the coast of the United States or its territories. Warning Areas serve to alert non-participating pilots of potential hazards associated with the airspace. Warning Areas provide airspace for supersonic maneuvers, which are practiced by both the F-22 and F-15E. Figure 2.2-3 depicts the ATCAAs around Guam and FDM. Guam is at the approximate center of the figure and FDM is in R7201.

The F-22 could use the full, authorized capabilities of the airspace units from 500 feet above ground level (AGL) to above 60,000 feet above mean sea level (MSL). The F-22 and F-15E would rarely (5% or less) fly below 5,000 feet AGL and consistently fly from 10,000 feet AGL to above 30,000 feet MSL. Actual flight altitudes would depend on the lower and upper limits of specific airspace units.

The F-22 has an air-to-ground mission. F-22 pilots are projected to spend 80 percent of their training in air-to-air missions and 20 percent of their training in air-to-ground training. Most air-to-ground training would be simulated, where no munitions would be released from the aircraft.

The F-22 uses avionics to simulate ordnance delivery on a target. This type of training could be conducted in any of the airspace units and would not require an air-to-ground range.

Table 2.2-4 Projected F-22 and F-15E Training Activities

Training Activity	Description	Airspace Type	Altitude (feet)	Time in Airspace
Aircraft Handling Characteristics	Training for proficiency in use and exploitation of the aircraft's flight capabilities (consistent with operational and safety constraints) including, but not limited to high/maximum angle of attack maneuvering, energy management, minimum time turns, maximum/optimum acceleration and deceleration techniques, and confidence maneuvers.	MOA and ATCAA	5,000 AGL to 60,000 MSL	0.5 to 1.0 hour
Basic Fighter Maneuvers	Training designed to apply aircraft (1 versus 1) handling skills to gain proficiency in recognizing and solving range, closure, aspect, angle, and turning room problems in relation to another aircraft to either attain a position from which weapons may be launched, or defeat weapons employed by an adversary.	MOA and ATCAA	5,000 AGL to 30,000 MSL	0.5 to 1.0 hour
Air Combat Maneuvers	Training designed to achieve proficiency in formation (2 versus 1 or 2 versus 1+1) maneuvering and the coordinated application of Basic Fighter Maneuvers to achieve a simulated kill or effectively defend against one or more aircraft from a pre-planned starting position. Use of defensive countermeasures (chaff, flares). Air Combat Maneuvers may be accomplished from a visual formation or short-range to beyond visual range.	MOA and ATCAA	5,000 AGL to 60,000 MSL	0.5 to 1.0 hour
Low-Altitude Training	Aircraft offensive and defensive operations at low altitude, G-force awareness at low altitude, aircraft handling, turns, tactical formations, navigation, threat awareness, defensive response, defensive countermeasures (chaff/flares) use, low-to-high and high-to-low altitude intercepts, missile defense, combat air patrol against low/medium altitude adversaries.	MOA	500 AGL to 5,000 AGL	0.5 to 1.0 hour
Tactical Intercepts	Training (1 versus 1 up to 4 versus multiple adversaries) designed to achieve proficiency in formation tactics, radar employment, identification, weapons employment, defensive response, electronic countermeasures, and electronic counter countermeasures.	MOA and ATCAA	500 AGL to 60,000 MSL	0.5 to 1.0 hour
Night Operations	Aircraft intercepts (1 versus 1 up to 4 versus multiple adversaries) flown between the hours of sunset and sunrise, including tactical intercepts, weapons employment, offensive and defensive maneuvering, chaff/flare, and electronic countermeasures.	Warning Area, MOA and ATCAA	2,000 AGL to 60,000 MSL	0.75 to 1.5 hour
(Dissimilar) Air Combat Tactics	Multi-aircraft and multi-adversary (2 versus multiple to larger force exercises) conducting offensive and defensive operations, combat air patrol, defense of airspace sector from composite force attack, intercept and simulate and destroy bomber aircraft, destroy/avoid adversary ground and air threats with simulated munitions and defensive countermeasures, strike-force rendezvous and protection.	MOA and ATCAA	500 AGL to 60,000 MSL	0.5 to 1.0 hour

Table 2.2-4 Projected F-22 and F-15E Training Activities (*continued*)

Training Activity	Description	Airspace Type	Altitude (feet)	Time in Airspace
Navigation and Basic Surface Attack	Navigation on MTRs and air-to-ground simulated delivery of ordnance on a range.	MOA, Range	Surface to 18,000 MSL	0.5 to 1.0 hour
Tactical Weapons Delivery	More challenging multiple attack headings and profiles; pilot is exposed to varying visual cues, shadow patterns, and the overall configuration and appearance of the target. Supersonic speeds that can include target acquisition are added to the challenge.	ATCAA, MOA, Range	Surface to 60,000 MSL	0.5 to 1.0 hour
Surface Attack Tactics	Practiced in a block of airspace such as a MOA or Restricted Area that provides room to maneuver up to supersonic speeds. Defensive countermeasures may be deployed. Precise timing during the ingress to the target is practices, as is target acquisition. Training includes egress from the target area and reforming into a tactical formation.	ATCAA, MOA, Range	Surface to 60,000 MSL	0.5 to 1.0 hour
LRSOW Delivery	Practiced in an MOA or ATCAA that provides for maneuvering room and supersonic speeds. Precise timing for speed, altitude, and launch parameters is practiced at high altitudes without release. Use of inert munitions in low altitude drops to evaluate timing and aircraft performance. Remote training using LRSOW at authorized ranges outside Alaska.	ATCAA, MOA Range	Surface to 60,000 MSL	0.5 to 1.0 hour
Suppression of Enemy Air Defenses	Highly specialized mission requiring specific ordnance and avionics and can include supersonic speeds and defensive countermeasures. The objective of this mission is to simulate neutralizing or destroying ground-based anti-aircraft systems	ATCAA, MOA, Range	Surface to 60,000 MSL	0.5 to 1.0 hour
Large Force Exercises/Mission Employment	Multi-aircraft and multi-adversary composite strike force exercise (day or night), air refueling, strike- force rendezvous, conducting air-to-ground strikes, strike force defense and escort, air intercepts, electronic countermeasures, electronic counter- counter measures, combat air patrol, defense against composite force, bomber intercepts, destroy/disrupt/avoid adversary fighters, defensive countermeasure (chaff/flare) use.	MOA, MTR, ATCAA, and Range	Surface to 60,000 MSL	0.5 to 1.0 hour

Note: WA = warning area, MTR = Military Training Range; MSL = mean sea level; LRSOW = Long Range Standoff Weapon; AGL = above ground level.

Air-to-ground training also includes ordnance delivery training. Ranges currently used for F-15E training offer limited target capabilities. All ordnance delivery training would adhere to the requirements and restrictions of the ranges. Table 2.2-5 presents the current F-15E air-to-ground munitions used in training and the projected F-22 training munitions. Although several different types of smaller munitions are being studied for the F-22, the primary air-to-ground ordnance carried by the F-22 is the Guided Bomb Unit (GBU)-32 and a Small Diameter Bomb (SDB) (GBU-39/B). The GBU-32 is a 1,000-pound equivalent variant of the Joint Direct Attack Munition (JDAM). JDAMs are guided to the target by an attached Global Positioning System (GPS) receiver. SDBs are guided 250-pound equivalent munitions. Training with these weapons in airspace could include accelerating to launch speed, altitude, and delivery profile prior to opening the weapons bay.

Table 2.2-5 Current and Projected Annual Air-to-Ground Munitions

Training Munition Class	F-15E	F-22
25 pound	590	0
250 pound	0	200
500 pound	57	0
1,000 pound	0	50
2,000+ pound	30	0
Total	**677**	**250**

Note: Data in table reflect the number of munitions by munitions type and aircraft type.

In combat, these weapons could be released by an F-22 at supersonic speeds at altitudes up to 50,000 feet MSL. Actual ordnance delivery training at approved delivery profiles would occur during the times when F-22 squadrons would be deployed to other locations during special training cycles. Locations where levels of munition training is authorized could include the Nellis Range Complex in Nevada, the Utah Test and Training Range, and the approved ranges associated with Eglin AFB. The negligible level of use of these remote ranges and the current level of use by others suggest that projected F-22 use does not warrant additional detailed environmental analysis for these ranges. F-22 flight profiles, altitudes, and speed would be restricted to ensure that such munitions meet approved range weapon safety footprints.

Tanker. Based KC-135 aircrews would fly four sorties per day, 240 days per year from Andersen AFB. A typical sortie would include a departure from the Base, aerial refueling of receiver aircraft, and an arrival at Andersen AFB followed by an average of 60 to 90 minutes of instrument approach and closed pattern training at the Base before termination. It is estimated that about 13 percent of airfield operations for the tankers would occur during nighttime.

Unmanned Aerial Vehicle. The based Global Hawks would fly one sortie per day, 220 days per year from Andersen AFB. A typical sortie would include departing from the Base, conducting its mission or training, and then return to Andersen AFB. A closed pattern would be flown on approximately half of the sorties. It is estimated that about 15 percent of airfield operations for the Global Hawks would occur during nighttime.

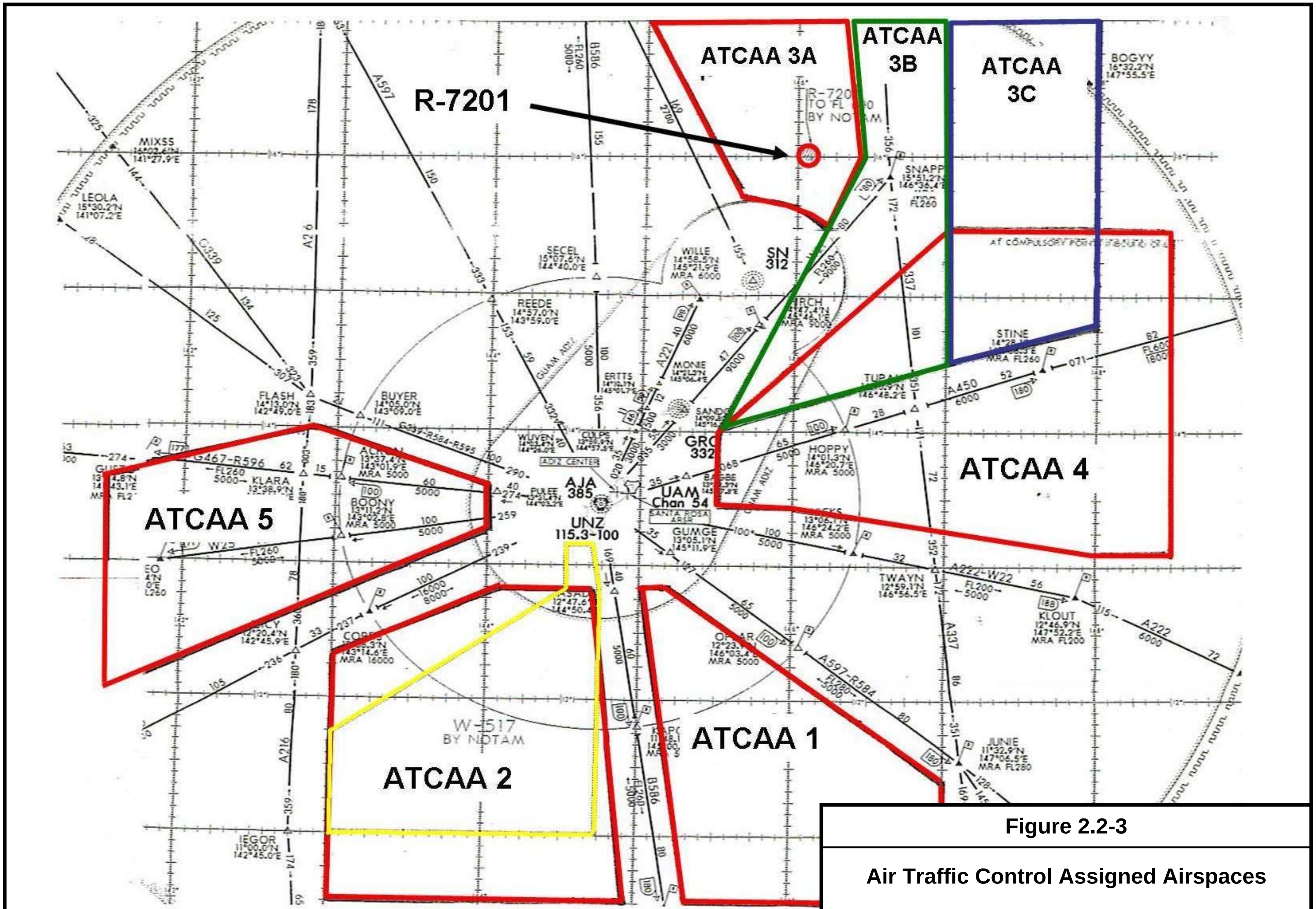

Figure 2.2-3

Air Traffic Control Assigned Airspaces

Andersen AFB, Guam

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Bomber. Rotational bomber aircrews would fly two sorties per day, 240 days per year from Andersen AFB. The percents of bomber operations would be: 10 percent B-2; 45 percent B-1; and 45 percent B-52. A typical sortie would include a departure from the Base, weapons training at a range/training airspace (*i.e.*, FDM) complex, low level terrain avoidance procedures training, anti-ship mining operations, and an arrival at Andersen AFB followed by two closed patterns before termination. It is estimated that about 13 percent of airfield operations for the bombers would occur during nighttime. Since 1990, there has a been a persistent rotational presence of bombers at Andersen AFB. The average annual ordnance from rotational bombers are included in Table 2.2-6:

Table 2.2-6 Annual Ordnance Release from Rotational Bombers

Munition	Training Munitions Class	Released
BDU 50	500 lb practice bomb	50
GBU 31	2000 lb JDAM bomb	23
M117	750 lb bomb	672
Mk 82	500 lb bomb	150
BDU 56	Inert 2000 lb bomb	39
MJU 23	Flare/chaff	519
RR 188	Chaff cartridge	519
Mk 107	Impulse cartridge	8
Total	**--**	**1,980**

The projected ordnance release for ISR/Strike bombers at FDM presented in Table 2.2-6 would not exceed that assessed for bombers at FDM in the Marianas Training EIS (*i.e.*, 7,344 live and inert bombs). Currently, there are no plans to expand the airspace and training ranges for the bombers.

2.2.1.1 Facility Construction and Operation

Numerous construction and building addition/alteration projects would be constructed over an approximate 16-year period to support establishment and operation of the ISR/Strike capability at Andersen AFB. Figure 2.2-4 depicts the locations for the construction projects. Table 2.2-7 lists details for the projects. Table 2.2-8 lists the forest habitat that would be cleared for facility construction associated with Alternative A. New facilities that have washracks would have oil/water separators designed into wastewater disposal systems.

No surface discharge of water from oil/water separators would be allowed. All new wastewater systems are evaluated to determine if necessary, what size and type of treatment is required before wastewater is sent to the sewer system. Vegetative waste from clearing and construction activities would be diverted from the landfill and would be mulched and composted.

Under EO 13123, *Greening the Government through Efficient Energy Management*, the facilities that would be constructed should incorporate pollution prevention, energy, and water conservation and water quality goals into facilities and activities where practicable. In addition to EO 13123, the DoD signed an Memorandum of Understanding (MOU) on January 24, 2006 entitled "*Federal Leadership in High Performance and Sustainable Buildings*" which committed federal agencies to design, construct and operate their facilities in an energy-efficient and sustainable manner. Through the MOU, the DoD agreed to: reduce the energy cost budget by 30 percent for new construction and 20 percent for major renovations; employ strategies to reduce indoor and outdoor water use and reduce stormwater runoff and pollution; use products with recycled content; and use bio-based products made from rapidly renewable resources and certified sustainable wood products.

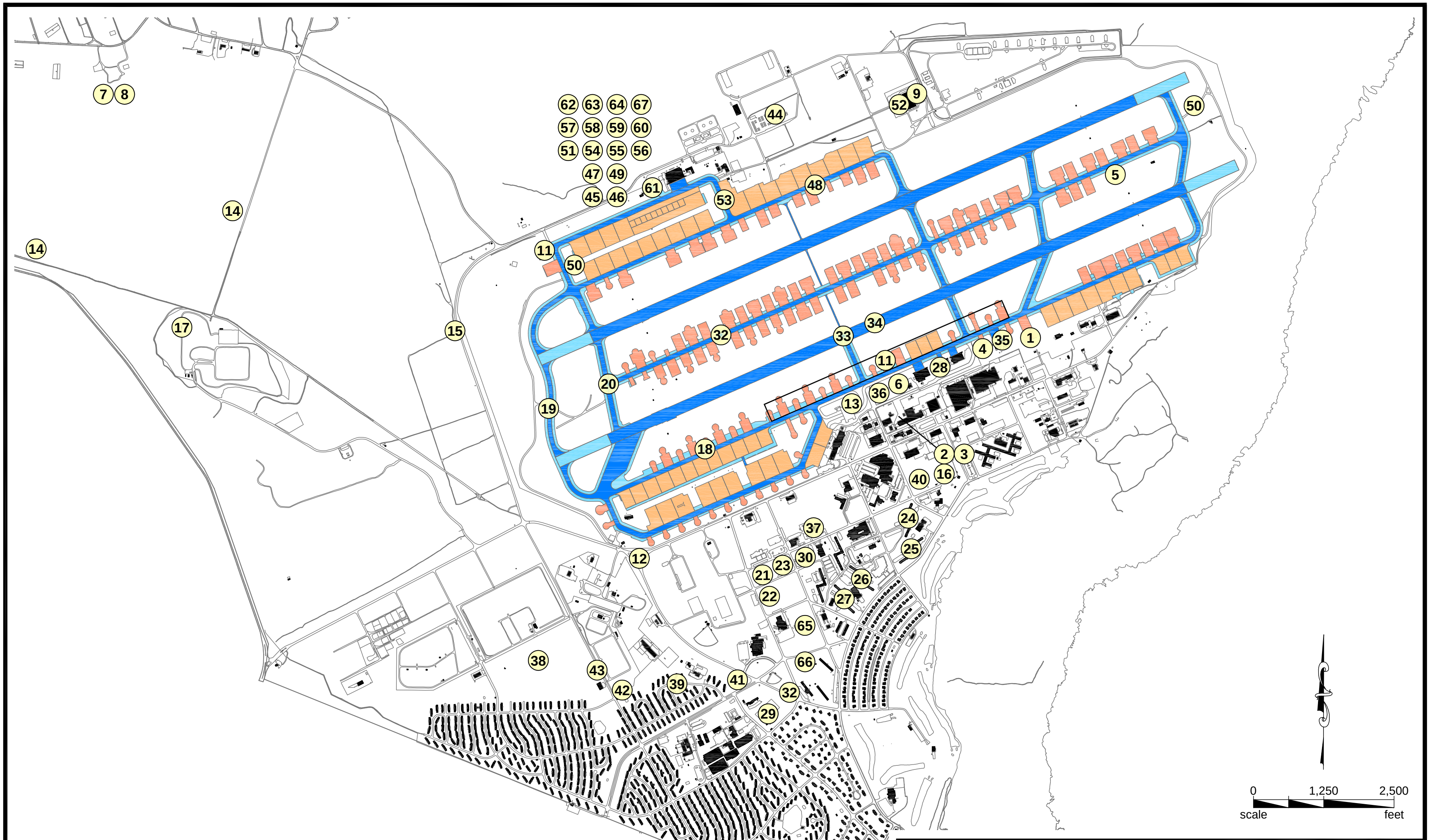
The new facilities and military family housing units would be constructed to meet the Air Force policy to implement, where feasible, noise level reduction (NLR) measures in on-Base residential and public use buildings. Since implementation of NLR standards, all new buildings are designed and constructed to comply with the appropriate NLR standards to achieve an indoor noise level of DNL 45 dBA or less (USAF 1978). In June 2002, the American National Standards Institute, Inc. (ANSI) released a new classroom acoustics standard. Compliance with the standard is voluntary; however, school boards and municipalities may reference the standard for new school projects. The goal is to achieve a learning space with low background sound levels and reverberation times in which people would be able to communicate effectively. The new standard establishes an hourly A-weighted average sound level of 40 decibels (dB) which must not be exceeded for more than 10 percent of the hour (ANSI 2002). This standard would be implemented when constructing the new high school and when existing schools on Andersen AFB are modernized.

Draft EIS Comment: Identify significance criteria for the analysis of noise impacts in the Final EIS. We recommend that EPA’s recommended DNL of 55 dBA for residences, schools and hospitals be used.

Response: The criteria are listed at the beginning of the noise section of Chapter 4 and include the factors considered. Additionally, text in Subchapter 3.1.1 discusses why the Air Force uses DNL 65 dBA for impact analysis. The analysis in the FEIS was improved and modified by further analyzing the issues noted in the comment by adding text to Subchapters 2.2.1.1 and 4.1.1.1 that states that all new on-Base residential and public use buildings will be designed and constructed to comply with the appropriate NLR standards to achieve an indoor noise level of DNL 45 dBA or less.

Aircraft Staging Area. Approximately 23 different facilities, taxiways, and aircraft parking aprons would be constructed to support F-22 and F-15E operations. These projects are collectively referred to as the aircraft staging area (ASA). Figure 2.2-5 shows the conceptual layout and relative sizes of the proposed ASA complex. Approximately 74 hectares (183 acres) would be cleared for the ASA facilities and road construction.

Commercial Gate. The Commercial Gate project consists of three elements: constructing an Entry Gate; constructing a Truck Inspection Facility between the Entry Gate and the western end of the airfield; and repaving an existing road between the Entry Gate and the Truck Inspection Facility sites (see Figure 2.2-6). All commercial vehicles would enter the Commercial Gate but would exit the Base via the Main Gate. An estimated 200 commercial vehicles would enter the Base through the Commercial Gate, which likely would operate from 6:00 a.m. to as late as 9:00 p.m.



Notes:

1. Number indentifiers correspond to project on Table 2.2-7. Locations are approximate.

2. (37) Road repair would occur throughout base as needed to repair roads after construction is completed.

Figure 2.2-4

Location of Alternative A Construction Projects

Andersen AFB, Guam

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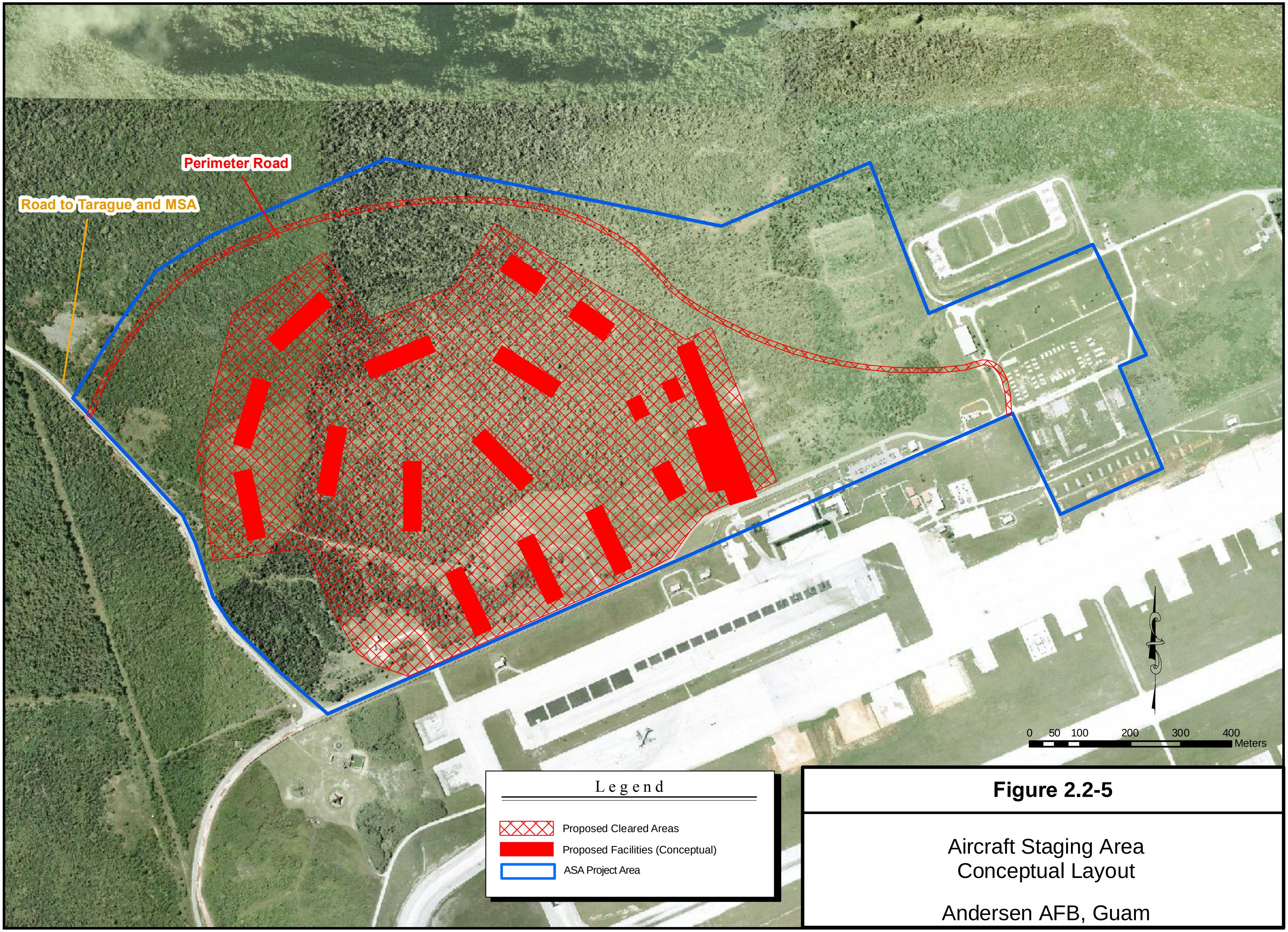

Figure 2.2-5

Aircraft Staging Area
Conceptual Layout

Andersen AFB, Guam

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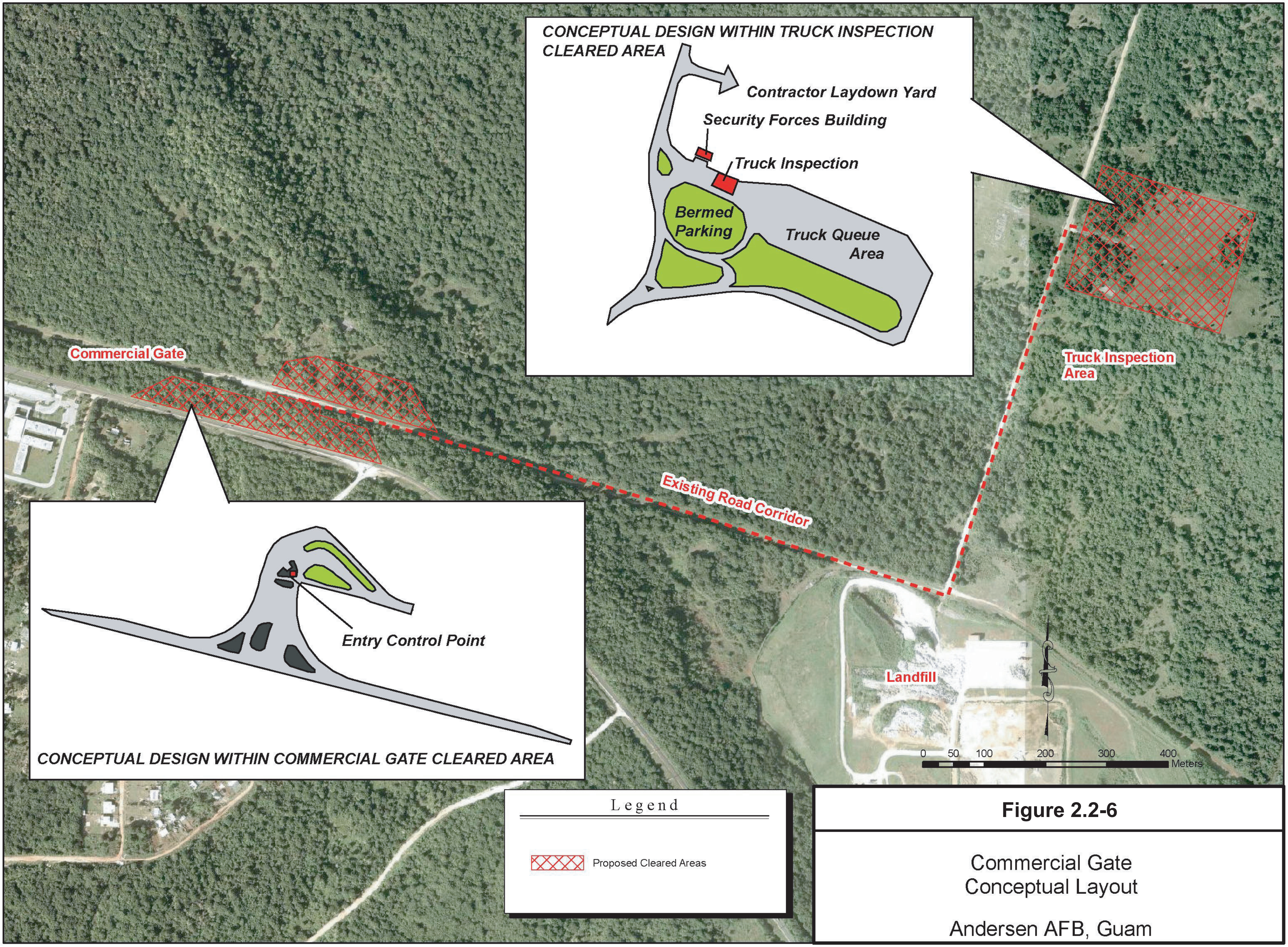

Figure 2.2-6

Commercial Gate
Conceptual Layout

Andersen AFB, Guam

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Table 2.2-7 Alternative A Construction Project Information

Project	Project Number on Figure 2.2-4	New Construction (Square Feet)	Demolition (Square Feet)
Global Hawk Operations/Maintenance Facility	1	57,500	3,769
Construct Commercial Gate	14	--	--
Fuel Cell Maintenance Hangar	4	52,417	0
Clear Water Rinse Facility	5	173,943	0
Fighter Tactical Missile Maintenance (Precision Guided Munitions) Facility	7	10,250	0
Realign Arc Light Boulevard	12	225,000	225,000
Electrical Power Station Upgrade (20 megawatt substation)	15	0	0
Corrosion Control Hangar	28	52,417	0
AGE Covered Storage	36	12,940	0
Repair Taxiway D	48	--	--
Maintenance Hangar/Aircraft Maintenance Unit	6	52,417	0
Conventional Missile Maintenance Facility	8	11,000	0
Landfill Expansion	17	217,801	0
Repair Taxiway Bravo	18	--	--
Dorms Construction, Phase 1, 240 Rooms	21	--	0
Dorms Construction, Phase 2, 240 Rooms	22	--	0
Convert Dorms to AEF Lodging, Phase 1, 126 Rooms	24	--	0
Convert Dorms to AEF Lodging, Phase 2, 126 Rooms	25	--	0
Repair Taxiway Foxtrot	20	--	--
Repair Taxiway Charlie	32	--	--
Airmen Dining Facility	30	18,400	0
Fire Station	31	30,349	0
Military Family Housing Office	41	5,619	0
Military Family Housing Supply and Storage	42	4,155	0
Military Family Housing Warehouse	43	6,975	0
Dorms Construction, Phase 3, 240 Rooms	23	--	0
Convert Dorms to AEF Lodging, Phase 3, 126 Rooms	26	--	0
Convert Dorms to AEF Lodging, Phase 4, 126 Rooms	27	--	0
North Ramp Water Infrastructure	46	--	--
AEF Support Hangar	35	52,417	0
Armament System Shop (Mod Bldg 51104)	50	800	
Repair South Runway, Phase 1	33	--	--
Repair Roads after Construction Traffic	37	--	--

Table 2.2-7 Alternative A Construction Project Information (*continued*)

Project	Project Number on Figure 2.2-4	New Construction (Square Feet)	Demolition (Square Feet)
North Ramp Infrastructure, ASA Phase 1 (24 hardened aircraft shelters [HAS])	45	--	--
Fighter LO/Composite Repair Facility (two bay HAS)	49	32,390	0
Munitions Trailer Maintenance Shop Mod 51104)	53	5,780	0
Repair D-Loop Taxiway	54	--	--
Fighter Armament Systems Maintenance Shop	55	27,015	0
Aircraft Shelters, Phase 1 (8 aircraft)	57	73,616	0
Fighter Hangar/Squad Operations/Aircraft Maintenance Unit (Relocate HSC-25	44	173,713	0
Fighter Wash Rack (Mod to HAS)	47	6,869	0
Fighter Taxiway Network - HAS Phase 1	52	1,125,018	0
Aircraft Shelters, Phase 2 (6 Aircraft)	58	55,212	0
Repair Taxiway Echo	19	--	--
Repair South Runway, Phase 2	34	--	--
Sports Field Complex	38	--	--
Fighter Arm/Disarm Pads/End of Runway Shelter	51	590,193	0
Fighter Fuel Systems Maintenance (Mod to HAS)	56	13,225	0
Aircraft Shelters, Phase 3 (8 Aircraft)	59	73,616	0
Fighter Taxiway Network - HAS Phase 2	60	1,125,018	0
North Ramp Infrastructure, HAS Phase 2 (48 HAS)	61	--	--
Fighter Squadron Operations/Aircraft Maintenance Unit	62	18,622	0
Aircraft Shelters, Phase 4 (8 Aircraft)	63	73,616	0
Visiting Quarters (200 rooms)	65	132,912	0
Flight Kitchen	24	2,002	0
Aircraft Shelters, Phase 5 (8 Aircraft)	64	73,616	0
Visiting Quarters (200 rooms)	66	106,000	0
High School	29	50,000	0
Aircraft Shelters, Phase 6 (8 Aircraft)	67	73,616	0
Global Hawk Wheel and Tire Shop	2	6,437	TBD
Global Hawk Electro-environmental Shop	3	1,195*	TBD
Mooring and Grounding Points	10	--	--
Run Up Pads	11	9,603	0
Modernize Flightline Perimeter	13	--	--
Alter Maintenance Back Shops	16	0	0
Renovate 225 Family Housing Units	39	--	--
Construct 190 Family Housing Units	40	--	--

Table 2.2-8 Proposed Forest Habitat Clearing

Project Area Name	Cleared Area (hectares)
ASA (including perimeter road)	66.4
Commercial Gate Project Entry Gate	3.5
Commercial Gate Project Road	0.0
Commercial Gate Project Truck Inspection Facility	4.0
Total	**73.9**

An Entry Gate would be constructed along Route 9 to allow for commercial and contractor vehicles to enter the Base on the west side of Andersen main. This facility would require a paved entry with gate, security fence, and small facility for security personnel. This facility is shown in Figure 2.2-6. The amount of area that would be cleared for the Entry Gate equates to 3.5 hectares (8.6 acres).

A Truck Inspection Facility would be constructed east of the Entry Gate for the purpose of inspecting vehicles and material delivered to the Base. The Truck Inspection Facility is shown on Figure 2.2-6. The amount of area that would be cleared for the Truck Inspection Facility equates to 4.0 hectares (10 acres).

The existing road between the sites for the Entry Gate and the Truck Inspection Facility would be repaved to a width of 7.3 meters (24 feet) with 1-meter shoulders on each side, for a total width of 9.3 meters (30.5 feet). Because the existing road corridor can accommodate proposed road modifications, vegetation clearing within the existing road corridor would be minimal and limited to removal of herbaceous or shrubby vegetation. Street lights would be installed along the road between the Entry Gate and the Truck Inspection Facility. The street lights would be illuminated only when the Commercial Gate is in operation.

Aircraft Wash Racks and Clear Water Rinse Facility. As indicated in Table 2.2-7, aircraft wash rack and clear water rinse facilities would be constructed and operated to support ISR/Strike operations. Wastewater from the facilities would be discharged to the Base wastewater collection system. The facilities would be constructed with environmental controls to remove contaminants from the wash water before entering the wastewater collection system. Table 2.2-9 lists the number of aircraft that would be washed annually at the wash rack facilities (one on the south ramp for large aircraft and one on the north ramp for fighter aircraft) and the gallons of water that would be used for each aircraft washing. The table also lists the number of aircraft that would pass through the clear water rinse facility and the number of gallons used for each aircraft rinse.

Table 2.2-9 Aircraft Wash Rack and Aircraft Clear Water Rinse Facility Information for ISR/Strike Aircraft

Aircraft Type	Number of Aircraft Washed/Rinsed per Year	Gallons of Water per Aircraft Wash/Rinse
Aircraft Washracks		
F-22	115	250
F-15E	29	250
KC-135	18	500
Global Hawk	36	250
B-1	36	2,000
B-2	12	2,000
B-52	18	2,000
Clear Water Rinse Facility		
F-22	230	1,000
F-15E	58	1,000
KC-135	36	1,000
Global Hawk	72	1,000
B-1	72	1,000
B-2	24	1,000
B-52	36	1,000

Source: Sherrill 2005.

Corrosion Control Hangar. As indicated in Table 2.2-7, a corrosion control hangar would be constructed and operated to support ISR/Strike operations. The hangar would be constructed in accordance with directives for corrosion control facilities to provide the required emissions controls and safety for personnel. The hangar would have systems that filter particulate matter. The following describes the planned activities at the corrosion control hangar.

- An entire aircraft would not be painted at Andersen AFB and painting would be limited to touchup.
- Annual primer use would be about 40 and 120 gallons, respectively, for aircraft and aerospace ground equipment (AGE).
- Annual paint use would be about 40 and 120 gallons, respectively, for aircraft and AGE.
- Paint would be removed from aircraft and AGE surfaces by hand sanding.
- The largest panel that would be painted for any aircraft would be about 200 square feet, and the smallest could be less than 1 square foot.

Fuel Cell Maintenance Hangar. As indicated in Table 2.2-7, a fuel cell maintenance hangar would be constructed and operated to support ISR/Strike operations. The hangar would be constructed in accordance with directives for fuel cell maintenance facilities to provide the required emissions controls and safety for personnel. A trench would be installed to capture fire fighting foam along with a collection point for the fire suppression water should foam and water be discharged in the event of a fire. The water would be treated and metered into the wastewater collection system. The following describes the planned activities at the fuel cell maintenance hangar.

- 72 B-52 fuel tanks would be entered and each tank would be open 4 days.
- 53 B-1 and B-2 fuel tanks would be entered and each tank would be open 1 day.
- 104 KC-135 fuel tanks would be entered and each tank would be open 2 days.

Dormitory Construction and Military Family Housing Renovation and Construction. The housing projects would occur on a phased schedule that mirrors the increases in the number of personnel.

2.2.1.2 Conservation Measures

As defined in the Endangered Species Consultation Handbook for Section 7 consultation, conservation measures are actions to benefit or promote recovery of listed species included by the federal agency as an integral part of the proposed action. These actions are taken by the federal agency and serve to minimize or compensate for project effects on the species under review. These may include actions taken prior to the initiation of consultation or actions which the federal agency have committed to complete in a BA or similar document (USFWS 1998).

The conservation measures developed by the Air Force and described in this subchapter are designed to compensate and minimize the potential impacts from implementation and operation of the ISR/Strike action to threatened and endangered (T&E) species resulting from Alternative A, specifically the Mariana fruit bat (*Pteropus mariannus mariannus*), Mariana crow (*Corvus kubaryi*), Micronesian kingfisher (*Halcyon cinnamomina cinnamomina*), and the Guam rail (*Rallus owstoni*). (The conservation measures also are included in the BA the Air Force completed for the ISR/Strike proposal and contained in Appendix E.) The conservation measures, as components of Alternative A, correspond to recovery actions outlined in various USFWS recovery plans. Overall goals of the conservation measures contribute to important habitat and species management objectives on Guam, including BTS management and removal, habitat restoration and protection, feral ungulate impact reduction, and research. All conservation measures that involve activities on the Refuge Overlay unit would be coordinated with GNWR staff.

Draft EIS Comment: We understand that the construction footprint has already been altered to reduce clearance in intact forest (p. 2-28). We are confident Air Force planners have the skill to further adjust the footprint to protect the patches of higher quality habitat (totaling 3.5 acres), and to realign the road from a perimeter concept to one within the area already to be cleared for the ASA.

Response: Based on the process described in the Adjustment of the Construction Footprint conservation measure in Subchapter 2.2.1.2, further adjustment is not possible due to the facility requirements for the ASA. The October 3, 2006 USFWS Biological Opinion states that "…the Service's finding of no jeopardy is based in large part on the conservation measures built into the project by the Air Force."

Adjustment of the Construction Footprint

The construction footprint of the ASA, as shown in Figure 2.2-5, was altered from the first proposed design to reduce clearing within areas of relatively intact secondary forest. Similarly, the initially planned location for construction of military family housing units was relocated to a previously developed site on the golf course after a reconnaissance survey involving Air Force and DAWR staff in June 2005. This action avoided constructing the units on approximately 26 hectares (65 acres) of primary and intact secondary limestone forest.

Wildlife Management Specialist

Andersen AFB proposes to employ a full-time Wildlife Management Specialist who would also contribute to many of the conservation measures included in the proposed action. This new position would supplement the current Base natural resource staff. The Wildlife Management Specialist would report to the Chief of Conservation Resources who would provide oversight and administrative support. This would allow the Wildlife Management Specialist to fulfill specified job duties, supported by numerous volunteer conservation officers. Details associated with the duties, goals, control methods, and results tracking for the Wildlife Management Specialist would be developed in conjunction with the next revision of the Andersen AFB Integrated Natural Resources Management Plan. A preliminary list of key duties of this position includes:

- **Conducting and managing depredation hunts within ungulate exclosure areas**. Exclosure fencing construction would be in tandem with depredation hunts within proposed exclosure fencing (see Ungulate Exclosure Fencing in this subchapter). Time-critical goals for eradication of deer and feral pigs within these areas would be outlined in a multi-year ungulate management plan (see Ungulate Planning and Research in this subchapter). The Wildlife Management Specialist would be responsible for organizing depredation hunts in partnership with Andersen AFB conservation officers.
- **Recording information on ungulate kills**. Measurements would be obtained from ungulate carcasses. These metrics would include sex of the kill, teeth measurements appropriate for age determination, and cranium size, and would be made available to research specialists (see Ungulate Planning and Research in this subchapter).
- **Trapping of exotic predators**. The Wildlife Management Specialist would also be responsible for deployment and maintenance of traps designed for rodents, feral cats, and feral dogs. Ungulate exclosure areas would be prioritized for trapping.
- **Fenceline reconnaissance for maintenance**. During typhoon events in Northern Guam, intense and sustained wind speeds pose a significant maintenance concern for proposed exclosure fencing. A breach in a fenceline would present an opportunity for re-invasion of unwanted species. In addition to routine monitoring of the fenceline (through pedestrian surveys), fenceline inspection would be conducted by the Wildlife Management Specialist after episodic typhoon events.
- **Coordination with resource agencies**. The Wildlife Management Specialist would coordinate management activities with the appropriate cooperating resource agencies, such as USFWS, U.S. Department of Agriculture (USDA), and GovGuam Division of Aquatic and Wildlife Resources (DAWR).

Ungulate Exclosure Fencing

To offset the loss of habitat from clearing and aircraft operations associated with the proposed action, two units totaling approximately 200 hectares (494 acres) would be fenced to prevent incursion of deer and pigs. A depredation program would be managed by the Wildlife Management Specialist within exclosure areas. The intent of exclosure fencing is to facilitate forest regeneration without the presence of ungulate pressure, so emergent canopy species may be replaced by saplings. Figure 2.2-7 shows the location of two proposed exclosure areas in the Guam Natural Wildlife Refuge (GNWR) overlay, both near Ritidian Point and adjacent to the

Ritidian Point unit. The Ritidian West Unit would fence 90 hectares (222 acres), while the Ritidian East Unit would fence 110 hectares (271.8 acres). This proposed exclosure area would occupy land designated by the USFWS as "Priority 1" for recovery of the Mariana crow (USFWS 2005b). Final placement of the exclosure units would be coordinated with GNWR, USFWS, and DAWR. Further, the Andersen AFB General Plan would be modified to include a special conservation designation for the exclosure areas after the units are finalized.

Existing roads, existing and/or previous fencelines, and cleared/previously cleared areas were considered when proposing the location of fencelines for the exclosure areas. Assuming that cliff lines can serve as effective barriers to ungulate entry, cliff lines would not be fenced. Leveraging cliff lines as barriers would reduce forest clearing and disturbance necessary for fence construction. The proposed exclosure fencing would involve construction of 3,400 meters (11,155 feet) of fenceline, using suitable posts and fencing material sufficient to prevent ungulate incursion and to withstand Guam's environmental conditions (*e.g.*, sea spray, high winds, humidity). Construction would require removal of vegetation along 310 meters (1,117 feet) of fenceline, which amounts to 0.1 hectare (assuming a 3-meter buffer along the fenceline to allow for construction access). The remaining 3,090 meters (10,138 feet) of fenceline are along roads and through herbaceous areas, requiring little or no clearing. Approximately 1,600 meters (5,249 feet) of fenceline would be shared with ungulate exclosure fencing included in the proposed actions associated with Northwest Field. Fenceline routes would be surveyed prior to fence construction to plan for minor adjustments and construction planning.

Maintenance inspections of the fenceline would occur on a quarterly basis, as well as after episodic typhoon events. Fenceline breaks and preventative maintenance needs would be logged during the inspections, and maintenance activities would be planned accordingly.

Inspections of the fenceline would be assigned to the proposed Wildlife Management Specialist. As discussed in Subchapter 1.2.5, clearing and grading would require Guam EPA permits as well as an EPP.

Ungulate Planning and Research

Impacts of high ungulate densities in northern Guam's limestone forest have been well documented (Morton, *et al.* 2000; Perry and Morton 1999; Schreiner 1997; Wiles 2005). Efforts to manage and control populations of ungulates include:

Development of an Ungulate Control Plan. Coordination with resource agencies such as USFWS and DAWR would be sought to develop a multi-year ungulate control plan. The plan would be designed to guide the proposed Wildlife Management Specialist, Andersen AFB conservation officers, and other management stakeholders in efforts to eradicate deer and pigs within the ungulate exclosure area, and to reduce ungulate densities in non-fenced areas. Control and monitoring techniques would be clearly defined in the ungulate control plan.

- ***Facilitation of Research.*** The USFWS identified the need for ungulate movement studies to enhance current and future management strategies. Typically, these movement studies involve radio telemetry techniques and would be suitable for academic publication. The proposed Wildlife Management Specialist would provide technical support for such research activities, including anesthetizing deer and pigs for radio tagging. The proposed Wildlife Management Specialist may also provide technical assistance for dressing of carcasses for stomach content analysis or wildlife disease studies.

Transplanting of *Tabernaemontana rotensis* Seedlings and Saplings

There are at least 15 locations containing approximately 1,000 *T. rotensis* trees within the ISR/Strike area. The majority of the trees are seedlings or saplings and the remaining are mature trees. *T. rotensis* saplings respond well to transplanting. A landscaping crew can remove the saplings and transplant them outside the project area(s). At the same time, a landscaping crew can collect *T. rotensis* seeds for outplanting outside the project area. This would offset removal of *T. rotensis* individuals during construction operations within the project areas.

Outplanting of Foraging Trees Important to Mariana Fruit Bat and Mariana Crow

This conservation measure would contribute to existing foraging habitat with native trees important to the Mariana fruit bat and Mariana crow. Foraging plots are an accepted tool for repairing damaged wildland areas, namely because attractant plants will spread propogules. The goal of this conservation measure is to increase the attractiveness of habitat outside ISR/Strike project areas by establishing foraging plots within ungulate exclosures. Establishment of foraging plots would include:

- Five 50-meter by 50-meter foraging plots (Figure 2.2-7). A finalized list of tree species would be dependent on commercial nursery or herbarium stocks, and would involve coordination with USFWS, DAWR forestry personnel, University of Guam herbarium personnel, and the USDA Natural Resources Conservation Service field office;
- Supplemental protective fencing to prevent browse pressure within foraging plots; and
- Management actions within these plots to include herbaceous vegetation control, fenceline maintenance, and quarterly monitoring of outplanting success.

Foraging plots as part of the proposed action associated with the ISR/Strike capability would be additional to foraging plots as part of the proposed actions associated with Northwest Field projects (see Subchapter 2.4.2.2).

Vegetation Surveys Relevant to Recovery of Mariana Fruit Bat and Mariana Crow

The limestone forest of northern Guam is not homogeneous in composition or structure. Quantification of the vegetation community types that cover Andersen AFB can aid in the proper allocation of resources for species management. Vegetation surveys of habitat areas for the Mariana fruit bat and Mariana crow would be conducted as part of the proposed action to target management resources for species recovery. These surveys would include:

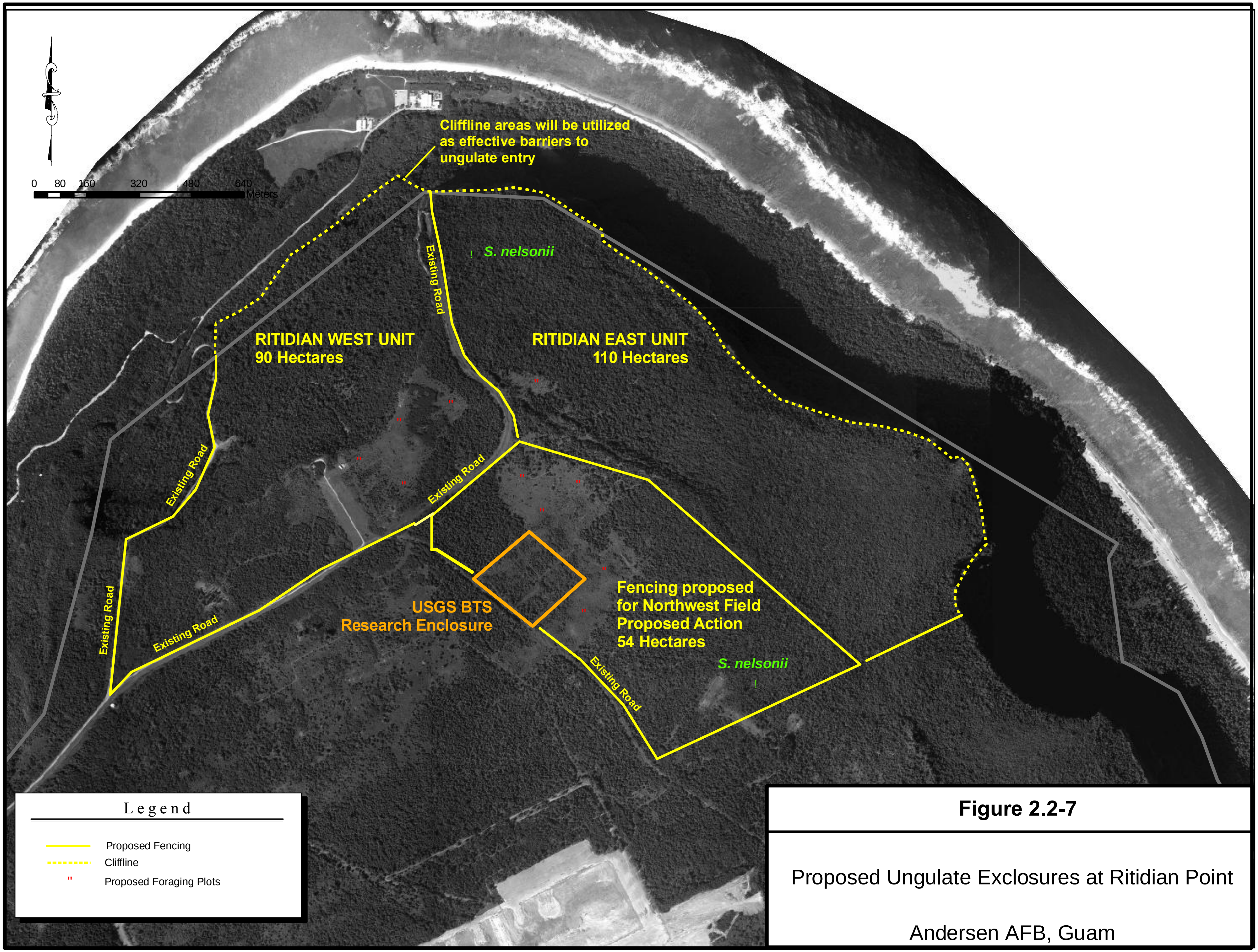

Figure 2.2-7

Proposed Ungulate Exclosures at Ritidian Point

Andersen AFB, Guam

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- ***Vegetation assessment of occupied habitats of the Mariana fruit bat.*** The vegetation community composition and structure would be described and mapped as part of this vegetation assessment. Goals of these efforts include assessment of locations for possible reestablishment attempts and detection of invasive herbaceous and woody species in essential habitat area. The vegetation survey would be conducted throughout the entire area of Andersen AFB, excluding Andersen South.

  This vegetation assessment corresponds to Recovery Actions 2.1.2 and 3.1.1.2 of the USFWS Recovery Plan for the Mariana fruit bat (USFWS 1990b). A scope of work would be developed in cooperation with USFWS and DAWR. Modifications to the survey objectives would be concurrent with anticipated results from new research (Brooke 2005; Janeke 2005), as well as updates to recovery plans.

- ***Vegetation assessment of areas important to the Mariana crow.*** Goals of this vegetation assessment would include determination of vegetation elements in need of management treatments within current and potential utilization areas of the Mariana crow.

  This vegetation assessment corresponds with Recovery Action 2.3.4 of the USFWS Recovery Plan for the Mariana crow (USFWS 2005b). A scope of work would be developed in cooperation with USFWS and DAWR to ensure that deliverables have maximum value to recovery efforts and can be integrated into existing data collection programs.

> **Draft EIS Comment:** The final EIS should include further assurances that reintroduction of endangered species to native habitat will not be impeded by the proposed action.
>
> **Response:** Implementation of the conservation measures described in Subchapter 2.2.1.2 would reverse the continued degradation of important habitat, and therefore, contribute to the recovery actions associated with the reintroduction of listed species. The October 3, 2006 USFWS Biological Opinion states that "…the Service's finding of no Implementation of the conservation measures described in Subchapter 2.2.1.2 would reverse the continued degradation of important habitat, and therefore, contribute to the recovery actions associated with the reintroduction of listed species. The October 3, 2006 USFWS Biological Opinion states that "…the Service's finding of no jeopardy is based in large part on the conservation measures built into the project by the Air Force." measures built into the project by the Air Force."

- **Base-wide inventories of trees of value to the Mariana fruit bat, Mariana crow, and Micronesian kingfisher.** Ongoing surveys for *T. rotensis* and *Cycas circinalis* may provide a template for the inventory of rare trees of value to listed species. Rare tree inventories would be conducted for *Pisonia grandis, Heritierra longipetiolata, Serianthes nelsonii, Artocarpus mariannensis,* and/or *Elaeocarpus joga*. Surveys for all these species can be conducted concurrently and could use the existing transects used in the *T. rotensis* surveys. These surveys would provide resource managers with additional information about the relative scarcity of some species that may be important to the Mariana fruit bat, Mariana crow, and Micronesian kingfisher.

  The rare tree inventories contribute to recovery actions associated with vegetation assessments and baseline habitat studies for the Mariana fruit bat, Mariana crow, and Micronesian kingfisher. Specifically for *S. nelsonii*, rare tree inventories correspond to Recovery Actions 1.1.1.1 and 1.3.1 of the USFWS Recovery Plan for *S. nelsonii* (USFWS 1994), which concern identification and inventory of newly discovered individual trees. Cooperation with USFWS and DAWR forestry personnel would be sought in developing the scope of work for these rare tree inventories.

Noise Study

Aircraft noise has the potential for effects to the Mariana fruit bat and the Mariana crow. A field study was conducted from October 1992 to September 1995 to assess the potential effects of aircraft overflights on the Mariana fruit bat and Mariana crow resulting from aircraft operations at Andersen AFB (Morton 1996). The types of aircraft and the level of aircraft operations expected under the ISR/Strike capability would be different than those that occurred at the Base under the Morton (1996) study. Therefore, the data and results of the Morton study may not apply to the ISR/Strike aircraft operations condition. Surveys similar to those performed by Morton (1996) would be done prior to and during incremental increases of additional overflights at Andersen AFB. The noise study would focus on Mariana fruit bats near the main colony at Pati Point and the Mariana crow in the area north of the airfield. Supplemental to field measurements of noise, surveys of reproductive success and predator pressures would be accomplished concurrently with the noise studies. Development of a scope of work and survey methods would be a cooperative effort with USFWS and DAWR. Replication of the Morton (1996) study would not be possible because the current mix of aircraft operating at Andersen AFB differs from when Morton collected data. In addition, procedural standards for acoustical studies have progressed since Morton's study. To be in line with current standards, enhancements to Morton's methods would include:

- ***Sound level meter***. Morton used a class III Radioshack™ digital sound level meter which is not typically used in current acoustical studies. The American National Standard for sound level meters recommends the use of class I sound level meters. (ANSI S1.4-1983 [R 2001]).
- ***Sound level meter height.*** The recommended meter height for similar acoustical studies is 1.5 meters (5 feet). The sound level meter height in the Morton study was 50 centimeters (20 inches). The recommended height of 1.5 meters (5 feet) avoids ground reflectivity of sound (American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound Part 1: ANSI S12.9-1988, Part 2: S12.9-1992, and Part 3: ANSI S12.9-1003).
- ***Aircraft altitude measuring.*** Aircraft altitude was estimated in the Morton study. The new studies would use ground track data to supplement field estimations of aircraft altitude.

Environmental Education and Awareness Information

Incoming military personnel would receive education in the identification, behavior, and habits of the BTS. BTS inspection and interdiction issues and procedures would be monitored by the Base Environment, Safety, and Occupational Health Council to ensure that the USDA accomplishes inspection of departing aircraft and cargo in accordance with the 36th Wing Instruction 32-7004, *Brown Tree Snake Management* (36 WI 32-7004).

Encouragement of Mariana Fruit Bat Pup Recruitment at Pati Point Colony

A recent census of Mariana fruit bat populations at the Pati Point colony reported less than 30 mature individuals and a complete lack of fruit bat pups (Dicke 2006). The population of Mariana fruit bats in northern Guam may number approximately 100 individual adults when considering bats that are not associated with colonial roosting. Predation by the BTS on fruit bat pups is believed to be the primary factor for the absence of young individuals. This conservation measure proposes to trap or bait BTSs at the Pati Point Colony, or apply other treatments to reduce BTS numbers, thereby reducing the threat posed to Mariana fruit bat pups by BTS predation.

The USDA Denver Wildlife Research Center began an ongoing program for BTS control technologies in 1994. The program continues to evaluate and improve BTS control products including toxicants, repellants, fumigants, sterilants, attractants, artificial baits, and aerial delivery of control products. The DoD funds a significant portion of this applied research. Cooperation with various resource agencies would be sought to determine the most appropriate method of BTS control in the Pati Point Colony vicinity.

Brown Tree Snake Interdiction and Control

Brown tree snake control is a priority for the DoD (Kreig 2005). The procedures in the 36 WI 32-7004 ensure that 100 percent of out-bound craft (air and water) from Andersen AFB is inspected (USAF 2006). The Instruction implements and builds on prior related plans and complements the “Brown Tree Snake Control and Eradication Act of 2004.” A copy of the Instruction is contained in Appendix C of the BA (see Appendix E). 36 WI 32-7004 states, *All shipments by air or sea of material originating from Andersen AFB facilities for military exercise support, day-to-day military cargo and equipment and private contractors will be inspected by USDA WS personnel and/or their trained snake detection canines and properly document the inspection before transport off-island. All aircraft, military or civilian, taking off from Andersen AFB will be inspected by USDA WS to the maximum extent possible.* Under the 36 WI 32-7004, the USDA notifies the Air Terminal Operations Center that the aircraft has been inspected, and the aircraft are marked off electronically in an Access database. The Air force has initiated the internal process to provide a 5-year agreement with USDA WS for the use of Building 22002 on Andersen main. This agreement will provide enhanced infrastructure stability for the BTS interdiction program.

Adaptive Management and Ground Track Modification

Habituation of Mariana fruit bats to noise is suspected (Janeke 2005); however, the degree of habituation represents a data gap in the current literature. A similar data gap exists for habituation of Mariana crows to aircraft noise (40 CFR Part 1502.22).

This conservation measure would use data from the proposed noise studies (see Noise Study in this subchapter) to adjust the aircraft ground track location and flight profile (*i.e.*, airspeed, altitude, and/or power setting) to evaluate if changing the ground track location and flight profile would minimize impacts to Mariana fruit bats or whether habituation is likely to occur resulting in very little negative impact on this species. Changes could be made in the flight profile provided the change would not constitute a flight hazard or noncompliance with the aircraft flight manual. As aircraft overflights increase, management recommendations would be submitted to modify existing flight tracks and profiles (40 CFR Part 1508.20).

Adaptive management is a process that allows for development and implementation of natural resource management strategies in response to a degree of biological uncertainty. Under adaptive management, land managers use models of natural resource systems to develop performance measurements and initial policy choices, that incorporate into the regulatory implementation framework a process for continuous monitoring, evaluation, and adjustment of decisions and practices (Ruhl 2004; Nagel, *et al*. 2002). Adaptive management is considered a component concept of ecosystem management, which has become the dominant model of regulatory practice for Integrated Natural Resource Management Plan (INRMP) implementation on military lands. Adaptive management involves two basic tenets:

- A commitment to a continual learning process, a reiterative evaluation of goals and approaches, and redirection based on an increased information base (Baskerville 1985); and
- Explicit hypotheses regarding ecological structure, function, and anticipated response of variables within an ecosystem (Holling 1978; Walters 1986).

Frequent aircraft noise may be an external source that might affect components within the ecosystem. Monitoring of key components within the ecosystem as an adaptive management approach may allow changes to be made in the external source to support the overall health of the ecosystem or minimize noise impacts.

As noise studies progress, an adaptive management working group chaired by the Andersen AFB Natural Resource Planner and consisting of representatives from DAWR, USFWS GNWR, and USFWS Ecological Services would meet periodically with special meetings in response to typhoon events, aircraft accidents, or Mariana fruit bat colony abandonment. The adaptive management working group would develop the strategy for this conservation measure. Successful implementation of adaptive management will be dependent on receiving and evaluating new information (Ringold 1996), as it becomes available, from noise studies and other continuous studies conducted by researchers and resource agencies. Future updates of the Andersen AFB INRMP would include useful information gained from this adaptive management strategy.

2.2.2 Description of Alternative B

At full implementation and operation, the ISR/Strike capability under Alternative B would base four Global Hawks and associated personnel at Andersen AFB and rotate as many as 48 fighter (F-22 and F-15E), 12 KC-135 tanker, and 6 bomber (B-1, B-2, and B-52) aircraft and personnel from bases within the 50 states. These 70 aircraft, when added to the 14 HSC-25 helicopters currently based at Andersen AFB, would increase the number of based and rotational aircraft to as many as 84. The rotational period for aircraft and personnel would be 120 days.

Table 2.2 -10 presents the time periods for each operational phase and summarizes the number of aircraft by aircraft type and the personnel changes for the operational phases. The Base population could increase to as many as 7,750 personnel when the 1,850 additional personnel associated with Alternative B would be added to the current population of 5,900 persons. The 1,850 personnel include military, Air Force civilian, contractor, and dependent personnel.

Table 2.2-10 Aircraft and Personnel Associated with Alternative B

	Phase			
	Phase 0	**Phase 1**	**Phase 2**	**Phase 3**
Number of Aircraft				
Based				
Global Hawk	4	4	4	4
Rotational				
Fighter	12	24	24	48
Tanker	6	12	12	12
Bomber	6	6	6	6
Total	28	46	46	70
Number of Personnel				
Permanent				
Global Hawk	50	50	50	50
Support	50	50	50	50
Subtotal	100	100	100	100
Rotational				
Fighter	300	500	500	900
Tanker	250	400	400	400
Bomber	350	350	350	350
Subtotal	900	1,250	1,250	1,650
Total	1,000	1,350	1,350	1,750
Number of Permanent Personnel Accompanied by Dependents, not Accompanied by Dependents, and Dependents				
Unaccompanied	50	50	50	50
Accompanied	50	50	50	50
Dependents	100	100	100	100
Summary of Additional Personnel Resulting from Alternative B				
Permanent	100	100	100	100
Rotational	900	1,250	1,250	1,650
Dependents	100	100	100	100
Total	1,100	1,450	1,450	1,850
Resulting Base Population by Combining the Alternative B Population with Current Base Population				
Alternative B	1,100	1,450	1,450	1,850
Current Population	5,900	5,900	5,900	5,900
Total	**7,000**	**7,350**	**7,350**	**7,750**

Note: Three of the Global Hawk aircraft would be PAA, and one aircraft would be BAI. The data in the Number of Personnel section of the table reflect military, Air Force civilian, and contractor personnel. Number of dependents is based on an average of 2.5 dependents per accompanied individual and is rounded to the nearest 50. The number of fighter, tanker, and bomber aircraft reflect an "as many as" condition.

Airfield Operations

Table 2.2-11 lists the projected annual and average daily airfield operations for the ISR/Strike aircraft at Andersen AFB under Alternative B, and reflects the total recurring airfield operations condition after establishment of the ISR/Strike capability. Operations for the ISR/Strike aircraft include mission arrivals and departures as well as training sortie arrivals and departures, and closed pattern operations. The following paragraphs describe mission and training sorties for each ISR/Strike aircraft type that would be at Andersen AFB under Alternative B.

Fighter. As with Alternative A, the fighter element of the ISR/Strike capability under Alternative B would be accomplished by the same numbers of rotational F-22 and F-15E aircraft. The description of flying activities for fighters in Alternative A in Subchapter 2.2.1 applies to Alternative B because the sortie number and sortie profile information are the same for both alternatives.

Tanker. Rotational KC-135 aircrews would fly four sorties per day, 240 days per year from Andersen AFB, the same as Alternative A. A typical sortie would include a departure from the Base, aerial refueling of receiver aircraft, and an arrival at Andersen AFB. However, the flying training would be less under Alternative B because aircrews would accomplish the training events necessary to stay mission ready throughout the rotational period prior to departing their home base. Therefore, approximately 30 minutes of instrument approach and closed pattern training would be accomplished at the Base after arrival and before termination instead of the 60 to 90 minutes associated with Alternative A. It is estimated that about 13 percent of the airfield operations for the tankers would occur during nighttime.

Table 2.2-11 Alternative B Annual and Average Daily Airfield Operations

	Arrival and Departure Operations		Closed Pattern Operations		Total Operations	
Aircraft	**Annual**	**Avg. Daily**	**Annual**	**Avg. Daily**	**Annual**	**Avg. Daily**
ISR/Strike Aircraft						
Fighter						
F-22	5,530	23.04	16,589	69.12	22,119	92.16
F-15E	1,382	5.76	4,147	17.28	5,529	23.04
Fighter Subtotal	6,912	28.80	20,736	86.40	27,648	115.20
KC-135	1,920	8.00	1,901	7.92	3,821	15.92
Global Hawk	440	2.00	220	1.00	660	3.00
Bomber						
B-1	432	1.80	864	3.60	1,296	5.40
B-2	96	0.40	192	0.80	288	1.20
B-52	432	1.80	864	3.60	1,296	5.40
Bomber Subtotal	960	4.00	1,920	8.00	38,868	12.00

Table 2.2-11 Alternative B Annual and Average Daily Airfield Operations (*continued*)

	Arrival and Departure Operations		Closed Pattern Operations		Total Operations	
Aircraft	**Annual**	**Avg. Daily**	**Annual**	**Avg. Daily**	**Annual**	**Avg. Daily**
ISR/Strike Aircraft						
Subtotal ISR/Strike Aircraft	10,232	42.80	24,777	103.32	35,009	146.12
Other Military	25,144	68.88	59,648	163.42	84,792	232.30
Transient Civil	942	2.58	0	0.00	942	2.58
Total	**36,318**	**114.26**	**84,425**	**266.74**	**120,743**	**381.00**

Note: See Table 2.3-1 for detailed transient military and civil aircraft for the baseline condition. Fighter, tanker, and bomber operations are based on 240 days per year of operations and the Global Hawk operations are based on 220 days per year. The ISR/Strike operations represent the operations associated with as many as 48 fighter, 12 KC-135, and six bomber aircraft.

Unmanned Aerial Vehicle. As with Alternative A, the Global Hawks associated with the ISR/Strike capability under Alternative B would be permanently based. The description of flying activities for Global Hawks in Alternative A in Subchapter 2.2.1 applies to Alternative B because the sortie number and sortie profile information are the same for both alternatives.

Bomber. As with Alternative A, the bomber element of the ISR/Strike capability under Alternative B would be accomplished by rotational B-1, B-2, and B-52 aircraft. The description of flying activities for bombers in Alternative A in Subchapter 2.2.1 applies to Alternative B because the sortie number and sortie profile information are the same for both alternatives.

2.2.2.1 Construction Projects and Facility Operation

Numerous construction and building addition/alteration projects would be constructed over an approximate 16-year period to support establishment and operation of the ISR/Strike capability at Andersen AFB. Many of the projects identified for Alternative A (see Table 2.2-7) would also be constructed for Alternative B. Figure 2.2-4 depicts the proposed locations for the projects. The following Alternative A projects listed on Table 2.2-7 would not be constructed under Alternative B.

- 190 Family Housing Units
- Military Family Housing Office
- Military Family Housing Supply and Storage
- Military Family Housing Warehouse

Facilities Operation

Facilities operations would be the same as that described for Alternative A.

2.2.2.2 Conservation Measures

The conservation measures would be the same as those described for Alternative A.

2.3 NO ACTION ALTERNATIVE

Under the No Action Alternative, the ISR/Strike capability would not be established. Andersen AFB would continue as a location from which as many as six bomber aircraft accomplish missions on a rotational basis. Fourteen UH-60 helicopters belonging to HSC-25 would continue to be based at Andersen AFB and accomplish missions from the airfield. The Base also would continue to provide refueling, aircraft maintenance, and air cargo handling for transient military and civil aircraft. Construction projects would be those typically accomplished for individually programmed facility actions and operations and maintenance (O&M) activities.

The number of Air Force active duty and civilian authorizations, as well as contractor personnel at the Base, would remain at approximately the September 2004 levels (*i.e.*, 3,300 personnel) (Andersen AFB 2004a). Total Base population when considering personnel authorizations plus dependents would continue to be about 5,900 persons. Likewise, airfield operations would continue at the 2004 levels of activity. Table 2.3-1 lists the average daily and annual airfield operations for the No Action Alternative (*i.e.*, baseline condition) at Andersen AFB.

2.4 PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS

Complete environmental impact analysis of the No Action and proposed action must consider cumulative impacts due to other actions. A cumulative impact, as defined by the CEQ (40 CFR 1508.7), is the "…impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." Subchapter 1.2.1 discusses the Air Force's request for actions by other DoD and GovGuam agencies that could be considered for cumulative impacts.

Table 2.3-1 Baseline Annual and Average Daily Airfield Operations

	Arrival and Departure Operations		Closed Pattern Operations		Total Operations	
Aircraft	**Annual**	**Avg. Daily**	**Annual**	**Avg. Daily**	**Annual**	**Avg. Daily**
Military						
EA-6	153	0.42	0	0.00	153	0.42
B-1	453	1.24	0	0.00	453	1.24
B-52	569	1.56	0	0.00	569	1.56
C-5	891	2.44	0	0.00	891	2.44
C-9	927	2.54	0	0.00	927	2.54
KC-10	204	0.56	0	0.00	204	0.56
C-12	88	0.24	0	0.00	88	0.24
C-17	314	0.86	0	0.00	314	0.86
C-20	285	0.78	0	0.00	285	0.78
C-21	606	1.66	0	0.00	606	1.66
C-130	1,956	5.36	0	0.00	1,956	5.36

Table 2.3-1 Baseline Annual and Average Daily Airfield Operations (*continued*)

	Arrival and Departure Operations		Closed Pattern Operations		Total Operations	
Aircraft	**Annual**	**Avg. Daily**	**Annual**	**Avg. Daily**	**Annual**	**Avg. Daily**
Military						
KC-135	694	1.90	0	0.00	694	1.90
C-141	197	0.54	0	0.00	197	0.54
E-2	796	2.18	0	0.00	796	2.18
F-15	409	1.12	0	0.00	409	1.12
F-16	380	1.04	0	0.00	380	1.04
F-18	1,000	2.74	0	0.00	1,000	2.74
P-3	650	1.78	0	0.00	650	1.78
CH-46	88	0.24	0	0.00	88	0.24
Ch-53	95	0.26	0	0.00	95	0.26
SK-70	183	0.50	0	0.00	183	0.50
UH-60	14,206	38.92	59,648	163.42	73,854	202.34
Subtotal	25,144	68.88	59,648	163.42	84,792	232.30
Transient Civil Aircraft						
B-747	847	2.32	0	0.00	847	2.32
B-757	95	0.26	0	0.00	95	0.26
Subtotal	942	2.58	0	0.00	942	2.58
Total	**26,086**	**71.46**	**59,648**	**163.42**	**85,734**	**234.88**

Note: Annual operations based on 365 days per year.
Source: AFCEE 2003.

2.4.1 Other Actions Planned for Andersen Main Base

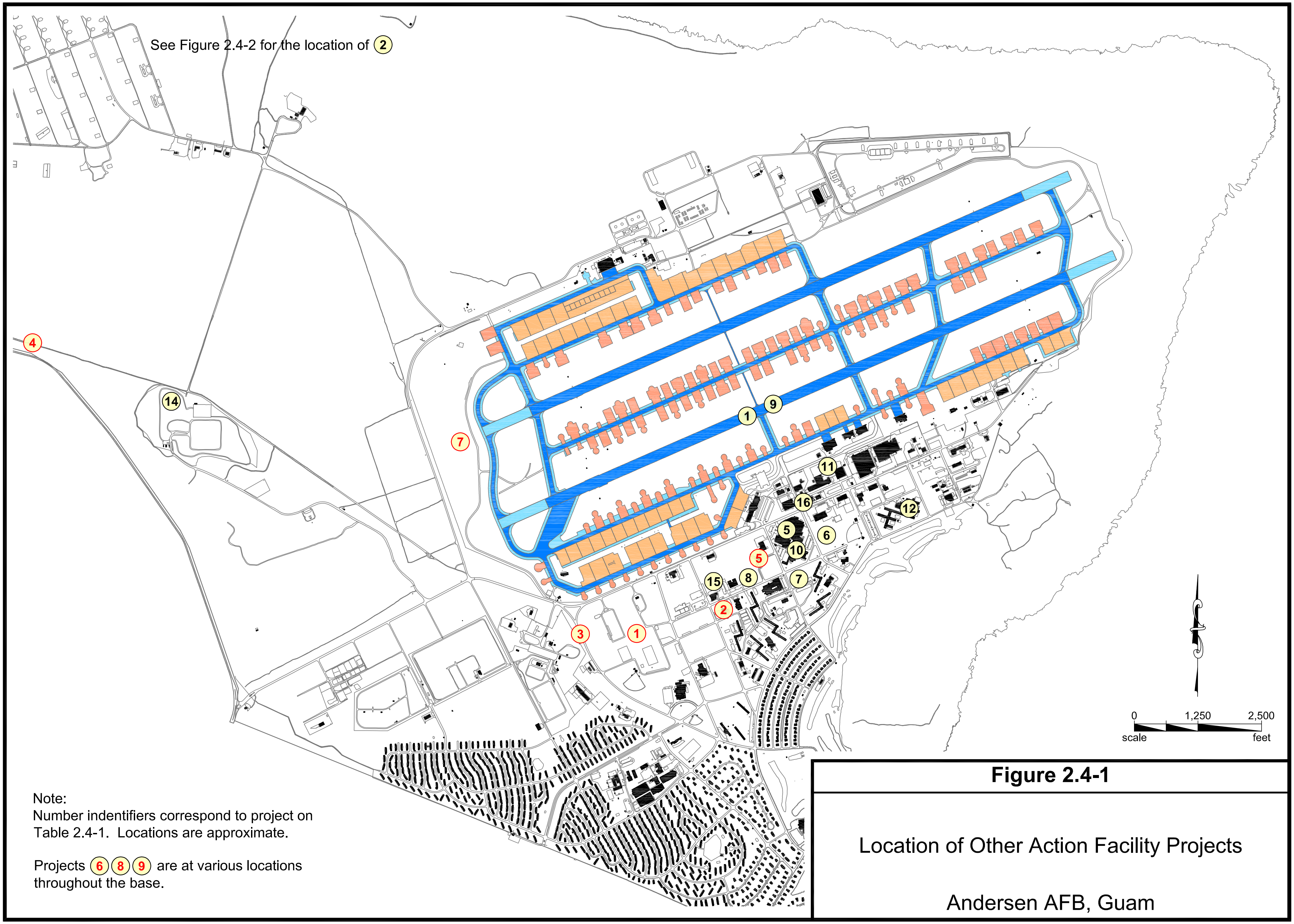
Figure 2.4-1 depicts the locations for the other actions, and Figure 2.4-2 shows Munitions Storage Area (MSA) 1, the location proposed for construction of 60 additional munitions storage igloos. Table 2.4-1 contains information on these other projects. No additional personnel would be assigned to Andersen AFB as a result of these other actions planned by Andersen AFB. Other projects such as the landfill expansion and water system upgrade are currently in progress or would be completed before implementation of the ISR/Strike capability, and are considered in the baseline in this EIS.

The Air Force proposes to initiate construction of 60 additional munitions storage igloos within the existing MSA 1 at Andersen AFB, beginning in FY06. Each new igloo would be approximately 80 feet by 30 feet and covered with soil. No additional personnel would be assigned to Andersen AFB as a result of the project. The Finding of No Significant Impact for the first phase that would construct 12 igloos was signed October 14, 2005.

Table 2.4-1 Other Actions Announced for Andersen Main Base

Project	Color Code and Project Number on Figure 2.4-1	New Construction (Square Feet)	Demolition (Square Feet)	Start Date
Repair AEF FOL south runway, Phase 1	1 black	1,118,500	1,118,500	FY09
Construct munitions igloos	2 black	24,000	0	FY07
Construct AT/FP Perimeter Fence/Road	3 black	54,282	0	FY09
Relocate Main Gate	4 black	4,383	3,617	FY09
Construct War Readiness Materials Storage Warehouse	5 black	2,520	0	FY09
Construct Family Support Complex	6 black	162,600	162,600	TBD
Construct Education/Library Complex	7 black	116,250	116,250	FY09
Construct Consolidated Communications Facility	8 black	47,178	0	FY07
Repair AEF FOL South Runway, Phase 2	9 black	1,118,500	1,118,500	FY12
Construct Base Post Office/Bank Complex	10 black	13,433	0	TBD
Construct Aerospace Ground Equipment Corrosion Control Facility	11 black	--	--	TBD
Construct Civil Engineer Complex	12 black	86,832	TBD	TBD
Construct Combat Arms Training and Maintenance Facility	13 black	9,634	0	TBD
Construct Waste-to-Energy Plant	14 black	--	--	TBD
Construct Consolidated Wing Headquarters	15 black	27,125	0	TBD
Construct Air Traffic Control Tower	16 black	6,662	0	TBD
Extend Chicago Avenue	1 red	--	--	TBD
Relocate Military Clothing Sales	2 red	--	--	TBD
Repair Caroline Avenue	3 red	--	--	TBD
Install Security Lighting, New Commercial Gate	4 red	--	--	TBD
Wing Realignment Renovations	5 red	--	--	TBD
Install Generator (Water Wells)	6 red	--	--	TBD
Replace Short Approach Lighting System with Approach Lighting, 06L	7 red	--	--	TBD
Repair Sewer Lift Stations	8 red	--	--	TBD
Replace Sewer Force Main	9 red	--	--	FY06

Note: *Start dates reflected as FY. These are estimated start dates subject to Congressional funding. Due to possible funding shifts, construction could be delayed and the construction time periods could be extended. See Figure 2.4-2 for the location of the Combat Arms Training and Maintenance Facility (project number 13 black).*



Note:
Number indentifiers correspond to project on Table 2.4-1. Locations are approximate.

Projects ⑥⑧⑨ are at various locations throughout the base.

Figure 2.4-1

Location of Other Action Facility Projects

Andersen AFB, Guam

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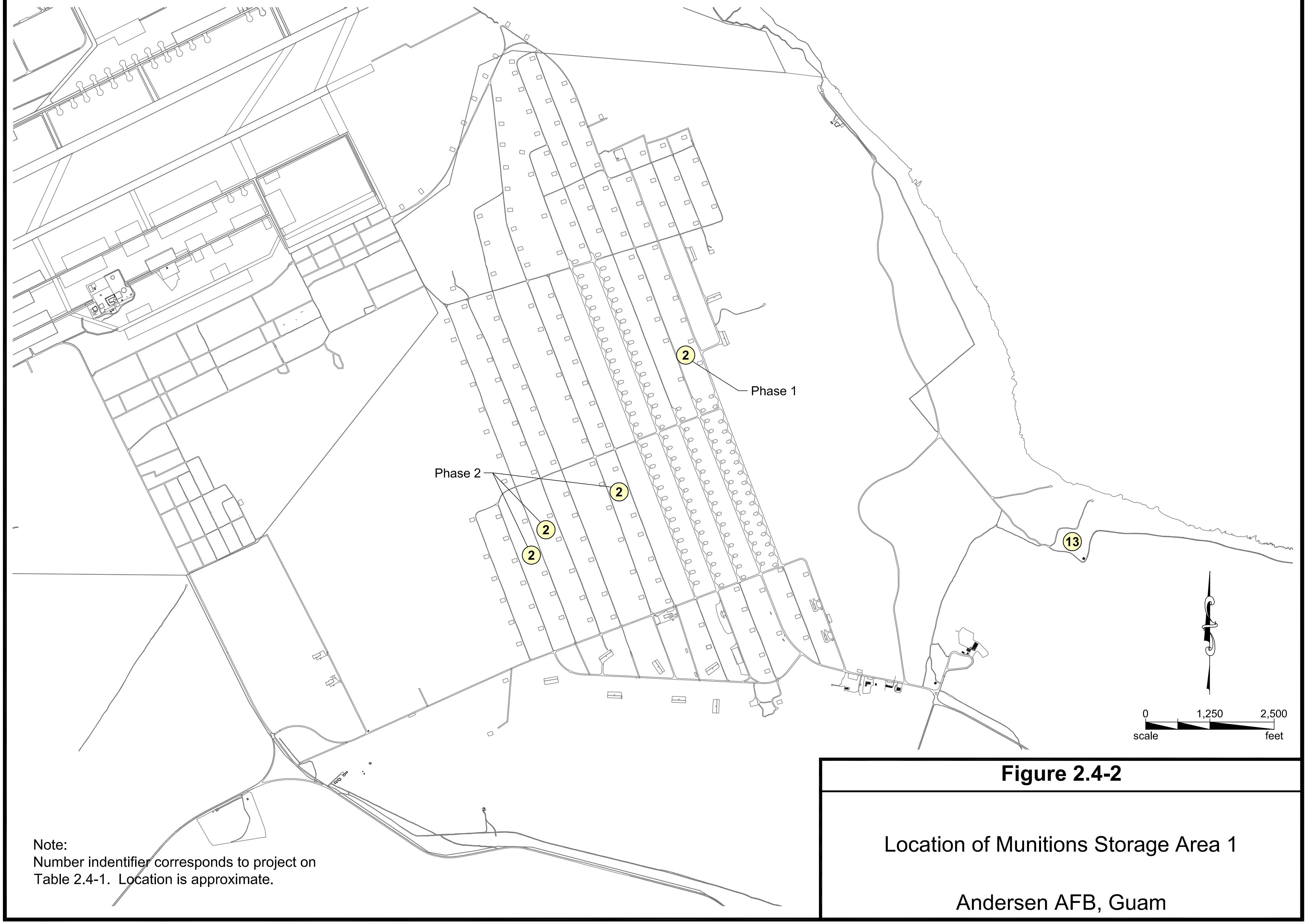

Note:
Number indentifier corresponds to project on Table 2.4-1. Location is approximate.

Figure 2.4-2

Location of Munitions Storage Area 1

Andersen AFB, Guam

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2.4.2 Other Actions on the Northwest Field Portion of Andersen AFB

2.4.2.1 Beddown of Training and Support Initiatives at Northwest Field

Another action that would begin before the ISR/Strike project and which would continue during the same time as implementation of the ISR/Strike capability would relocate one of PACAF's Rapid Engineer Deployable Heavy Operational Repair Squadron Engineer (RED HORSE) squadrons, a PACAF Combat Communications squadron, and the Silver Flag, Commando Warrior, and Combat Communications training programs to the Northwest Field area of Andersen AFB. These actions were assessed in an EA entitled *Environmental Assessment Proposed Beddown of Training and Support Initiatives at Northwest Field on Andersen Air Force Base, Guam*. The Finding of No Significant Impact for the action was signed June 20, 2006.

The RED HORSE squadron is restricted to deployment and employment in the country in which it is located. Additionally, the squadron's Silver Flag Training unit is located in another country. The Silver Flag Training unit trains other PACAF engineering squadrons and PACAF services personnel in a 7-day training exercise.

Training for PACAF security forces personnel is accomplished through five training courses that are part of the Commando Warrior training program. Training for PACAF combat communications personnel is conducted by a Combat Communications squadron in a 10-day Combat Communications course at an installation operated by one of the other U.S. military services.

Facility construction, addition, and alteration projects would be required to support relocation of the two squadrons and the three training programs to Northwest Field. Table 2.4-2 lists the type of unit and number of personnel that would be based at Northwest Field, and Table 2.4-3 contains information on the number of students, classes per year, and average number of students per class.

Facility construction projects are planned to begin in FY06 and be completed in FY16. Figure 2.4-3 shows the proposed project areas at Northwest Field and the routes for the respective water, electrical, sanitary sewer, and communications projects. Figure 2.4-4 shows the area of Andersen AFB main in which a dormitory would be constructed. Table 2.4-4 summarizes the amount of new building space, additional impervious cover, and additional area from construction and renovation associated with the Northwest Field action.

Table 2.4-2 Additional Personnel Associated with the Beddown of Training and Support Initiatives at Northwest Field

Unit Name	Number of Personnel
RED HORSE	140
Silver Flag Training	40
Commando Warrior Training	30
Combat Communication	140
Supporting Personnel (Base Operating Support)	30
Total	**380**

Note: The number in the Number of Personnel column reflects military, Air Force civilian, and contractor personnel. It is estimated approximately 120 of the personnel would not be accompanied by dependents and that 260 personnel would be accompanied by an average of 2.5 per each military, Air Force civilian, and contractor employee, or a total of 650 dependents.

Table 2.4-3 Students Associated with the Beddown of Training and Support Initiatives at Northwest Field

Training Course	Annual Number of Students	Number of Classes per Year	Training Days per Class
Silver Flag and Combat Communications	2,000	15	7
Silver Flag Special Class (GPS, Aircraft Barrier)	500	15	5
Commando Warrior	2,060	24	14-18
Total	**4,560**	**54**	**--**

There would be an average of 135 students per day based on 365 days per year and 4,560 students per year.

Source: PACAF 2005.

Table 2.4-4 Summary of Building Space, Impervious Cover, and Area of Construction and Renovation Associated with Northwest Field Action

Condition	Area in Square Feet
Additional Building Space	476,802
Additional Impervious Cover	1,322,924
Construction and Renovation Area	1,872,838

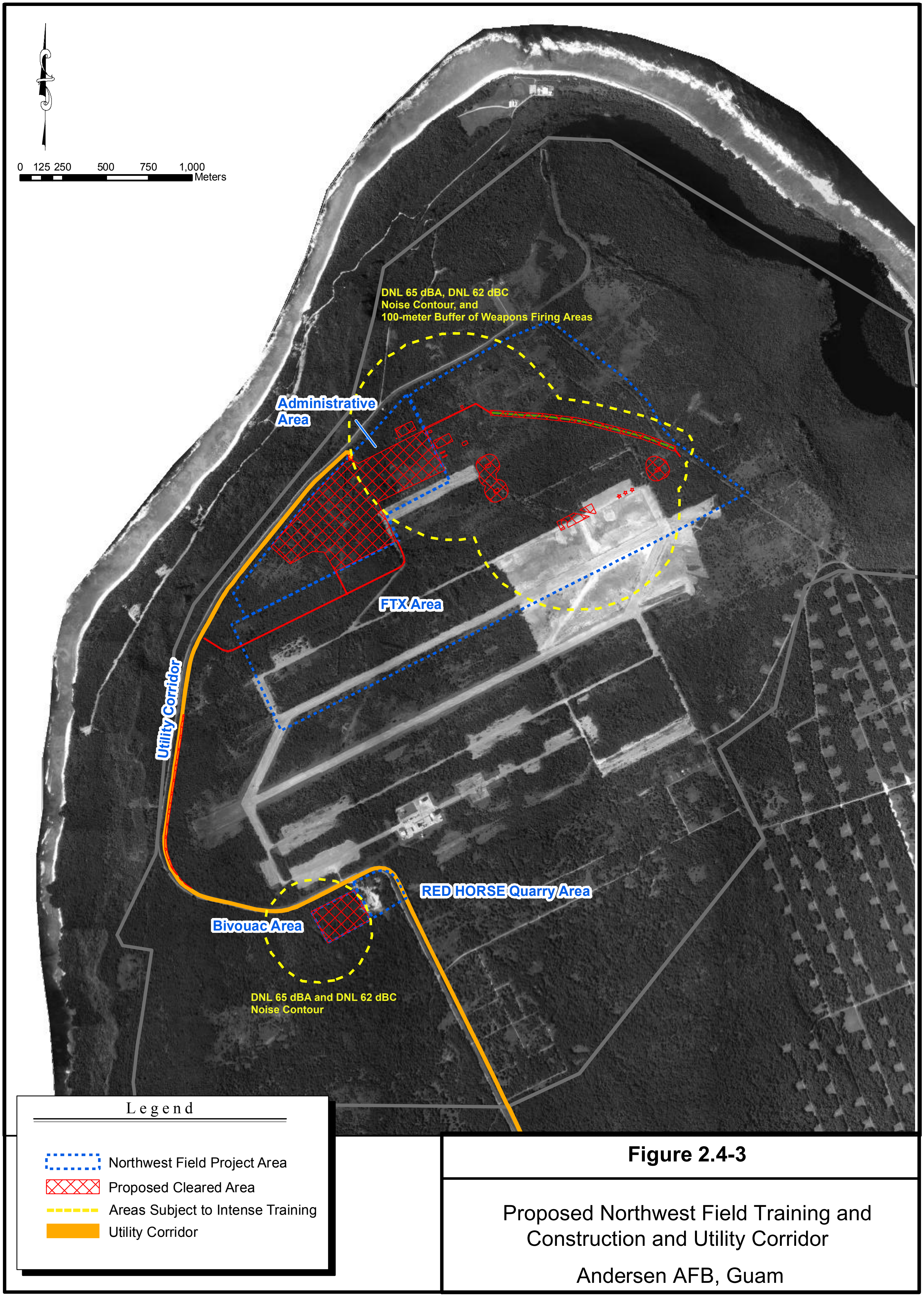

Figure 2.4-3

Proposed Northwest Field Training and Construction and Utility Corridor

Andersen AFB, Guam

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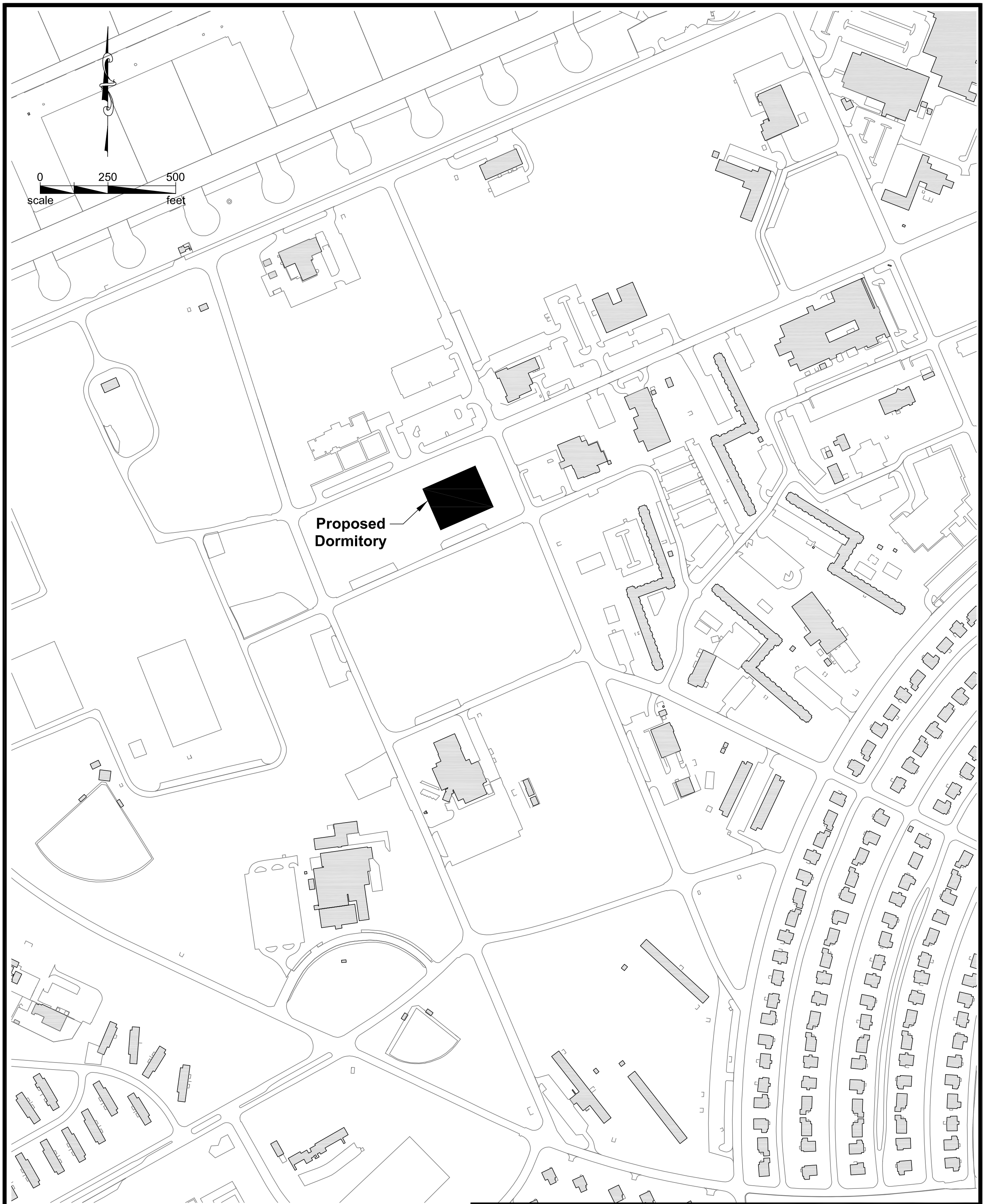

Figure 2.4-4

Potential Location for Dormitory

Andersen AFB, Guam

Note:
Location is approximate.

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2.4.2.2 Conservation Measures

Table 2.4-5 lists the forest habitat that would be cleared for the Northwest Field project infrastructure construction and training area establishment.

Table 2.4-5 Proposed Forest Habitat Clearing for the Northwest Field Project

Cleared Area	Acres	Hectares
Administrative Area	74	29.90
Road Connecting Administrative Area to Route 3A	2	0.90
Utilities Corridor	<1	0.05
Defensive Fighting Position Line	8	3.3
Unpaved Roads Connecting the Ends of the Defensive Fighting Position Line to Existing Roads	1	0.3
Entry Control Points, Base Defense Operations Centers, Sector Command Posts	17	6.83
Bivouac Training Area	15	6.00
Unpaved Road Connecting the Bivouac Training Area to Route 3A	<1	0.03
Total	**119**	**47.31**

The Northwest Field conservation measures are designed to be flexible and reduce impacts to T&E species resulting from the Beddown of Training and Support Initiatives at Northwest Field, specifically the Mariana crow, Mariana fruit bat, Guam rail, and the Micronesian kingfisher. The conservation measures, as components of the Northwest Field initiatives, correspond to recovery actions outlined in various USFWS recovery plans. The overall goals of the Northwest Field conservation measures are the same as those for the ISR/Strike project.

- **Wildlife Management Specialist**. The discussion for the wildlife management specialist for the ISR/Strike project applies to the Northwest Field conservation measure.
- **Ungulate Exclosure Fencing**. About 54 hectares (133 acres) of forest area would be fenced to create exclosures to prevent incursion of deer and pigs. The ungulate exclosure details for the ISR/Strike project apply to the Northwest Field conservation measure. Figure 2.2-7 shows the location of the proposed exclosure area.
- **Ungulate Management and Control Programs**. The discussion for the ungulate management and control programs for the ISR/Strike project applies to the Northwest Field conservation measure. Land available for public hunting currently totals approximately 1,265 hectares (3,126 acres) and is divided into hunting units. Some units are available on alternating days while others are available every day. Recreational hunting in 21 (total 671 hectares or 1,658 acres) hunting units would be eliminated or reduced in size due to the expected training operations in Northwest Field. Depredation hunts would not be conducted in these areas due to safety concerns. Recreational hunting would continue at the same level in the existing hunting units that would not be closed. The public hunting areas on Andersen AFB, and the units that would be removed from hunting in Northwest Field are shown in Figure 2.4-5.

- **Outplanting of Foraging Trees Important to Mariana Crow and Mariana Fruit Bat**. The processes and procedures for the ISR/Strike project apply to the Northwest Field conservation measure. Five 50-meter by 50-meter foraging plots are proposed.
- **Vegetation Surveys Relevant to Recovery of Mariana Crow and Mariana Fruit Bat**. The conservation measures for the ISR/Strike project apply to the Northwest Field conservation measure.
- **Environmental Education and Awareness Information**. This conservation measure is the same as the ISR/Strike measure except that the information concerning conservation issues at Andersen AFB would be made available to participants of the Northwest Field training programs instead of ISR/Strike personnel.
- **Brown Tree Snake Interdiction and Control.** The process and procedures outlined for the ISR/Strike conservation measures apply to the Northwest Field initiatives.
- **Area 50 and Experimental Habitat Management Unit**. Area 50 is an opportunistic experimental HMU south of the Northwest Field runway. This area lies within the overlay refuge, and in 1991 was fenced to exclude ungulates. In 1998, extensive measures were undertaken to remove BTSs from Area 50. The BTS control efforts reduced the population of BTSs enough to allow an experimental attempt to release captive-bred Guam rails into Area 50. Area 50 has also been studied extensively to directly compare forest growth, regeneration, and other ecological characteristics within secondary growth forests found in adjacent areas. The DAWR is the primary entity for these ecological studies. Area 50 would continue to be used for biological resources studies.

  A new habitat management unit (HMU) (60 hectares, 148 acres) would be established for biological resources studies within the overlay refuge, south of Northwest Field and west of MSA 1. The goal of the HMU is to create a 148-acre snake exclosure using a typhoon-proof snake barrier. Figure 2.4-6 shows Area 50 and the proposed location for the new HMU. The new HMU would be fenced to prevent incursion of deer, feral pigs, and BTSs. The fence would also be expected to repel feral cats. However, due to the difficulties of constructing a typhoon-proof snake fence, the text states that a weather resistant (*i.e.*, wind, salt spray, *etc*.) fence would be constructed. A fence that could withstand a typhoon in total would be very difficult to construct. Management and operation of the new HMU would be established in a partnering relationship between Andersen AFB, the USFWS, and the DAWR. The Area 50 Restoration Plan, which was developed by DAWR with assistance from the Air Force, United States Geological Service, USDA, and USFWS, will provide guidance for management of the new HMU.

  Management guidelines of the new HMU include the following objectives:

  - ***Brown tree snake control, including exclusion and eradication.*** Exclusion can be achieved through weather resistant fencing, with an access gate that would also repel snakes. The exclusion barrier would require periodic maintenance (particularly after

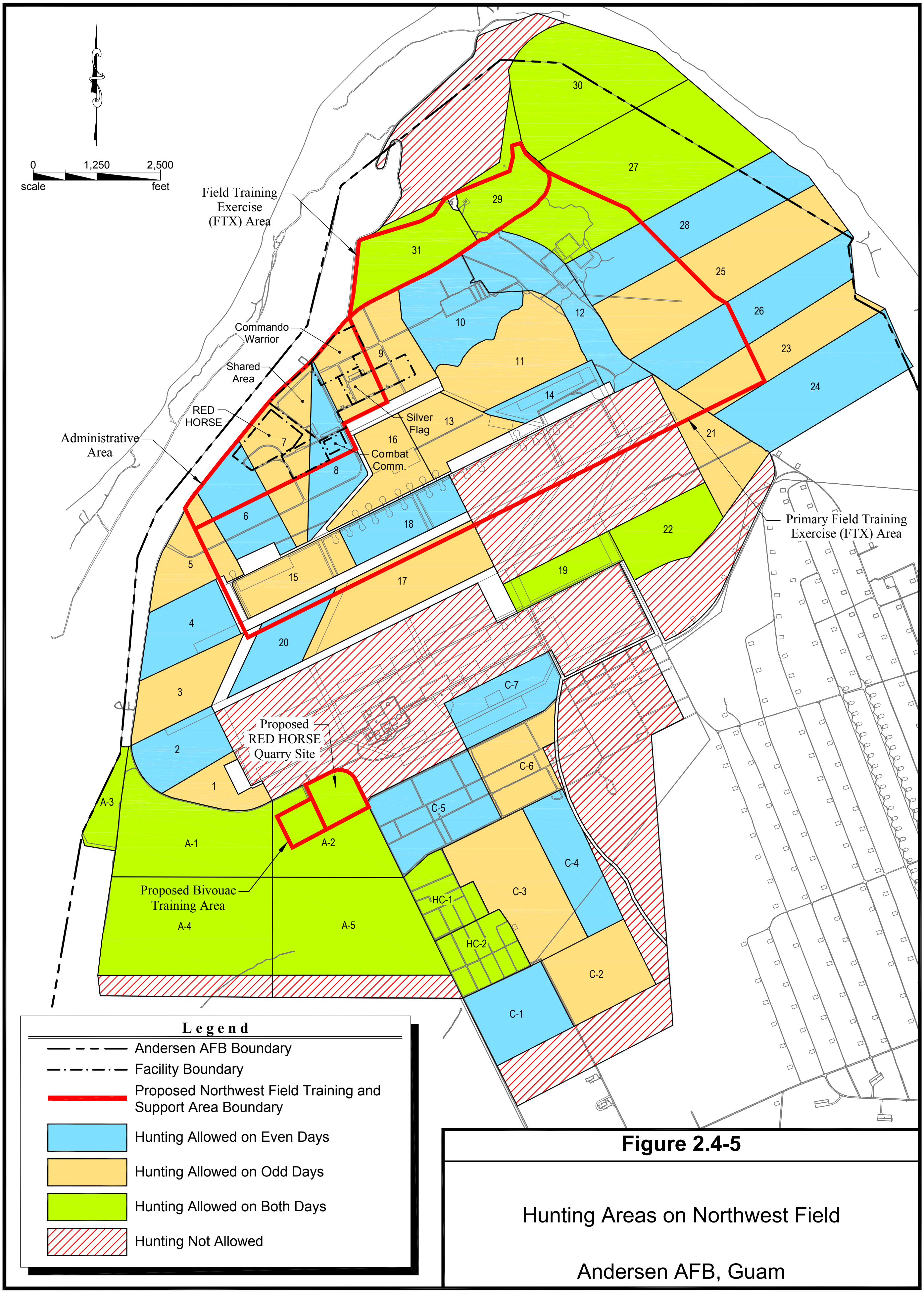

Figure 2.4-5

Hunting Areas on Northwest Field

Andersen AFB, Guam

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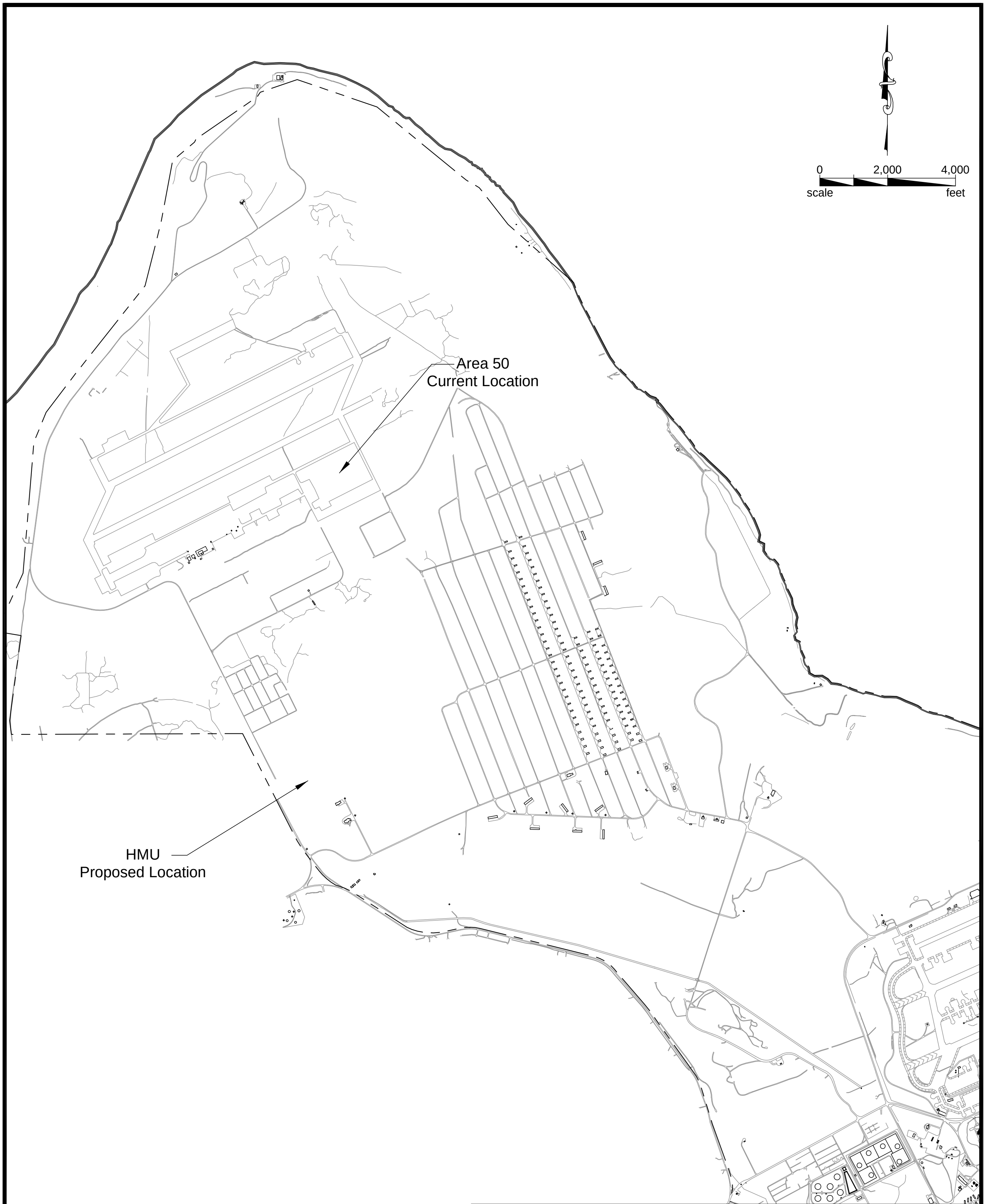

Figure 2.4-6

Location of Area 50 and Proposed New HMU

Andersen AFB, Guam

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typhoons), and vegetation removal around the barrier to prevent barrier breaches by BTSs. Eradication within the barrier can be accomplished through trapping and toxic bait stations, hand captures, visual searches, and monitoring for re-establishing populations (either due to barrier breach or unknown residual snakes).

- ***Deer and feral pig control, including exclusion and eradication.*** Exclusion would be accomplished with the BTS fence. Eradication would be accomplished through targeted removal within the area by the proposed Wildlife Management Specialist.
- ***Feral cat control, including exclusion and eradication.*** The BTS fence may be modified slightly to repel cats, and vegetation around the perimeter would be managed to prevent agile cats from climbing adjacent trees or shrubs and breaching the barrier. Eradication within the barrier would be accomplished through cage and leg-hold traps to remove existing cats and monitoring by spotlight surveys for additional animals.
- ***Rodent control, including exclusion and population reduction.*** Exclusion would be accomplished with the BTS and feral cat fence. Population reduction may be accomplished through targeted rodenticide application using bait boxes and monitoring for population increases using Hagaruma-type and snap traps.
- ***Native plant restoration and invasive plant removal***. These activities include outplanting of native woody species and targeted removal of invasive herbaceous species. Outplanting activities would be contingent on ungulate removal.
- ***Native bird reintroductions***. Reintroductions may occur in the area if exotic predators are eradicated from the area. It is possible that Guam rails could establish a breeding population in the area.

2.4.3 Other Air Force Unit Relocations to Andersen AFB

A Transportable Airlift Control Element (TALCE) unit and a Logistics Unit would be relocated to Andersen AFB beginning in FY06, with completion occurring during the same time period as the ISR/Strike action. No construction actions would be accomplished to accommodate either of the two units. Training for the TALCE and Logistics Unit would be accomplished within existing facilities. Table 2.4-6 lists the number of personnel associated with each unit.

Table 2.4-6 Additional Personnel Associated with Other Unit Relocations at Andersen AFB

Unit Name	Number of Personnel
Transportable Airlift Control Element	25
Logistics Unit	55
Total	**80**

Note: The number in the Number of Personnel column reflects military, Air Force civilian, and contractor personnel. It is estimated approximately 25 of the personnel would not be accompanied by dependents and that 55 personnel would be accompanied by an average of 2.5 per each military, Air Force civilian, and contractor employee, or a total of 138 dependents.

2.4.4 Summary of Additional Personnel at Andersen AFB from Other Actions

Table 2.4-7 summarizes the number of permanently based and dependent personnel that would occur under the other Northwest Field initiatives, and unit relocations that would occur at the same time as the establishment of the ISR/Strike capability. The table also details the estimated number of permanently based personnel who would not be accompanied by dependents and those who would be accompanied by dependents. No rotational personnel would occur as a result of the other actions.

Table 2.4-7 Summary of Additional Personnel at Andersen AFB from Other Actions

	Number of People
Permanently Based Military, Air Force Civilian, and Contractor	460
Accompanied	315
Unaccompanied	145
Dependents	788
Total Additional Personnel from Other Actions	**1,248**

Note: This table reflects the additional personnel associated with the Northwest Field initiatives and the unit relocations. No rotational personnel would occur under any of the other actions and no additional personnel would be associated with the other actions identified for Andersen AFB main.

2.5 IDENTIFICATION OF THE PREFERRED ALTERNATIVE

Alternative A is the Preferred Alternative.

CHAPTER 3
AFFECTED ENVIRONMENT

This chapter describes the existing environmental resources that could be affected by or could affect Alternative A, Alternative B, and the No Action Alternative. Only those specific resources relevant to potential impacts are described in detail. The baseline represents the current condition for the respective resource or conditions that may exist due to the No Action Alternative.

3.1 NOISE

Aviation-related activities at Andersen AFB dominate the acoustic environment. Equipment used during construction also generates noise. Therefore, noise from aircraft operations and construction activities is analyzed. Vehicular activity associated with the operation of government-owned vehicles (GOV) and privately owned vehicles (POV) contributes little to the general background noise levels around the airfield. Thus, noise from vehicle operation is not analyzed.

The characteristics of sound include parameters such as amplitude (loudness), frequency (pitch), and duration. Sound varies over an extremely large range of amplitudes. The decibel is the accepted standard unit for describing levels of sound. Decibels are expressed in logarithmic units to account for the variations in amplitude. On the dB scale, an increase of 3 dB represents a doubling of sound energy. A difference on the order of 10 dB represents a subjective doubling of loudness.

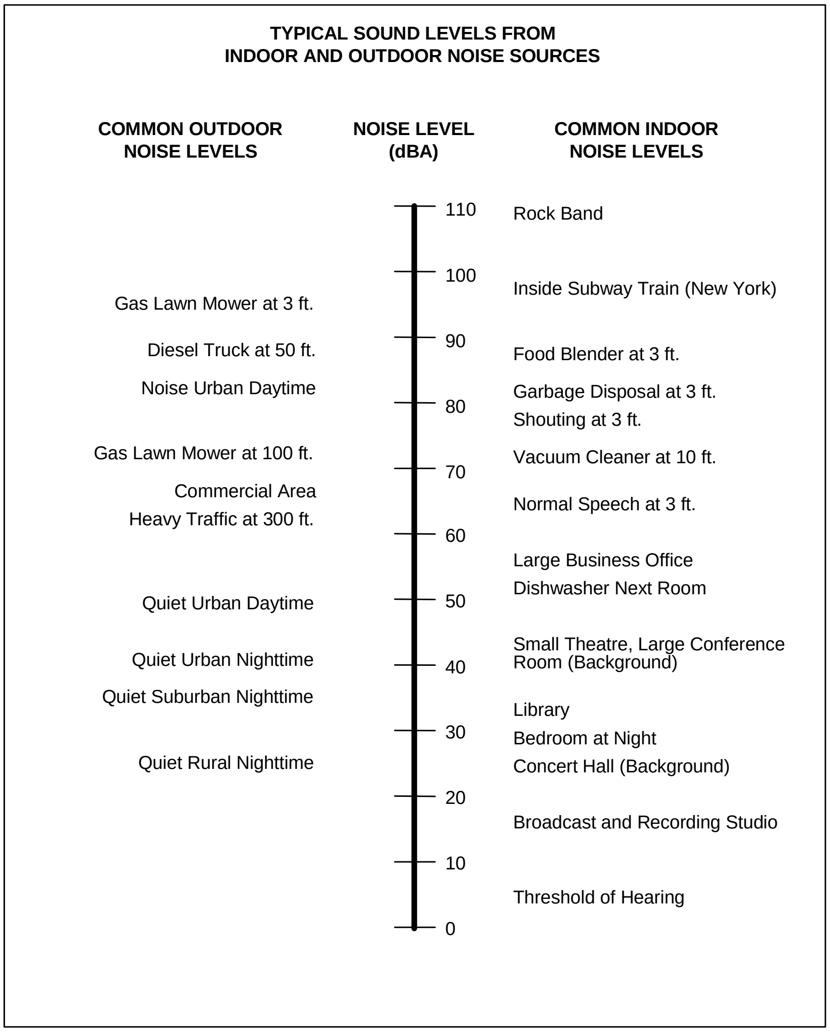
Different sounds have different frequency contents. Because the human ear is not equally sensitive to sound at all frequencies, a frequency-dependent adjustment, called A-weighting, was developed to measure sound similar to the way the human hearing system responds. The adjustments in amplitude, established by the American National Standards Institute (ANSI 1983), are applied to the frequency content of the sound. Figure 3.1-1 depicts typical A-weighted sound pressure levels (dBA) for various sources. As indicated in the figure, 65 dBA is equivalent to normal speech at a distance of 3 feet.

Noise is defined as sound that is undesirable because it interferes with speech and hearing, is intense enough to damage hearing, or is otherwise annoying. Noise levels change with time and the distance of the receptor from the noise source.

3.1.1 Noise Metrics and Analysis Methods

A variety of metrics may be used to assess the impacts of noise. Depending on the specific situation, appropriate analysis may include single event or averaged metrics. Single event metrics are used to assess the potential impacts of noise on structures and animals, and are sometimes used in the assessment of human effects. Sound exposure level (SEL), a single event metric, is commonly used to evaluate sleep disturbance. Averaged noise metrics are useful in characterizing the overall noise environment and are primarily used to analyze community (population) exposure to noise. Averaged noise exposure is expressed as the day-night average sound level (DNL) metric. The USEPA selected DNL as the uniform descriptor of averaged noise exposure. Subsequently, federal agencies, including the DoD, adopted DNL for expressing averaged sound. DNL is used to estimate the number of persons potentially highly annoyed by aircraft noise.

Figure 3.1-1 Typical A-Weighted Noise Levels



Single Event Sound Metrics

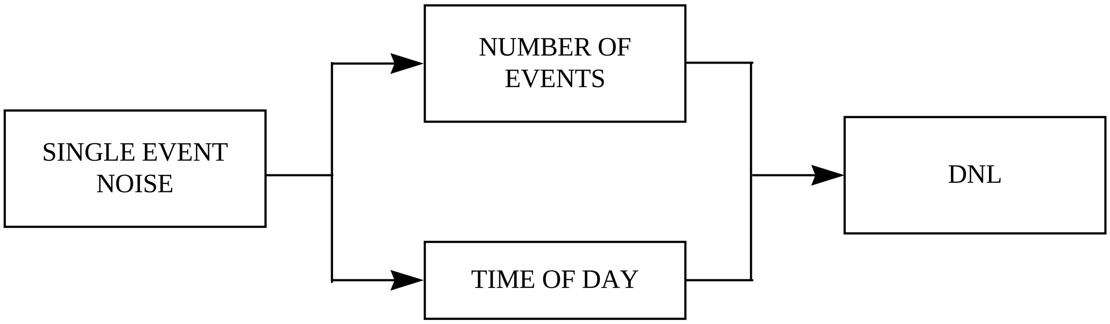
Although the highest dBA level measured during an event (*i.e.*, maximum sound level, L_{max}) is the most easily understood descriptor for a noise event, alone it provides little information. Specifically, it provides no information concerning either the duration of the event or the amount of sound energy. Thus, SEL, which is a measure of the physical energy of the noise event and accounts for both intensity and duration, is used for single event noise analysis. Subjective tests indicate that human response to noise is a function not only of the maximum level, but also of the duration of the event and its variation with respect to time. Evidence indicates that two noise events with equal sound energy will produce the same response. For example, a noise at a constant level of 85 dBA lasting for 10 seconds would be judged to be equally as annoying as a noise event at a constant level of 82 dBA and duration of 20 seconds (*i.e.,* 3 dBA decrease equals one half the sound energy but lasting for twice the time period). This is known as the “equal energy principle." The SEL value represents the A-weighted level of a constant sound with a duration of 1 second, providing an amount of sound energy equal to the event under consideration.

By definition, SEL values are referenced to a duration of 1 second and should not be confused with either the average (L_{eq}) or L_{max} associated with a specific event. The L_{eq} is the constant level which has the same A-weighted sound energy as that contained in the time-varying sound. When an event lasts longer than 1 second, the SEL value will be higher than the L_{max} from the event. The L_{max} would typically be 5 to 10 dBA below the SEL value for aircraft overflight.

Averaged Noise Metrics

Single event analysis has a major shortcoming -- single event metrics do not describe the overall noise environment. DNL is the measure of the total noise environment. DNL averages the sum of all aircraft noise producing events over a 24-hour period, with a 10 dBA upward adjustment added to the nighttime events (between 10:00 p.m. and 7:00 a.m.). Figure 3.1-2 depicts the relationship of the single event, the number of events, the time of day, and DNL. This adjustment is an effort to account for increased human sensitivity to nighttime noise events. The summing of sound during a 24-hour period does not ignore the louder single events, it actually tends to emphasize both the sound level and number of those events. The logarithmic nature of the dB unit causes sound levels of the loudest events to control the 24-hour average.

Figure 3.1-2 Day-Night Average A-Weighted Sound Level



DNL is the accepted unit for quantifying annoyance to humans from general environmental noise, including aircraft noise. The Federal Interagency Committee on Urban Noise (FICUN) developed land use compatibility guidelines for noise exposure areas (FICUN 1980). Based on these FICUN guidelines, the Federal Aviation Administration (FAA) developed recommended land uses in aircraft noise exposure areas. The Air Force uses DNL as the method to estimate the amount of exposure to aircraft noise and predict impacts. Land use compatibility and incompatibility are determined by comparing the predicted DNL level at a site with the recommended land uses.

Noise Analysis Methods

NOISEMAP noise model, version 7.296, was used to develop the noise contours and DNL and SEL values from airfield operations for this EIS. Maximum sound level noise used in this EIS was calculated by using the Flyover Noise Calculator (USAF 2002).

NOISEMAP is a suite of computer programs developed by the Air Force to predict noise exposure in the vicinity of an airfield due to aircraft flight, maintenance, and ground run-up operations. Data describing flight tracks and flight profile use, power settings, ground run-up information by type of aircraft/engine, and meteorological variables are assembled and processed for input into NOISEMAP. The model uses this information to calculate SEL and DNL values at points on a regularly spaced grid surrounding the airfield. A plotting program generates contour lines connecting points of equal DNL values in a manner similar to elevation contours shown on topographic maps. Contours are generated as 5 dB intervals beginning at DNL 65 dBA, the maximum level considered acceptable for unrestricted residential use. The contours produced by NOISEMAP are used in the averaged noise analysis sections in this EIS. While there is no technical reason why a lower level cannot be measured or calculated for comparison purposes, DNL 65 dBA:

- has been adopted by the DoD, USEPA, FAA, and HUD as the threshold for comparing and assessing community noise effects; and
- represents a noise exposure level which is normally dominated by aircraft noise and not other community or nearby highway noise sources.

Although the number of military and civil aircraft operations at an installation usually varies from day to day, NOISEMAP requires input of the specific numbers of daily flight and aircraft maintenance engine runup operations. The Air Force does not follow the Federal Aviation Administration's use of the "average annual day" in which annual operations are averaged over an entire 365-day year. Neither does the Air Force use the "worst-case day" since it typically does not represent the typical noise exposure. Instead, the Air Force uses the "average busy day" concept in which annual operations for an aircraft type are averaged over the number of flying days per year by that aircraft type. Non-flying days (*e.g.*, weekends or holidays) are not used in computing the "average busy day" operations. The "average busy day" concept is used for noise modeling in this EIS.

3.1.2 Baseline Noise Analysis

The primary source of noise in the vicinity of Andersen AFB is airfield operations. Baseline noise conditions are based on the average daily airfield operations shown on Table 2.3-1 (No Action Alternative). About 235 average daily airfield operations occur at Andersen AFB under the baseline condition. Approximately 5 percent of the operations occur during the nighttime (10:00 p.m. to 7:00 a.m.). These operations and the resultant baseline noise environment are based on airfield operations data collected in 2003 (AFCEE 2003). Figure 3.1-3 shows the baseline condition aircraft ground tracks, and Figure 3.1-4 depicts the noise exposure area for the baseline.

Residences and public use facilities such as schools, libraries, hospitals, churches, nursing homes, and recreational areas are more sensitive to noise than those in other types of facilities because the activities that take place in those structures require lower sound levels and, for that reason, were selected for use as analysis points for the effect of aircraft noise at these public facilities. Table 3.1-1 lists the DNL and SEL values at the 10 points selected for analysis for the aircraft producing the greatest SEL at the point. The maximum sound level at the analysis point would typically be 5 to 10 dBA below the SEL value for aircraft overflight.

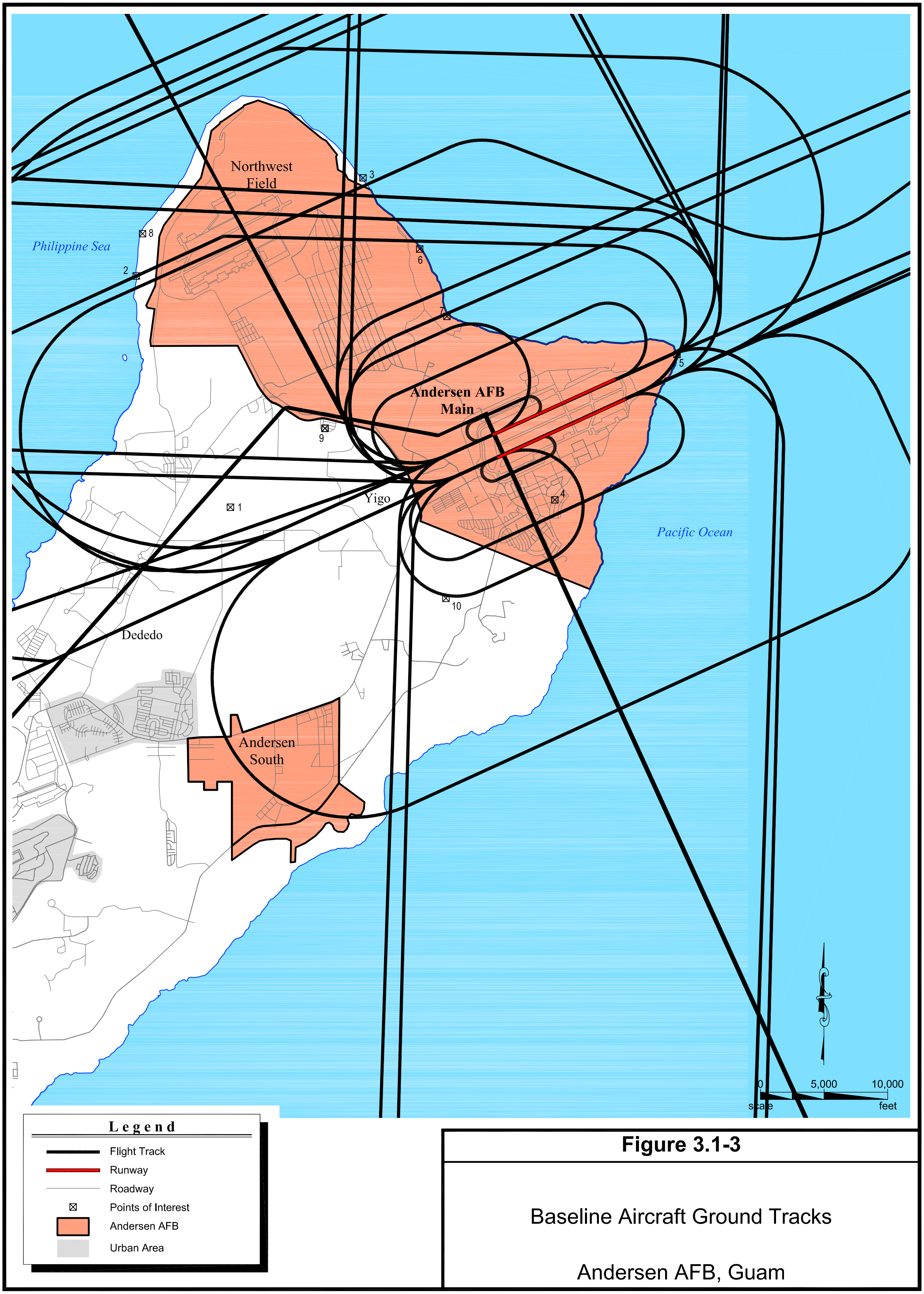


Figure 3.1-3

Baseline Aircraft Ground Tracks

Andersen AFB, Guam

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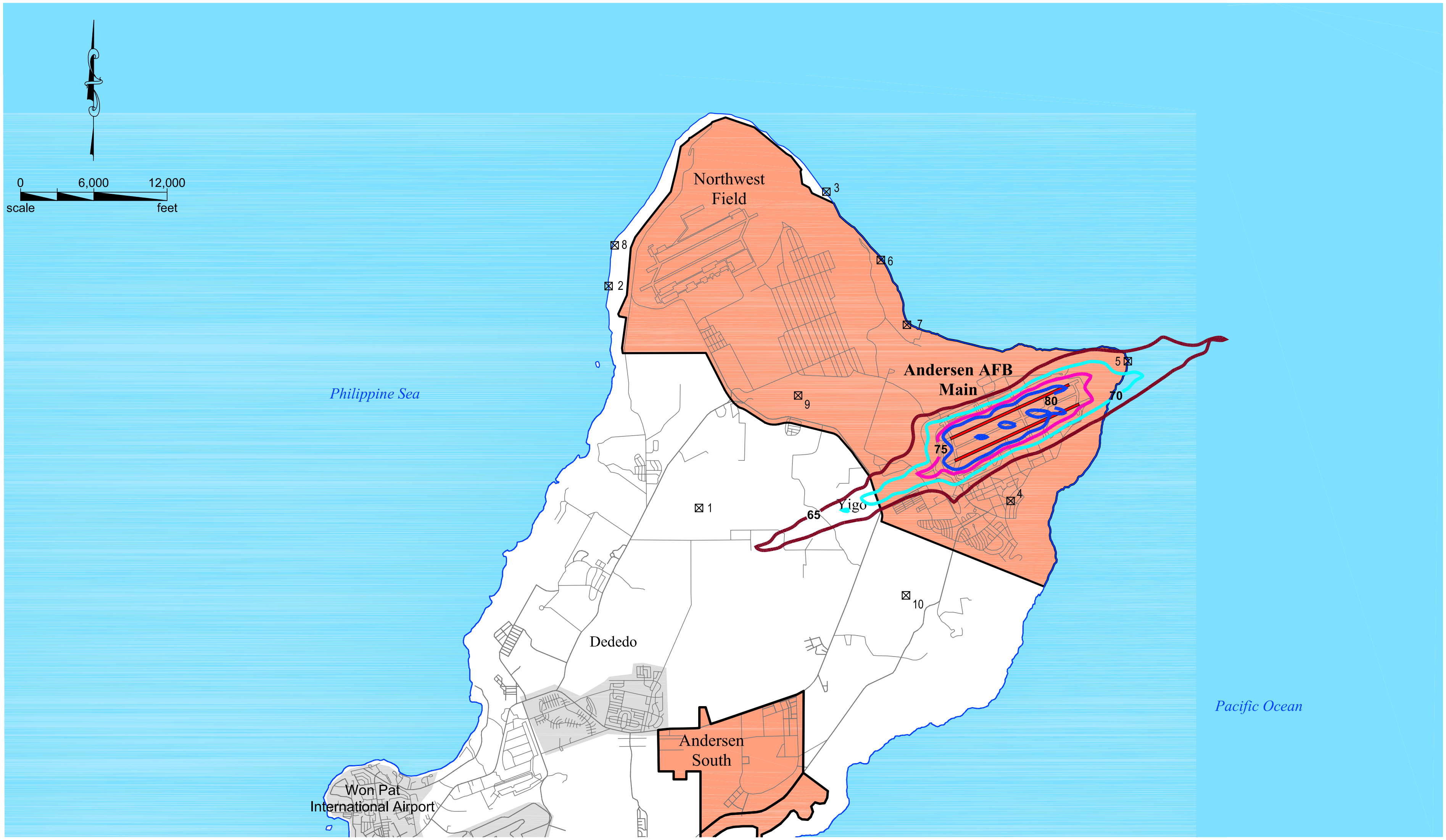

Figure 3.1-4

Baseline Noise Contours

Andersen AFB, Guam

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Single Event Sound Analysis

Single event analysis is conducted to evaluate effects on noise-sensitive receptors. Figures 3.1-3 and 3.1-4 show the ten points identified for analysis in the area surrounding the airfield. These points are locations where the public may be sensitive to noise from single aircraft overflight events.

Table 3.1-1 Baseline DNL and SEL at Analysis Points

Number	Description	DNL (dBA)	Aircraft	SEL (dBA
1	Dededo	49	C-5	99
2	Falcona Beach	47	C-5	108
3	Jinapsan Beach	47	C-5	111
4	Andersen AFB Middle School	55	EA-6B	103
5	Pati Point	66	C-5	116
6	Tarague Beach	44	C-5	98
7	Tarague Channel	44	F-18	97
8	Uruno Point	36	C-5	90
9	Off-Base School	41	C-5	106
10	Yigo	54	EA-6B	108

Note: The SEL shown in the table is the loudest SEL for only those aircraft flying the top 20 flight tracks events contributing the most DNL at each location. NOISEMAP determines the SEL for the 20 flight track events contributing the most DNL at each analysis point. These SEL values may not necessarily be the loudest SEL values occurring at each point. It is possible for an aircraft to produce a larger SEL, but because of the infrequency of occurrence, the aircraft would not be among the top 20 contributors to the DNL level at the location. The maximum sound level would typically be 5 to 10 dBA below the SEL value for aircraft overflight. The analysis point number and description correspond to the point as reflected on the noise contour and aircraft ground track figures. There may be minor differences when comparing the DNL for a point from the table to the DNL for the point as depicted on the noise contour figure. This difference is a result of small misalignments during the process of overlaying the noise contours the background map.

Day-Night Average Noise Analysis

Table 3.1-2 presents the results of over a dozen studies on the relationship between noise and annoyance levels. This relationship was suggested by Schultz (1978) and was reevaluated for use in describing the reaction of people to environmental noise (Fidell, *et al.* 1988). These data provide a perspective on the level of annoyance that might occur. For example, 12 to 22 percent of people exposed on a long-term basis to DNL of 65 to 70 dBA are expected to be potentially highly annoyed by noise events. The study results summarized in Table 3.1-2 are based on outdoor noise levels.

Table 3.1-2 Theoretical Percentage of Population Potentially Highly Annoyed by Noise Exposure

DNL Intervals in dBA	Percentage of Persons Highly Annoyed
<65	<12
65-70	12-22
70-75	22-37
75-80	37-54
>80	61

Note: Noise impacts on individuals vary as do individual reaction to noise. This is a general prediction of the percent of the community potentially highly annoyed based on environmental noise surveys conducted around the world.

Source: Adapted from NAS 1977

Figure 3.1-4 shows the DNL noise contours for the baseline average daily airfield operations condition at Andersen AFB. Table 3.1-3 lists the number of acres (land area off-Base, excluding water surface), the number of people within the DNL 65 dBA and greater noise exposure area, and the estimated number of people who might be potentially highly annoyed by noise at those levels.

Table 3.1-3 Baseline Noise Exposure

	DNL Interval (dBA)				
Category	**65-70**	**70-75**	**75-80**	**80+**	**Total**
Acres	353	22	0	0	375
People	242	14	0	0	256
People Potentially Highly Annoyed	53	5	0	0	58

Note: Acres reflect only off-Base land area (excluding water surface). Population data used to determine the number of people within a noise zone were obtained from the United States Census Bureau 2000 census. It was assumed that population was equally distributed within a census tract area to estimate affected population. Using the noise contour information, the number of acres of land in each noise zone (e.g., DNL 65-70 dBA, 70-75 dBA, 75-80 dBA, and 80 dBA and greater) were divided by the number of acres of land in each census block to determine the portion of the census tract within each noise zone. The population total in each block-group was then multiplied by this ratio to estimate affected population within each zone. This process was used throughout the EIS. People highly annoyed were determined by multiplying the total number of people in the noise zone times the higher percent number for the interval in Table 3.1-2

Effect of Aircraft Noise on Wildlife

In addition to effects of aircraft noise on humans, there is a possibility that animals near the airfield would be affected by noise from baseline aircraft operations, particularly mammals (bats) and birds. Subchapter 4.5 contains additional information concerning the effects of aircraft noise on the Mariana crow and Mariana fruit bat.

3.2 LAND USE

Andersen AFB is located on the north half of the Island of Guam. The Base is bounded on the south by Yigo and Dededo, by the Pacific Ocean to the north and east, and by the Philippine

Sea to the west. The majority of residents in Guam reside on the northern half of the island. Most of the off-Base land use in the vicinity of Andersen AFB is considered low density residential.

A narrow strip of non-Air Force land lies between Andersen AFB and the Pacific Ocean and the Philippine Sea to the north, northeast, and northwest of the Base boundary. The land to the northeast is accessed by the owners through a corridor on the Base under an agreement between the land owners and the Air Force.

Figure 3.2-1 depicts the land uses for Andersen main base established in the Andersen AFB General Plan. The land use categories include: administrative, aircraft operations and maintenance, airfield, community, housing (unaccompanied), housing (accompanied), industrial, medical, open space, outdoor recreation, and water.

The purpose of the long-standing AICUZ program is to promote compatible land development in areas subject to aircraft noise and accident potential around military airfields. The Air Force has no desire to recommend land use regulations that render property economically useless. An AICUZ Study reaffirms Air Force policy of assisting local, regional, state, and federal officials in the areas surrounding the military installation by promoting compatible development within the AICUZ area of influence; and protecting Air Force operational capability from the effects of land use that are incompatible with aircraft operations. AICUZ studies make recommendations for local government agencies to plan, zone, and mitigate noise, and to help protect the integrity of the installation’s flying mission.

AICUZ land use guidelines (see Table 3.2-1) reflect land use recommendations for clear zones (CZ), accident potential zones (APZ) I and II, and four noise exposure zones. Figure 3.2-2 depicts the CZs and APZs for Andersen AFB. The figure also depicts the four noise exposure zones based on the aircraft noise modeling accomplished for the Andersen AFB AICUZ Report prepared in 1998 and released to the public in 2001 (Andersen AFB 1998). The AICUZ Report is referred to as the 2001 AICUZ Report in this EIS. The noise contours in Figure 3.2-2 are not used for the baseline noise condition (No Action Alternative) in this EIS because the noise contours prepared from the aircraft operations data collected by AFCEE in 2003 more accurately reflect the current operations condition. The following paragraphs define the CZ and APZs.

- Clear Zone Surface—The CZ width is 3,000 feet (1,500 feet to either side of runway centerline) and extends outward 3,000 feet. Some obstructions may occur within the CZ if permitted under AICUZ land use guidelines, or if appropriate authorities waive airfield planning guidance. Of the three zones (*i.e.*, CZ, APZ I and APZ II, the CZ is the area with the greatest potential for an accident (see Figure 3.11-1).
- Accident Potential Zone Surfaces - APZ I begins at the outer end of the CZ and is 5,000 feet long and 3,000 feet wide. APZ II begins at the outer end of APZ I and is 7,000 feet long and 3,000 feet wide. APZ I has less accident potential than the CZ and APZ II has less potential than APZ I.

The land use guidelines in Table 3.2-1 were established on the basis of studies prepared and sponsored by several federal agencies, including the Department of Housing and Urban Development, USEPA, Air Force, and state and local agencies. The guidelines recommend land uses that are compatible with airfield operations while allowing maximum beneficial use of adjacent properties. The Air Force has an obligation to the inhabitants of the areas surrounding

Andersen AFB and to the citizens of the United States to point out ways to protect the people in adjacent areas, as well as the public investment in the installation itself.

Table 3.2-1 Recommended Land Use

	Clear Zones and Accident Potential Zones			**Noise Zones**			
Generalized Land Use	**CZ**	**APZ I**	**APZ II**	**65-69 dBA**	**70-74 dBA**	**75-79 dBA**	**80+ dBA**
Residential	No	No	Yes[1]	Not Recommended[4]	Not Recommended[4]	Not Recommended	Not Recommended
Commercial	No	No	Yes[2]	Recommended	Recommended	Recommended	Not Recommended
Industrial	No	Yes[2]	Yes[2]	Recommended	Recommended	Recommended	Recommended
Public/Quasi-Public	No	No	Yes[2]	Recommended	Not Recommended[4]	Not Recommended[4]	Not Recommended
Recreational	No	Yes[2]	Yes[2]	Recommended	Recommended	Not Recommended	Not Recommended
Open/Agriculture/Low Density	No[3]	Yes[2]	Yes[2]	Recommended	Recommended	Recommended	Recommended

1. Suggested maximum density one dwelling unit per acre.
2. Only limited low-density, low-intensity uses recommended.
3. Except for limited agricultural uses.
4. Unless sound attenuation materials are installed.
Source: Adapted from USAF 1999.

Most of the off-Base land in the immediate vicinity of Andersen AFB main base is undeveloped or residential with low to moderate density. The 2001 AICUZ Report indicates there is no off-Base incompatible land use resulting from aircraft noise (Andersen AFB 1998).

About 718 acres of land in the Village of Yigo occur in APZ II to the southwest of the Base. As shown on Figure 3.2-2, APZ II for Runways 06 Left and Right occurs outside the Andersen AFB boundary. The area surrounding this APZ continues the trend of low-to-moderate density housing with pockets of commercial activity along major roads. The 2001 AICUZ Report indicates there are 140 acres of residential land in the Runways 06 Left and Right APZ II that are considered incompatible when considering the safety element of the AICUZ program. Housing units range from two to four units per acre and exceed the one to two dwelling units per acre maximum recommended for APZ II (Andersen AFB 1998).

All other CZs and APZs occur either within the Andersen AFB boundary or are over water to the northeast. Therefore, there is no incompatible land uses in these areas when considering the safety element of the AICUZ program.

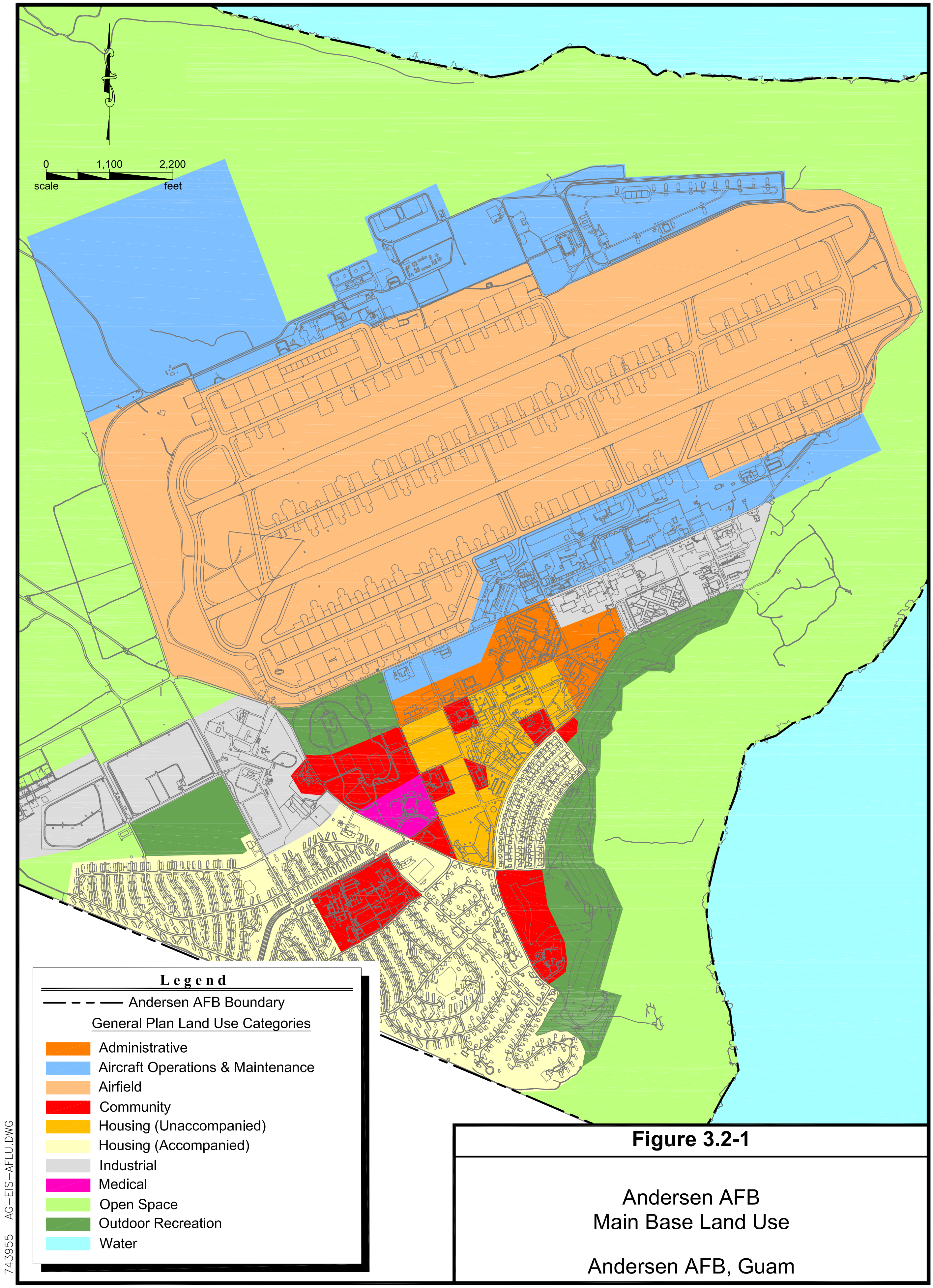

Figure 3.2-1

Andersen AFB
Main Base Land Use

Andersen AFB, Guam

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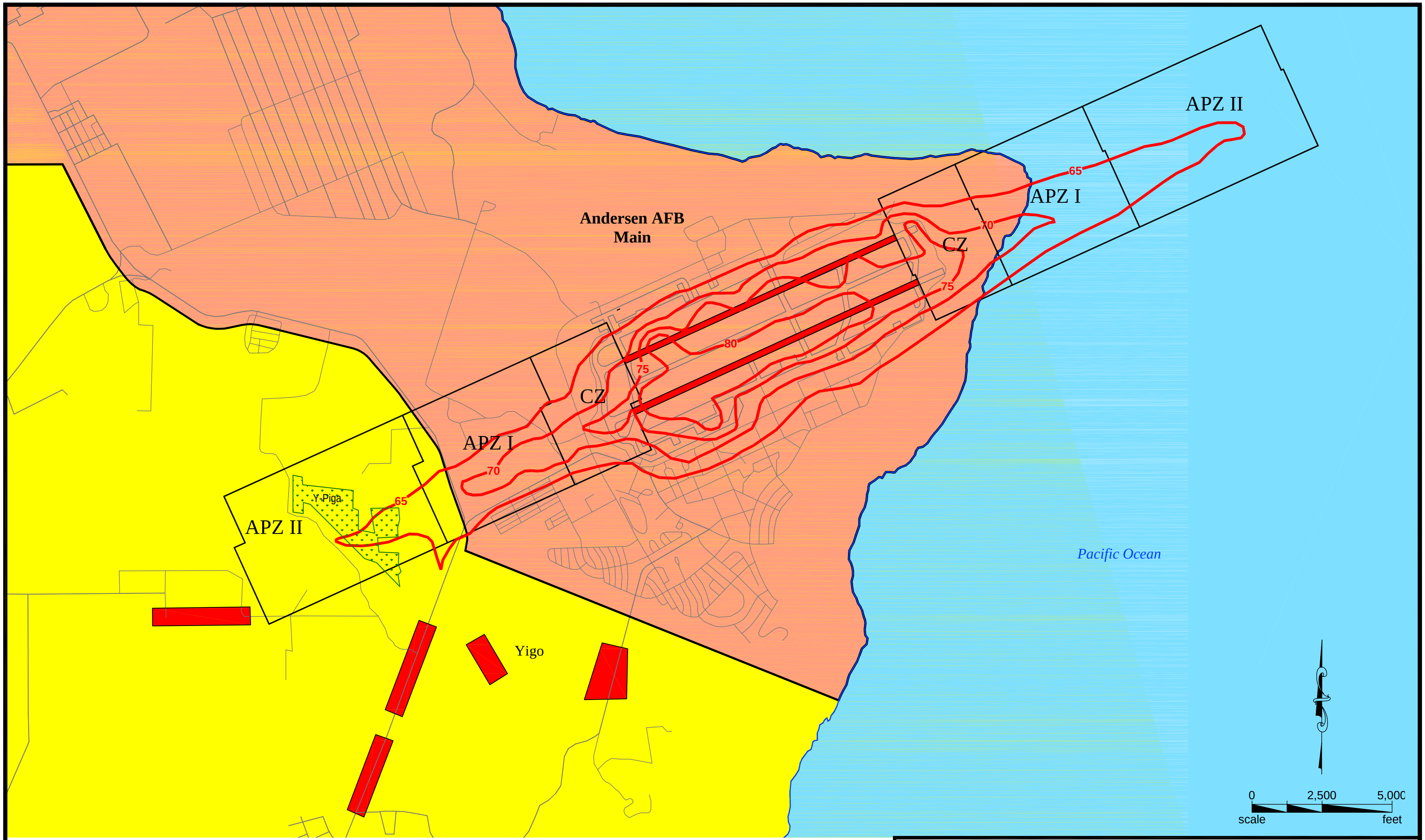

Legend

🟥	2001 AICUZ Noise Contours	▨	Andersen AFB
▬	Runway	🟨	Residential Land Use
—	Roadway	🟥	Commercial Land Use
		⁘	Conservation Reserve

Note:
The noise contours on this figure are from the AICUZ report that was released to the public in 2001. These contours are not used for the Baseline Noise of the No Action Alternative.

Source: Andersen AFB 1998.

Figure 3.2-2

Andersen AFB Clear Zones, Accident Potential Zones, and Off-Base Future Land Use

Andersen AFB, Guam

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Future land use in Guam is based on the Land Use Intensity system of land use planning. This system concentrates on the intensity of use instead of the type of use and assumes that certain uses have about the same impact on the land, such as residential and office use. The Runway 06 Left and Right APZ II is a naturally pervious area consisting of a number of sinkholes that allow rapid recharging of the aquifer, and development in the area is limited because of the importance of the recharge capability (Andersen AFB 1998). Figure 3.2-2 depicts the future land use for the off-Base area to the immediate south and west of the main base. Andersen AFB works closely with Guam planning offices to ensure compatible development in areas adjacent to the Base.

3.3 AIR QUALITY

Air quality in any given region is measured by the concentration of various pollutants in the atmosphere, typically expressed in units of parts per million (ppm) or in units of micrograms per cubic meter (µg/m3). Air quality is not only determined by the types and quantities of atmospheric pollutants, but also by surface topography, size of the air basin, and by prevailing meteorological conditions. The six criteria pollutants are ozone (O_3), particulate matter (PM_{10}), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), and lead (Pb).

Ozone (ground-level ozone), which is a major component of “smog,” is a secondary pollutant formed in the atmosphere by photochemical reactions involving previously emitted pollutants or precursors. Ozone precursors are mainly nitrogen oxides (NO_x) and volatile organic compounds (VOC). NO_x is the designation given to the group of all oxygenated nitrogen species, including nitric oxide (NO), NO_2, nitrous oxide (N_2O), and others. However, only NO, NO_2, and N_2O are found in appreciable quantities in the atmosphere. VOCs are organic compounds (containing at least carbon and hydrogen) that participate in photochemical reactions and include carbonaceous compounds except metallic carbonates, metallic carbides, ammonium carbonate, carbon dioxide, and carbonic acid. Some VOCs are considered non-reactive under atmospheric conditions and include methane, ethane, and several other organic compounds. The level of O_3 in the air depends on the outdoor levels of these organic gases, the radiant energy of the sun, and other weather conditions. The biggest concern with high O_3 concentrations is the damage it causes to human health, vegetation, and many common materials used everyday. High O_3 concentrations can cause shortness of breath, coughing, wheezing, headaches, nausea, eye and throat irritations, and lung damage.

There are two categories of particulate matter: particles with diameters less than 10 microns (PM_{10}); and particles with diameters less than 2.5 microns ($PM_{2.5}$). Currently, there are area designations only for PM_{10}. The sources of PM_{10} emissions include industrial and agricultural operations, automobile exhaust, and construction. Since PM_{10} is so small, it is not easily filtered and can penetrate into deeper portions of the lungs. Chronic and acute respiratory illnesses may be caused from inhalation of PM_{10}.

Particulate matter, which comes from diesel exhaust, is a concern. Diesel exhaust is emitted from a broad range of diesel engines, including the on-road diesel engines of trucks and the off-road diesel engines of heavy duty equipment. Exposure to diesel particulate matter is most commonly through breathing the air that contains the diesel particulate matter. Exposure to diesel particulate matter comes from both on-road and off-road engine exhaust that is either directly emitted from the engines or aged through lingering in the atmosphere. Diesel exhaust causes health effects from both short term or acute exposures and also long term chronic exposures. Acute exposure to diesel exhaust may cause irritation to the eyes, nose, throat, and lungs, and some neurological effects such as lightheadedness. Acute exposure may also elicit coughing or nausea and exacerbate asthma. Chronic exposures in experimental animal inhalation studies show a range of dose-dependent lung inflammation and cellular changes in the lung. There are also diesel exhaust immunological effects. Based on human and laboratory studies, there is considerable evidence that diesel exhaust is a likely carcinogen. Human epidemiological studies demonstrate an association between diesel exhaust exposure and increased lung cancer rates in occupational settings (USEPA 2006a).

Nitrogen dioxide is a reddish-brown to dark brown poisonous gas that produces an irritating odor. It is a byproduct of high combustion sources. Health effects include damage to lungs, bronchial and respiratory system irritation, headaches, nausea, coughing, choking, and chest pains.

Carbon monoxide is a colorless, odorless, and tasteless toxic gas found naturally in trace quantities in the atmosphere and emitted from any form of combustion. At low concentrations, the central nervous system is affected. At higher concentrations, irritability, headaches, rapid breathing, blurred vision, lack of coordination, nausea, and dizziness can all occur. It is especially dangerous indoors when ventilation is inadequate; unconsciousness or death can occur.

Sulfur dioxide (SO_2) is a colorless gas with a strong suffocating odor. It is a gas resulting from the burning of sulfur-containing fuels. Exposure to SO_2 can irritate the respiratory system, including lung and throat irritations and nasal bleeding. In the presence of moisture, SO_2 can form sulfuric acid that can cause damage to vegetation.

Lead is a bluish-white to silvery gray solid. Lead particles can originate from motor vehicle exhaust, industrial smelters, and battery plants. Health effects include decreased motor function, reflexes, and learning; as well as damage to the central nervous system, kidneys, and brain. At high levels of exposure to lead, seizures, coma, or death may occur.

3.3.1 Regulatory Requirements

The CAA directed the USEPA to develop, implement, and enforce strong environmental regulations that would ensure cleaner air for all Americans. To protect public health and welfare, the USEPA developed concentration-based standards called National Ambient Air Quality Standards (NAAQS). Enactment of the CAA was driven by the failure of nearly 100 U.S. cities to meet the NAAQS for O_3 and CO, and by the inherent limitations in previous regulations to effectively deal with those and other air quality problems. The USEPA established both primary and secondary NAAQSs under provisions of the CAA. Primary standards define levels of air quality necessary to protect public health with an adequate margin of safety. Secondary standards define levels of air quality necessary to protect public welfare (*e.g.,* soil, vegetation, property, and wildlife) from any known adverse impacts.

The CAA does not make the NAAQSs directly enforceable. However, it does require each state to promulgate a state implementation plan to provide for "implementation, maintenance, and enforcement" of the NAAQS in nonattainment areas. The General Conformity Rule, published in 58 Federal Register 63214 (November 30, 1993) and codified at 40 CFR part 93, subpart B, requires federal agencies to prepare written conformity determinations for federal actions in or affecting nonattainment areas, except when the action is covered under the Transportation Conformity Rule or when the action is exempted because the total increase in emissions is below the threshold emissions limits. The General Conformity Rule applies to federal actions occurring in air basins designated as nonattainment for criteria pollutants or areas designated as maintenance areas. Federal actions occurring in air basins in attainment of the NAAQSs are not subject to the General Conformity Rule.

3.3.2 Regional Air Quality

Andersen AFB is located in Agana County within the Guam Air Quality Control Region (AQCR) 246 which includes the entire Island of Guam. The Guam EPA is responsible for air quality within AQCR 246. The USEPA designated the entire Island of Guam to be in attainment or unclassified for all criteria pollutants, except for SO_2 within a 2-mile radius of the Tanguisson, Piti, and Cabras power plants. The power plant nearest Andersen AFB is the Tanguisson Plant, approximately 10 miles southwest of the Base.

3.3.3 Andersen AFB Air Emissions

Andersen AFB is a major source for purposes of the CAA Title V operating permit program. However, Andersen AFB currently operates under a more lenient permit under Guam's conditional exemption from Title V in 40 CFR 69.13. As a result, Andersen AFB's Potential To Emit must be examined to determine which regulatory threshold is most stringent for the Base. Andersen AFB is classified as a major Prevention of Significant Deterioration (PSD) source under Section 1105 of Guam's Air Pollution Control Standards and Regulations. Therefore, the PSD thresholds are the most stringent regulatory thresholds that apply to Andersen AFB.

An emissions inventory was not available for AQCR 246. Current emission quantities for Andersen AFB, presented in Table 3.3-1 include emissions from stationary sources, fuel tanks, fuel facilities, and aircraft, AGE, GOV, and POV operations. The 2003 emissions inventory is the most current and is used to describe the existing condition. The 2003 emissions inventory reflects the actual emissions for that calendar year. Mobile and stationary operational emissions can, and do, vary substantially from year to year while remaining within allowable limits.

Table 3.3-1 Baseline Emissions Inventory

Criteria Air Pollutant	CO (tpy)	VOC (tpy)	NO_x (tpy)	SO_x (tpy)	PM_{10} (tpy)	HAPs (tpy)
Aircraft Operation[a]	75.0	21.1	39.0	11.6	14.8	0.01
AGE Operation[a]	4.5	1.7	33.6	249.2	2.0	0.03
Fuel Tanks[a]	0.0	2.5	0.0	0.0	0.0	0.23
Fuel Facilities[a]	0.0	23.0	0.0	0.0	0.0	0.07
POV Operation[a]	111.2	8.0	12.8	1.2	80.1	0.86
GOV Operation[a]	28.4	3.4	9.1	0.7	8.6	0.26
Stationary Sources[a]	27.0	11.1	122.1	14.4	6.9	2.37
Total Andersen AFB Emissions	**246.2**	**70.8**	**216.6**	**277.1**	**112.3**	**3.83**

Note: VOC is not a criterion pollutant. However, VOC is reported because, as an ozone precursor, it is a controlled pollutant.

CO= carbon monoxide
NO_X= nitrogen oxides
SO_X= sulfur oxides
tpy= tons per year
HAPs= hazardous air pollutants
a USAF 2005c
PM_{10}= particulate matter less than 10 microns in diameter

3.3.4 Radon

Andersen AFB is in an area in which the radioactive gas radon is known to occur (USEPA 2004). The only known health risk associated with exposure to elevated levels of radon is an increased risk of developing lung cancer. Electrically charged radon atoms can attach to dust particles in indoor air. These dust particles can be inhaled into the lungs and adhere to the lining. The deposited atoms decay by emitting radiation that has the potential to damage the cells in the lungs. Typically, outside air contains very low levels of radon (USEPA 1998a). However, radon can accumulate in enclosed indoor spaces. The level at which the USEPA recommends consideration of radon mitigation measures is 4 picoCuries per liter (pCi/L). This level is based on the assumption that an individual will be exposed to those levels at least 75 percent of the time, a situation usually found only in residences (USEPA 1992).

In the past, naturally occurring radon levels in the indoor air of on-Base housing units were above the USEPA's recommended action level of 4 pCi/L. The full extent of this past exposure pathway is unknown and, therefore, the hazards associated with potential exposures are uncertain. The Air Force renovated 755 houses on Andersen AFB for radon abatement (as of May 2000). Only a few recently tested housing units contained elevated levels (between 4 and 20 pCi/L) of radon. The Air Force continues its radon monitoring and abatement program, and is taking action to ensure that Base housing meets health guidelines established for radon (Andersen AFB 2005a).

3.4 INFRASTRUCTURE AND UTILITIES

3.4.1 Water Supply

Potable water at Andersen AFB is supplied by transmission mains from eight wells on Andersen South that draw water from the Northern Guam Lens aquifer (USAF 2003a). The aquifer has been designated by USEPA as a Sole Source Aquifer under the Safe Drinking Water Act. The Guam EPA issues well-operating permits that limit the production from each well (USAF 2003a). There are three non-potable wells that provide irrigation water in addition to the potable water wells (Andersen AFB 2000).

The combined measured capacity of the eight active potable water wells is 3.6 million gallons per day (mgd). The current on-line capacity of the system is 3.1 mgd. The volume of water available to the Base includes the maximum production capacity of the drinking water treatment plant and the Base's treated water storage capacity, for a total of 6.3 mgd. There is a 12-inch water line that connects the Navy water system and the Air Force transmission line. An agreement with the Navy allows the Air Force to receive water from the Navy's water system during an emergency (Andersen AFB 2000; Andersen AFB 2005c). The Base also has one reverse osmosis treatment unit that can produce drinking water from seawater to sustain about 5,500 personnel. All drinking water is treated with chlorine and fluoride and is managed by Civil Engineering and Bioenvironmental Engineering. Civil Engineering manages the maintenance and operations of the drinking water supply and distribution, while Bioenvironmental Engineering monitors the quality of the drinking water and addresses any related health concerns. Water quality sampling is conducted in accordance with approved USEPA methods and certified laboratories. A number of contaminants were detected in samples collected by Andersen AFB Bioenvironmental Engineering, but none exceeded any USEPA standards. Detected contaminants included lead, copper, benzene, carbon tetrachloride, clorobenzene, p-dichlorobenzene, o-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethylene, *cis*-1,2-dichloroethylene, *trans*1-dichloroethylene, methylene chloride, 1,2-dichloropropane, ethylbenzene, styrene, tetrachloroethylene, toluene, 1,24-trichlorobenzene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethylene, vinyl chloride, and exylenes (CCR 2004).

Based on infrastructure system capability and overall water demand, the Base is able to support 83 percent of its current demand, meaning there is insufficient capacity to meet potable water and fire fighting demand, which is 1.2 mgd. The Base is currently addressing the water supply system shortfalls by installing a new well field and upgrading the distribution system (Andersen AFB 2005c). The project at Andersen AFB was started in 2003 and completion is projected for March 2007 (Torres 2006). The project would construct 10 new on-Base wells extending north of Arc Light Boulevard to Northwest Field. The total water system capacity (*i.e.*, existing capacity [3.1 mgd] plus that from the new wells [1.4 mgd]) should be 4.5 mgd (Cruz 2005a).

The Andersen AFB on-Base population is approximately 5,900 (Andersen AFB 2004a). Assuming a baseline water consumption rate of 100 gallons per day (gpd) (USEPA 2005), a total of 590,700 gpd (0.59 mgd) is used for all on-Base personnel. The 0.59 mgd water use by personnel would equate to 13 percent of the expanded system capacity.

A hydraulic study of the Andersen AFB water distribution system was accomplished in July 2003 because of tuberculation (deposits of corrosive product) in the old cast iron pipes. Results of the study concluded that major water transmission lines needed to be replaced to provide adequate flow and pressure to facilities in the future. A leak detection study conducted in March 2004 concluded there were substantial leaks in the system (USAF 2004a). Approximately 910.6 million gallons of water were pumped from the supply wells between March 2004 and March 2005 (USAF 2005a), which equated to a flow rate of approximately 2.5 mgd. Therefore, water system losses were substantially higher than water usage on Base; that is, 2.5 mgd pumped minus the estimated 0.59 mgd for personnel usage approximated a water loss of 1.91 mgd.

3.4.2 Wastewater Treatment

Andersen AFB is in the GovGuam northern sewage district. Sewage from Andersen AFB is pumped off-Base to the Guam Waterworks Authority (GWA) Northern District Wastewater Treatment Plant (WWTP) in Tanguisson for treatment and disposal. The WWTP is approximately 9 miles southwest of the Base. The WWTP was commissioned in 1979 and provides primary treatment. USEPA is working with GWA on reissuing a permit that considers GWA's waiver from secondary wastewater treatment requirements under Section 301(h) of the Clean Water Act (USEPA 2006b).

National Pollutant Discharge Elimination System (NPDES) permit (GU0020141) is the existing permit for the WWTP. The WWTP is currently out of compliance with its NPDES permit under existing conditions. Non-compliance issues for effluent 5-day biochemical oxygen demand (BOD_5) and suspended solids are common occurrences. The USEPA has not reissued the permit at this time and is working with GWA on collection of additional data to facilitate issuance of a new permit with respect to its proposed new ocean outfall. At the time of issuance of the existing permit in 1986, one of the two 6 mgd clarifiers was inoperable and therefore, USEPA would not issue a permit beyond the 6 mgd limit. It is anticipated that once the outfall improvement project is completed in 2007, USEPA will permit the treatment facility for 12 mgd (Antrobus 2006 and USEPA 2006b).

The NPDES permit currently under review by USEPA may be revised to decrease the allowable effluent concentration for BOD_5 and total suspended solids, eliminate total settleable solids concentration limitations, and add concentration limitations for aluminum, copper, nickel, and zinc. If USEPA imposes these revisions on GWA, it is likely GWA would in turn impose stricter control on influent received from Andersen AFB.

According to the USEPA, Guam has three water bodies listed as impaired on the 1998 Section 303(d) list: Agana Bay/River, Pago Bay/River, and Tumon Bay. Of these, only Tumon Bay is listed as a high priority due to its pathogen impairment. Currently there are no Total Maximum Daily Loads (TMDL) for this or any other impairment reported by Guam to the USEPA. However Guam EPA lists two additional water bodies on its 2004 303(d) List, both with a high priority ranking: Northern Guam Lens aquifer; and Ugum River. According to the Guam EPA, water bodies with a high priority ranking are targeted for TMDL. Although the Northern Guam Lens aquifer lies directly below Andersen AFB, the installation's ability to discharge its stormwater has not been affected to date (Andersen AFB 2005c).

The WWTP has a design capacity of 12 mgd and a peak flow capacity of 27 mgd, and it is anticipated that the new permit will reflect current flow projections, possibly up to its design capacity. Based on GWA's recent discharge monitoring reports, the WWTP average flow is around 9.0-9.5 mgd (Lee 2006). Based on a 9.5 mgd flow and 12 mgd design capacity, the plant is operating at approximately 79 percent of capacity.

Andersen AFB has a combined sanitary and industrial wastewater collection system. The GWA currently does not permit or restrict Andersen AFB's wastewater discharges. The Base's sewage collection system consists of approximately 530,000 linear feet of concrete, clay, cast iron, and asbestos cement pipe mains ranging from 6 to 20 inches in diameter. The collection system delivers wastewater by gravity to lift stations. There are 22 active septic tanks. There are also five grease traps and 12 oil/water separators that are periodically pumped out by service contract. The Back Gate Lift Station pumps all the collected sewage except landfill effluent to GWA for treatment and disposal. Base personnel estimate the maximum capacity of the lift station is 1.0 mgd.

Over the past 36 months, Andersen AFB has twice experienced an overflow of its wastewater collection system. Both instances occurred during typhoons which flooded a large percentage of the island. The overflows were a result of the limited infrastructure capacity to support a severe storm surge that infiltrated the wastewater collection system (Andersen AFB 2005c). The 20-inch diameter force main from the Back Gate Lift Station caused incoming sewage to back up and overflow into the adjacent storm runoff collection basin and into injection wells. The overflows also entered yards in adjacent family housing areas (USAF 2003b).

Repairs and upgrades to the wastewater pumping stations have been completed to preclude discharges to the UIC wells. New sensors were installed in the wet wells of the pumping stations to address potential overflows and timely responses to power and equipment failures. An evaluation of the present waste water system is in progress. The evaluation includes cleaning and video taping the lines to determine the locations of piping that need to be repaired and/or upgraded.

Andersen AFB personnel monitor waste water flow rates on a monthly basis at the lift station. Based on flow records at the lift station, the Base generates approximately 0.22 mgd of sewage per day (Monecke 2006). About 95 percent of the wastewater is generated from family housing, dormitories, and office/administrative areas, and 5 percent is generated by industrial activities (Exon 2005). Based on the total generation and the percentages for non-industrial and industrial generation, personnel generation equates to about 0.209 mgd (35 gpd per person) and industrial generation is 0.011 mgd. The 0.22 mgd equates to 22 percent of capacity of the Base's lift station and about 1.8 percent of the 12 mgd design capacity of the WWTP.

GWA is funding overflow studies and other infrastructure improvements to the treatment plant, pump stations, and upgrades to sanitary sewers in the Northern District WWTP system for FY07 through FY10 to eliminate surcharges for increased system reliability. The overflow studies will assess the opportunity to modify the Route 16 pump station overflow to avoid excess wet weather flow problems along Route 1. Improvements to sewer lines from Andersen AFB and Navy housing east of the WWTP include eliminating the flow split at the plant to reduce power usage at the pump station and increase system reliability. The current system is constructed in such a way that most of the dry weather flow and approximately 50 percent of the wet weather flow is diverted to the Southern Link Pump Station. These projects are necessary to improve the existing collection and treatment system and expand the system to support Guam's economic growth. Sewer line upgrades to eliminate overflows include construction of approximately 5,100 feet of sewers upstream of the Fujita Pump Station and just downstream of flow meters in the Buena Vista area. The planned improvements and repairs, including the completion of the ocean outfall, should bring the WWTP back into compliance with the USEPA (GWA 2006).

Andersen AFB has no concentration limitations on its wastewater discharge sent to the GWA WWTP. However, the GWA WWTP does have an NPDES permit for specific constituents. If the NPDES permit for the GWA plant is revised, it is likely the GWA would impose contaminant concentration limits on the Base (Andersen AFB 2005c).

3.4.3 Energy and Communications

Energy

Andersen AFB receives its power from the Guam Power Authority (GPA). The GPA system presently has a total of 552 megawatts (MW) of power generation capacity or 522,000 kilowatt-hours (kWH) for the Island of Guam. Power for Andersen AFB and the surrounding communities is provided through three main GPA substations: Dededo Substation, Yigo Substation, and Harmon Substation (Ostil 2006a). Recent peak demand of 274 MW (259,109 kWH) occurred in May 2005 (Sherrill 2006a). Based on this demand, the GPA has an approximate 100 percent generation capacity reserve (USAF 2004c). The Base's current energy consumption is 20 MW (Ostil 2006a), or 18,913 kWH (3.6 percent of GPA generation capacity). Based on this rate, electrical consumption is 0.0027 kWH per square foot (ft^2) per day when considering Base buildings contain 6.9 million square feet of space (Andersen AFB 2004a).

Air Force equipment in the Andersen AFB Substation includes two 20,000 kWH, 34.5 kV-13.8 kV outdoor, load tap changing substation transformers (T-15 and T-16). The 34.5 kV portion of the Andersen Substation has deteriorated substantially. Oil circuit breakers do not operate when a short circuit occurs, which causes a circuit breaker at the GPA power plant to trip. Any ensuing outage affects not only Andersen AFB, but also the local community. The structure and switching mechanisms have corroded due to the salt-laden air and high humidity. Different switching mechanisms have broken off when switch handles were operated, rendering the switches inoperable until repairs could be completed. Should the 34.5 kV portion of the substation continue to deteriorate, power reliability for Andersen AFB would decrease, causing outages to become more frequent and of longer duration (USAF 2004d).

An electrical utility system analysis conducted in September 2003 indicated that by the end of 2006, the tie feeder from the incoming Andersen Substation to on-Base Station D (P-66/P-70) would become overloaded. Additionally, there are some low voltage (>95%) problems at several locations. The analysis identified solutions that would eliminate both the overload and low voltage problems (USAF 2003b).

The analyses also indicated that by 2010, the Andersen Substation 1,200-amp switchgear would be loaded up to 95 percent of its capacity. Normally, switchgear should not be loaded to more than 80 percent of capacity. Replacing the existing 1,200-amp, 13.8 kiloVolt (kV) switchgear at the Main Substation with a 2,000-amp, 13.8 kV switchgear is a consideration (USAF 2003b).

Communications

The 36th Communications Squadron is responsible for communications systems at Andersen AFB. The primary communications hub for telephone service is located in Building 25008, and there are approximately seven primary Independent Telecom Nodes on Base. There are no significant problems or capacity issues with the current Base communications system according to the 36th Communications Squadron. The system is presently meeting the immediate needs of the Base even as it implements the Combat Information Transport System (CITS), which would also improve both capacity and reliability. However, to accomplish missions in the future and accommodate mission growth, the Base would continue to implement communications system expansions and improvements (USAF 2004c).

3.4.4 Storm Water Management

Guam is in a tropical environment that receives an estimated 100 inches of rainfall each year. As a result, the island has unique stormwater discharge requirements. Andersen AFB is relatively flat, and heavy precipitation generally flows by sheets into swales, then into sink holes or other depressions, where it percolates into the ground or is channeled into stormwater wells. The Base sits on over 17,500 acres and is divided into 20 drainage basins that contain over 103 dry injection wells in karst terrain that use the porous limestone bedrock to assist in storm water migration into the aquifer (USAF 2004b). Andersen AFB has Underground Injection Control (UIC) permits for these injection wells which inject an estimated 130 mgd of stormwater into the aquifer system. The Base does not meter the flow into these wells (Andersen AFB 2005c). Twelve of the wells are sampled twice a year to ensure that water entering the wells meets drinking water standards. The Base has accomplished projects such as constructing an overflow basin and reconfiguration of the well heads to protect the wells (Clark 2005). The Base is currently upgrading the UIC well system to accommodate the increase in stormwater runoff. New designs incorporate devices to increase ponding and retention (pretreatment) while maximizing capacity

The subsoil throughout Andersen AFB is composed of highly porous limestone covered with a soil layer generally less than 2 feet thick. Percolation rates are high, generally from 8 to 24 feet per day. Because of the high permeability of the limestone substrate, no perennial streams exist on the northern end of Guam (USAF 2000).

It is estimated there are approximately 578 acres of impervious cover on Andersen AFB; 302 acres from airfield pavements, 115 acres from buildings, and 161 acres from roadways and parking lots. This estimate does not include all the primary roadways on the Base.

Storm water at Andersen AFB is managed in accordance with the Base's Storm Water Pollution Prevention Plan (SWPPP), which establishes procedures that minimize the potential for storm water pollution from Base activities, including construction.

3.4.5 Solid Waste Management

Municipal solid waste at Andersen AFB is managed in accordance with guidelines specified in AFI 32-7042, *Solid and Hazardous Waste Compliance*, AFI 32-7080, *Pollution Prevention Program*, and the Base's Solid Waste Management Plan. The AFI incorporates by reference, the requirements of Subtitle D, 40 CFR, Parts 240 through 244, 257, and 258, and other applicable federal regulations, AFIs, and DoD Directives. In general, AFI 32-7042 establishes the requirement for installations to have a solid waste management program to incorporate the following: a solid waste management plan; procedures for handling, storing, collecting, and disposing solid waste; record-keeping and reporting; and pollution prevention.

Non-hazardous municipal solid waste (MSW) at Andersen AFB is either recycled or disposed in an on-Base landfill an average of 6 days per week (312 days per year). Andersen AFB personnel operate and maintain the Base landfill. The original landfill has been capped to contain environmental contamination within its confines. The new landfill is on top of the old landfill, the cap of which serves as a lining for the new landfill (USAF 2003b).

The landfill was opened in 1998 and had a 10-year life expectancy based on a design to accommodate 172,000 cubic yards (CY) of debris (estimated at 34,658 tons based on 403 pounds per CY). As of June 2005, about 254,000 CYs of debris (51,181 tons) were disposed in the landfill. The Base reevaluated the landfill design and the result is the landfill can accommodate 330,000 CYs (66,495 tons), or an additional 76,000 CYs (15,314 tons). The report of the reevaluation indicated the landfill could accommodate MSW at the current disposal rate of 2,750 CY per month (554 tons) through December 2007. The report stated that the disposal rate of 2,750 CY per month is attainable if recycling and composting are employed to the maximum extent possible, if soil cover material is applied as sparingly as possible, if typhoon debris is discounted, and if significant waste stream increases are not experienced due to outside events (Black and Veatch 2005). Additionally, a study is currently being conducted to investigate the possibility of vertically extending the current landfill beyond 2009. The study is scheduled for completion in January 2007.

Based on the disposal rate of 2,750 CYs per month, a total of approximately 23.1 tons per day (tpd) are disposed in the landfill. Using an on-Base population of 5,900 and an average generation rate of 2.5 pounds of MSW per person per day, a total of 7.4 tpd of waste would be generated. This equates to a personal MSW generation rate of approximately 2,309 tons per year (tpy) (192 tons per month) based on 6 days per week. Therefore, approximately 362 tons per month (554-192=362 tons) of other debris are disposed in other designed cells of the landfill.

The Base operates its solid waste disposal program under three permits from GovGuam. Permit 99-1001 LF is for MSW generated by residential and mission activities. The second permit (02-68 HFL) includes construction and demolition debris such as dirt, rock, concrete, asphalt, and reinforcement bars. The third permit (99-1003 PRO) covers recycling operations. Permits 99-1001LF and 99-1003 PRO expired in May 2004, and permit 02-68 HFL expired in October 2004. Andersen AFB submitted a 5-year renewal application to GovGuam for each permit on April 10, 2004, but has not yet received comments on the applications. However, GovGuam informed the Base it is permitted to continue operation even though the Base has not heard from the agency as of August 2006. Based on the process, the permits should be valid until April 2009 (Gingras 2005). Andersen AFB is working with Guam EPA to issue the landfill permits.

Andersen AFB implemented an aggressive pollution prevention program in accordance with AFI 32-7080, *Pollution Prevention Program*, that recycles as much of the solid waste stream as possible. The Base program diverts solid waste by grinding and reusing asphalt, concrete, construction and demolition debris, and wood/yard waste. Other debris (*e.g.*, scrap metal, reinforcement bars, conduit, piping, cardboard, and plastics is recycled (Gingras 2005). All green waste is segregated and collected for mulching, chipping, and composting (Andersen AFB 2005c). The Base currently recycles white bond paper, newspaper, magazines, aluminum, glass, cardboard, and will soon be recycling plastics under the residential recycling program. The average recycling rate for residential MSW is 75 tons per month.

A recycling contractor picks up aluminum, cardboard, and wastepaper from two drop-off locations on the Base: the service station and the Self-Help Store. Additionally, large recycle bins are located at each military family housing unit for easy collection of household recyclables. A policy to establish recycling in all unaccompanied dormitories and other locations on Base was also begun. There are currently over 69 outdoor recycling containers located throughout the entire Base. As much as 1,800 tons are collected each year at Andersen AFB. Due to the amount of green waste generated, the Base built a green waste and composting area. Within this area a large chipper/grinder is utilized to mulch green waste into compostable material. The grinder is used for green waste and wood pallets with the sole purpose of decreasing the amount of solid waste entering the landfill, well over 320 tons of green waste.

There are no other USEPA-permitted Resource Conservation and Recovery Act (RCRA) Subtitle D sanitary landfill facilities on the island of Guam. However, the Navy has a permitted landfill approximately 30 miles south of Andersen AFB (Andersen AFB 2005c).

GovGuam is also in the process of siting a new sanitary landfill. GovGuam, through the Guam Department of Public Works and Guam EPA, is proposing to construct a MSW Landfill Facility in the Layon area of Dandan, Inarajan, approximately 40 miles south of Andersen AFB. The creation of the new sanitary landfill is part of the terms of the Ordot Consent Decree (signed in 2004 by USEPA, U.S. Department of Justice, and GovGuam), and requires GovGuam to close the Ordot Dump and resolve the issues related to the unauthorized discharge of pollutants from the dump into the Lonfit River (Andersen AFB 2005c). The new, fully compliant Guam sanitary landfill is planned to be on line in 2009 or 2010 (Spoerer 2006). The only other fully compliant landfill facility within the Pacific is on the Island of Saipan, approximately 120 miles north of Guam (Andersen AFB 2005c).

3.4.6 Transportation System

Access to Andersen AFB is from Highway 1 which leads to the main base. Alternative routes are provided by Highway 15 leading to the Santa Rosa Gate, which is located south of Andersen main base. Figure 2.2-2 shows the primary roads and road numbers for the area outside Andersen AFB. The primary roads within Andersen AFB include Arc Light Boulevard, Santa Rosa Boulevard, Caroline Avenue, and Bonnis Boulevard. The secondary and local roadway systems at Andersen AFB provide access from the primary routes to various installation facilities. Parking is generally adequate throughout the Base, and the existing transportation system is adequate to meet present needs (USAF 2004b).

Draft EIS Comment: Routes 1, 15 and 3 now experience heavy traffic and should be a consideration in the Environmental Impact Assessment.

Response: Subchapter 3.4.6 was improved by considering and further analyzing the issues in this comment by using data from an August 2006 draft report of a traffic study that quantified peak time traffic volumes at the intersection of Arc Light Boulevard and Routes 1 and 9 and along Route 9 where the Commercial Gate would be constructed. These recent data were used to revise the analysis in Subchapters 4.4.1.6, 4.4.2.6, and 4.4.5.

The Main Gate at Andersen AFB is located along Arc Light Boulevard just north of the intersection of Highway 1 and Guam Route 9. This gate is open 24 hours a day, 7 days a week. A traffic study for the Main Gate and Route 9, which included the intersection of Route 9 and the proposed Commercial Gate, was accomplished in June 2006 (Austin, Tsutsumi & Associates 2006). Figure 3.4-1 presents the existing traffic volumes and level of service (LOS) at the intersection of Arc Light Boulevard and Highway 1 and Route 9 for the morning (6:30-7:30 a.m.) and afternoon (3:30-4:30 p.m.) peak hours of traffic. The figure also depicts the volume of traffic for the section of Route 9 where the Commercial Gate is proposed to be constructed. The report of the traffic study states that, overall, the intersection operates at LOS B (see below) during both the morning and afternoon peak hours of traffic (Austin, Tsutsumi & Associates 2006).

Level of service is a qualitative measure used to describe the conditions of traffic flow, with values ranging from free flow conditions at LOS A to congested conditions at LOS F. Following are descriptions of LOS.

- LOS A occurs when traffic flows at or above the posted speed limit and all motorists have complete mobility between lanes.
- LOS B is slightly more congested, with some impingement of maneuverability; two motorists might be forced to drive side by side, limiting lane changes. LOS B does not reduce speed from LOS A.
- LOS C has more congestion than B, where ability to pass or change lanes is not always assured. LOS C is the target for urban highways in many places. At LOS C most

experienced drivers are comfortable, roads remain safely below but efficiently near capacity, and posted speed is maintained.

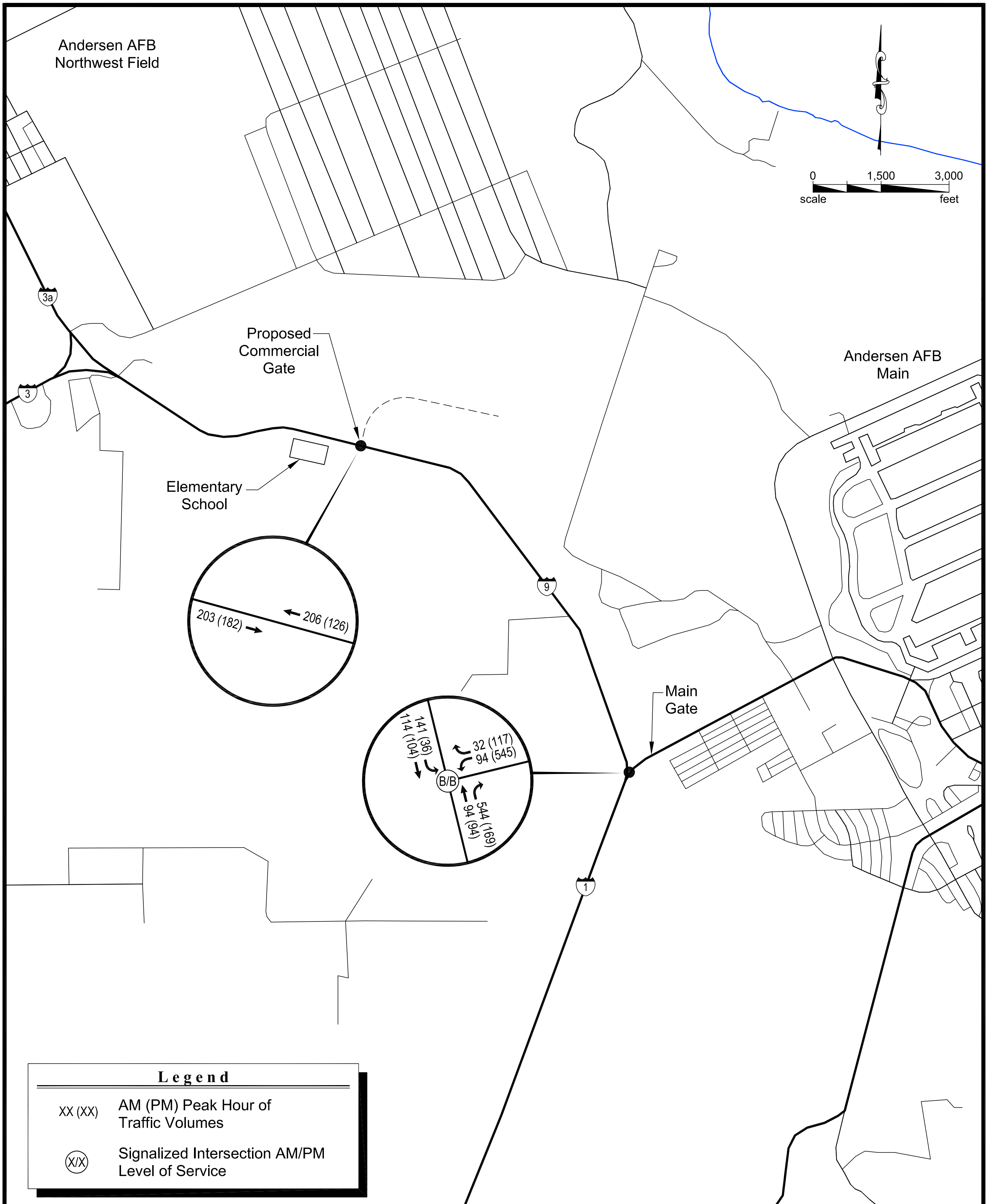
- LOS D is the level of service of a busy shopping corridor in the middle of a weekday, or a functional urban highway during commuting hours: speeds are somewhat reduced, motorists are hemmed in by other cars and trucks.
- LOS E is a marginal service state. Flow becomes irregular and speed varies rapidly, but rarely reaches the posted limit.
- LOS F is the lowest measurement of efficiency for a road's performance. Flow is forced; every vehicle moves in lockstep with the vehicle in front of it, with frequent drops in speed to nearly zero miles per hour.

3.5 BIOLOGICAL RESOURCES

3.5.1 Vegetation

Historic Vegetation / Primary Growth Limestone Forest

Historically, tree species in the native forest of Guam would have been broadly classified based on underlying soil type, the northern limestone vegetation, and the southern volcanic vegetation (Fosberg 1960; Donnegan, *et al*. 2004). Andersen AFB is entirely within the northern limestone vegetation area. The northern half of Guam is generally flat limestone with abrupt cliffs and drop-offs toward the ocean. The underlying limestone may be strongly weathered into a karst formation, and the vegetation would typically have been forests. The primary growth limestone forest of the northern portion of Guam was a tall, closed canopy forest dominated by very large *Artocarpus mariannensis* (dugdug) and *Ficus prolixia* (nunu) trees. In addition, several other species were probably well-represented throughout the plant community, including *Elaeocarpus joga* (yoga), *Instia bijuga* (ifit), *Neisosperma oppositifolia* (fagot), *Tristiropsis obtusangula* (faniok), and *Pisonia grandis* (umumu) (Fosberg 1960). Throughout northern Guam, these species would have formed a nearly contiguous canopy 15 to 20 meters (66 feet) tall. However, typhoon winds may blow down clusters of trees, making gaps in the forest canopy where understory vegetation could proliferate and seedlings of canopy species could germinate (Andersen AFB 2003c; Quinata 1994). The modified forest that regenerated after typhoons were historically composed of a denser understory vegetation, including ferns, herbaceous vegetation, and small shrubby species (Quinata 1994) which supported native bird and animal species. Some portions of northern Guam still contain forests that can be considered primary growth forest and typhoon-modified forest (Fosberg 1960; Quinata 1994; Lujan 2005). Table 3.5-1 lists plants present within the ASA and Commercial Gate project areas known to have occurred within the historical forested areas of Northern Guam.



Date of Count:
Tuesday, June 6, 2006 and Wednesday, June 7, 2006

AM Peak Hour:
6:30-7:30 AM

PM Peak Hour:
3:30-4:30 AM

Source: Austin, Tsutsumi & Associates 2006

743955 AG-EIS-VOL.DWG

Figure 3.4-1

Existing Traffic Volumes and
Level of Service

Andersen AFB, Guam

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Table 3.5-1 Historical Forest Plant Species within the ASA and Commercial Gate Project Areas

English Common Name[1]	Chamorro Common Name[1]	Scientific Name[2]	Growth Habit	Listing Status (F = Federal G = Guam)	Native or Introduced species	Present in Project Areas[3]
Mexican Creeper		*Antigonon leptopus*	Vine		Introduced	Yes
Breadfruit	Dogduk, Dukduk	*Artocarpus mariannensis*	Tree		Native	-
fish poison tree	Puting	*Barringtonia asiatica*	Tree		Introduced	-
Beggar's tick		*Bidens alba*	Herbaceous		Introduced	Yes
Wait-a-bit	Pakao	*Caesalpinia major*			Introduced	Yes
Ironwood, Australian Pine	Gagu	*Casuarina equisetifolia*	Tree		Native	-
China Inkberry	Tintanchina	*Cestrum diurnum*	Shrub		Introduced	Yes
Night-flowering cestrum		*Cestrum nocturnum*	Shrub		Introduced	Yes
Jack in the bush	Kesengasil	*Chromolaena ordata*	Shrub		Introduced	Yes
Cycad	Fandang	*Cycas circinalis*	Tree		Native	Yes
Yoga trees	Ghumar	*Elaeocarpus joga*	Tree		Native	Yes
Goosegrass	-	Eleusine indica	Grass		Introduced	Yes
Banyon, Strangling fig	Nunu	*Ficus prolixia*	Tree		Native	Yes
Dyer's fig	Hodda, Hoda	*Ficus tinctoria*	Tree		Native	-
	Paipai	*Guamia mariannae*	Tree		Native	Yes
Heritiera tree	Ufa halomtano	*Heritiera longipetiolata*	Tree	F=none G=Endangered	Native	-
Hibiscus tree	Pago	*Hibiscus tiliaceus*	Tree		Native	Yes
Ifil	Ifit	*Instia bijuga*	Tree		Native	Yes
Oceanblue Morning glory		*Ipomoea indica*	Vine		Introduced	Yes
Lantana		*Lantana camara*	Shrub		Introduced	Yes
False koa, Lead tree	Tangan-tangan	*Leucaena leucocephala*	Tree		Introduced	Yes
Mile-a-Minute weed		*Mikania micrantha*	Vine		Introduced	Yes
Sensitive plant		Mimosa pudica	Shrub		Introduced	Yes
Swordgrass		Miscanthus floridulus	Grass		Native	Yes
Noni	Lada	*Morinda citrifolia*	Shrub, tree		Native	Yes
Calabur-tree, calabura	mansanita	*Muntingia calabura,*	Tree		Introduced	-
	Fagot, Fago	*Neisosperma oppositifolia*	Tree		Native	Yes
Swordfern		Nephrolepis exaltata	Fern		Introduced	Yes
paper rose	alalag	*Operculina ventricosa*			Introduced	-

Table 3.5-1 Historical Forest Plant Species within the ASA and Commercial Gate Project Areas (*continued*)

English Common Name[1]	Chamorro Common Name[1]	Scientific Name[2]	Growth Habit	Listing Status (F = Federal G = Guam)	Native or Introduced species	Present in Project Areas[3]
Screw Pine, Pandanus	Pahong	*Pandanus dubious*	Tree		Native	-
	Kafu, Fatsao	*Pandanus tectorius*	Tree		Native	Yes
Scarlet-fruited Passion Flower	Kinahulo Atadao	*Passifolia foetida*	Vine		Introduced	-
Wild Passion Flower		*Passifolia suberosa*	Vine		Introduced	Yes
Elephant grass		Pennisetum purpureum	Grass		Introduced	Yes
	Umumu	*Pisonia grandis*	Tree		Native	Yes
False elder	Ahgao	*Premna obtusifolia*	Shrub		Native	Yes
Fire tree	Hayun lagu	*Serianthes nelsonii*	Tree	F=Endangered G=Endangered	Native	-
False verbena		*Stachytarpheta cayennensis*	Herbaceous		Introduced	Yes
No recorded English Common Name		*Tabernaemontana rotensis*	Tree	F=none G=Locally Rare	Native	Yes
Limeberry	Lemondichina	*Triphasia trifolia*	Shrub		Introduced	Yes
	faniok	*Tristiropsis obtusangula*			Native	Yes
Vitex	Lagundi	*Vitex parvflora*	Herbaceous		Introduced	Yes

[1] *Common English and Chamorro names taken from: Lee (1985); Moore and McMakin 2005, and Raulerson and Rinehart (1991)*

[2] *Names organized alphabetically by scientific name.*

[3] *Presence in Project Areas based on January 2006 surveys (Parsons 2006)*

Secondary Growth Limestone Forest

- Historic actions on the northern half of Guam about 60 years ago included clearing the native limestone forest of trees, understory, and shrubs, and grading the surface. Imported fill of crushed coral and argillaceous clay was placed and compacted over pulverized limestone to stabilize runways, taxiways, and aprons (USAF 2000). The area cleared included most of what is now Andersen AFB. The two airfields constructed on Guam were Northwest Field and North Field. Andersen main, including the North Field area, has remained active, with most of its operations and support facilities being in developed areas maintained as an urban landscape.

After clearing, the forest understory was also subject to invasion by non-native plant species, including *Bidens alba*, *Chromolaena odorata* (kesengasil), *Stachytarpheta cayennensis*, *Ipomaea indica*, *Passifolia foetida* (kinahulo), *Passifolia suberosa*, *Operculina ventricosa* (alalag), *Cestrum diurnum* (tintanchina), *Muntingia calabura* (mansanita), *Triphasia trifolia* (lemondichina), *Leucanea leucocephala* (haole koa), and *Caesalpinia major* (pakao). Woody species such as *L. leucocephala* quickly formed a major component of open xeric areas, and

Vitex parviflora (lagundi) dominated upper and mid-canopies of denser forests (Fosberg 1960; Space and Falanruw 1999).

Further, invasive ungulate species greatly reduced recruitment of native limestone woody species into the upper canopy, thereby altering forest composition and structure. For example, in 2005, Wiles identified ungulate pressure as the major factor for inhibiting recruitment of the native *Artocarpus mariannensis* tree (Wiles 2005). Wiles documented a decrease in *Artocarpus mariannensis* trees within MSA 1 from 549 individual trees in 1989, to 190 trees in 1999, a 65.4 percent decrease. In MSA 1, ungulate densities were reported to be 183 Philippine deer (*Cervus mariannus*) per square kilometer, and 38 feral pigs (*Sus scrofa*) per square kilometer (Brooke 2005; Knutson and Vogt 2002). Other native trees in secondary forests that are declining due to lack of recruitment include the *S. nelsonii* (hayun lagu), *E. yoga*, *Heritiera longipetiolata* (ufa halomtano), *P. grandis*, *Barringtonia asiatica* (puting), *T. obtusangula,* and *I. bijuga* (Wiles, *et al.* 1995; Wiles 2005; Schreiner 1997; GovGuam DAWR 2005).

The introduced Brown tree snake (*Boiga irregularis*) indirectly affected forest composition and structure by eliminating a many forest bird species (Savidge 1987). Birds and fruit bats are important in secondary limestone forests because they naturally pollinate and disperse seeds of shrubs and trees and thereby help maintain forest diversity (Wiles *et al.* 1995; Cox and Elmqvist 2000), contributing to recovery after typhoons and perturbations. The loss of most insectivorous birds may leave secondary limestone forests vulnerable to a variety of insect pests. With the absence of insect predators, insects arriving on Guam in ships or planes are potentially more likely to become established and threaten native woody species.

Among introduced invertebrates affecting secondary limestone forest species, the introduced Asian cycad scale (*Aulacaspis yasumatsui*) has effectively removed the native *Cycas circinalis* (fandang) from mid and lower canopies, where it once was a dominant tree species. This scale was first noted in Guam in 2003; *C. circinalis* suffers a mortality rate of 100 percent in infected areas (Moore 2005).

Intact Forested Areas

There are tracts of land adjacent to the cliff lines that have not been extensively modified, possibly because the karst topography and steep cliffs made the area difficult to clear and of doubtful purpose. These areas contain some of the best species composition and structure found in the primary growth limestone forest that once covered now-cleared areas of Guam, and are now considered Natural Areas that are protected from future human disturbance (*e.g.*, construction and development). Due to its proximity to Andersen main, Pati Point Natural Area is one area of special concern. The vegetation communities of Pati Point can most accurately be described as *F. prolixa* forests, with tall canopy trees. Other species may include *Mammea odorata* (chopak) and *N. oppositifolia* (USFWS 1990a). Additional vegetation communities include forest types dominated by *M. odorata* along the cliff line, and *N. oppositifolia* forest toward Tarague Basin. The Pati Point Natural Area is also directly under a current flight line from Andersen AFB.

Vegetation Survey for the ASA and Commercial Gate Project Areas

Vegetation surveys conducted in January 2006 (Parsons 2006) provided vegetation community type descriptions within the ASA and Commercial Gate project areas. These vegetation community types are associated with secondary growth limestone forests, as well as a herbaceous-dominant vegetation community. Vegetation community types observed are at a successional state resulting from a variety of past natural and human-induced perturbations, including browse pressure from ungulates and lack of pollinator birds that were effectively removed by BTS. Forest community types are still subject to natural perturbations, particularly typhoons, as evidenced by the many blowdowns of trees that have rooted in shallow soil and partial canopy defoliation.

Fosberg's classification (1960) of primary and secondary limestone forest set the baseline for the description of Guam's forests. Secondary limestone forests may be classified into secondary woody limestone community, secondary shrubby limestone community, and herbaceous scrub. Based on published descriptions (Donnegan, *et al.* 2004) and discussions with local conservation personnel familiar with the vegetation at Andersen main (Lujan 2005), the two secondary growth woody limestone communities are classified into the following vegetation community types (named by the dominant species): *Aglaia-Guamia* Forest, *Neisosperma – Macaranga* Forest, *Guamia* Forest, *Guamia – Premna* Forest, and *Vitex* – Remnant *Elaeocarpus* Forest. The secondary shrubby limestone community can be further classified as a *Hibiscus-Leucaena* shrub community type. Herbaceous scrub vegetation community is characterized by a dominant herbaceous species such as dense stands of *C. diurnum*, *B. alba*, *C. odorata*, *S. cayennensis,* with occurrences of *H. tiliaceus, Morinda citrifolia* (lada), *T. trifolia, P. tectorius* and *P. dubious.* For the purposes of this EIS, the herbaceous scrub community was not classified further into community types, although herbaceous-dominant areas are heterogeneous.

Table 3.5-2 identifies woody and sapling species of vegetation community types within the ASA and Commercial Gate project areas. Vegetation community types relevant to the ASA project area are shown in Figure 3.5-1, and vegetation community types relevant to the Commercial Gate project area are shown in Figure 3.5-2. Methods used in vegetation surveys involved circular quadrat sampling techniques and are described in detail in Appendix E. Mapping efforts were aided by comparing recent high resolution multi-spectral imagery acquired by the QuickBird Satellite (DigitalGlobe: 2.6-meter resolution and Panchromatic imagery: 0.6-meter resolution) to field data and ground conditions.

Table 3.5-2 Vegetation Community Types and Clearing Activities Within the ASA and Commercial Gate Project Areas

Vegetation Community Type	Woody Species Observed Within Plots	Woody Sapling Species Observed Within Plots	Total Area Subject to Clearing Hectares/Acres
Aglaia – Guamia Forest	*Aglaia mariannensis* *Guamia mariannae* *Cycas circinalis* *Ficus prolixa* *Hibiscus tiliaceus* *Eugenia thompsonii* *Morinda citrifolia* *Neisosperma oppositifolia* *Maytenus thompsonii* *Mammea odorata* *Tabernaemontana rotensis*	*Aglaia mariannensis* *Caesalpinia major* *Guamia mariannae* *Hibiscus tiliaceus* *Ixora coccinea* *Neisosperma oppositifolia* *Pandanus tectorius* *Triphasia trifolia*	20.5 / 50.7

Table 3.5-2 Vegetation Community Types and Clearing Activities (*continued*)

Vegetation Community Type	Woody Species Observed Within Plots	Woody Sapling Species Observed Within Plots	Total Area Subject to Clearing Hectares/Acres
Guamia Forest	*Guamia mariannae* *Aglaia mariannensis* *Hibiscus tiliaceus* *Cycas circinalis* *Neisosperma oppositifolia* *Psychotria mariana*	*Aglaia mariannensis* *Guamia mariannae* *Hibiscus tiliaceus* *Neisosperma oppositifolia* *Pandanus tectorius* *Triphasia trifolia*	17.6 / 43.5
Herbaceous Scrub	*Morinda citrifolia* *Pandanus tectorius* *Hibiscus tiliaceus* *Triphasia trifolia*	*Morinda citrifolia* *Pandanus tectorius* *Hibiscus tiliaceus* *Triphasia trifolia*	16.4 / 40.5
Neisosperma – Macaranga Forest	*Guamia mariannae* *Macaranga thompsonii* *Neisosperma oppositifolia* *Aglaia mariannensis* *Hibiscus tiliaceus* *Eugenia thompsonii* *Cycas circinalis* *Ficus prolixa* *Premna obtusifolia* *Morinda citrifolia* *Intsia bijuga* *Psychotria mariana* *Maytenus thompsonii* *Mammea odorata* *Pandanus tectorius*	*Aglaia mariannensis* *Flagellaria indica.* *Eugenia thompsonii* *Guamia mariannae* *Hibiscus tiliaceus* *Leucaena leucocephala* *Macaranga thompsonii* *Neisosperma oppositifolia* *Pandanus fragrans* *Pandanus tectorius* *Premna obtusifolia* *Tabernaemontana rotensis* *Triphasia trifolia*	1.4 / 3.5
Hibiscus – *Leucaena* Shrub	*Hibiscus tiliaceus* *Leucaena leucocephala* *Pandanus tectorius* *Aglaia mariannensis* *Cycas circinalis*	*Aglaia mariannensis* *Guamia mariannae* *Hibiscus tiliaceus* *Leucaena leucocephala* *Morinda citrifolia* *Pandanus tectorius* *Triphasia trifolia*	7.2 / 17.8
Guamia – *Premna* Forest	*Guamia mariannae* *Hibiscus tiliaceus* *Aglaia mariannensis* *Premna obtusifolia* *Neisosperma oppositifolia* *Cycas circinalis* *Ficus prolixa* *Macaranga thompsonii* *Maytenus thompsonii* *Eugenia thompsonii* *Pandanus tectorius* *Triphasia trifolia*	*Aglaia mariannensis* *Cycas circinalis* *Eugenia thompsonii* *Guamia mariannae* *Hibiscus tiliaceus* *Leucaena leucocephala* *Pandanus tectorius* *Premna obtusifolia* *Tabernaemontana rotensis* *Triphasia trifolia*	9.0 / 22.2
Vitex – Remnant *Elaeocarpus* Forest	*Guamia mariannae* *Vitex parviflora* *Cycas circinalis* *Neisosperma oppositifolia* *Premna obtusifolia* *Pandanus tectorius*	*Aglaia mariannensis* *Elaeocarpus joga* *Guamia mariannae* *Neisosperma oppositifolia* *Pandanus tectorius* *Triphasia trifolia* *Vitex parviflora*	1.8 / 4.4
TOTAL			**73.9 / 182.6**

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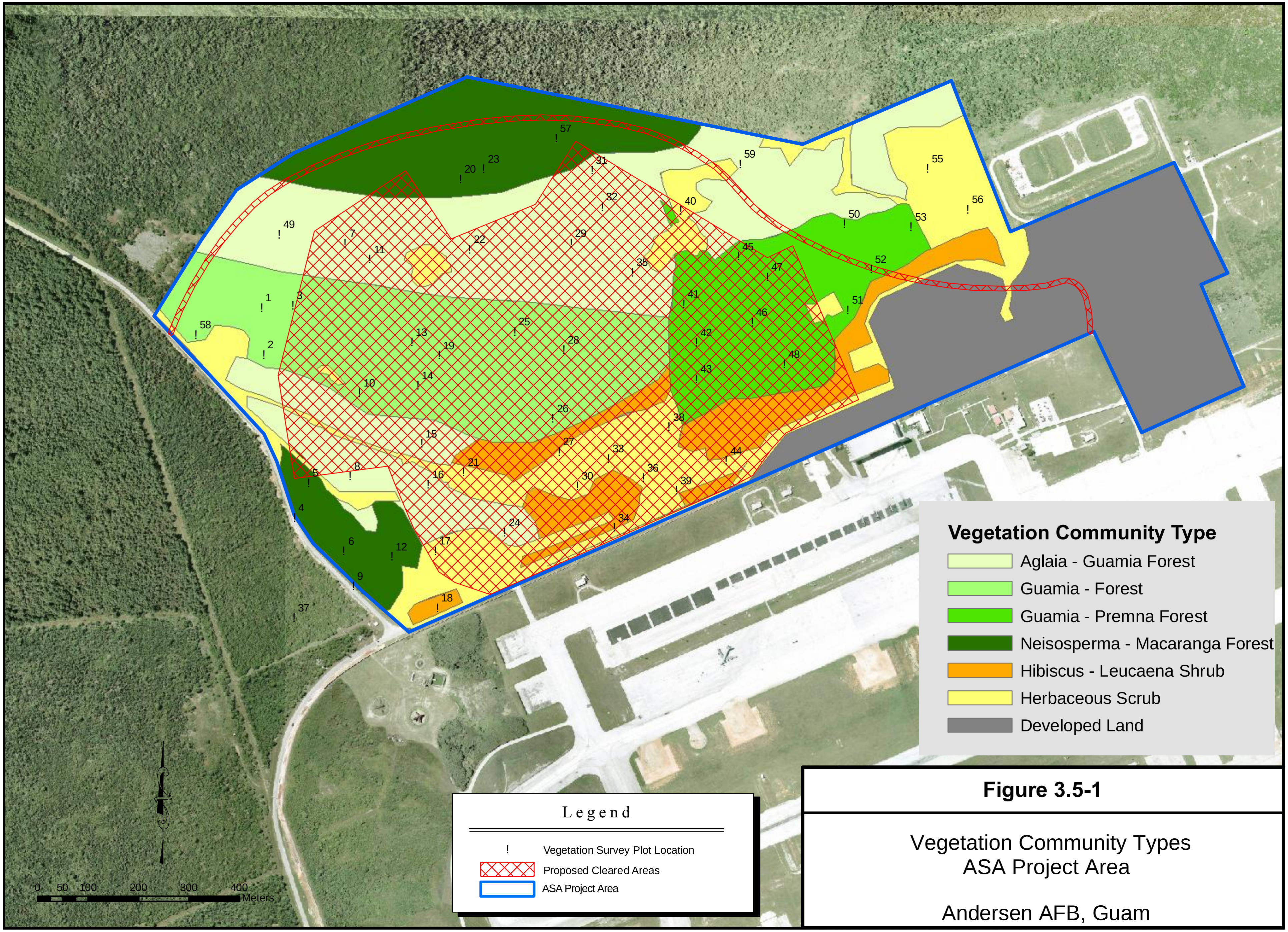

Figure 3.5-1

Vegetation Community Types
ASA Project Area

Andersen AFB, Guam

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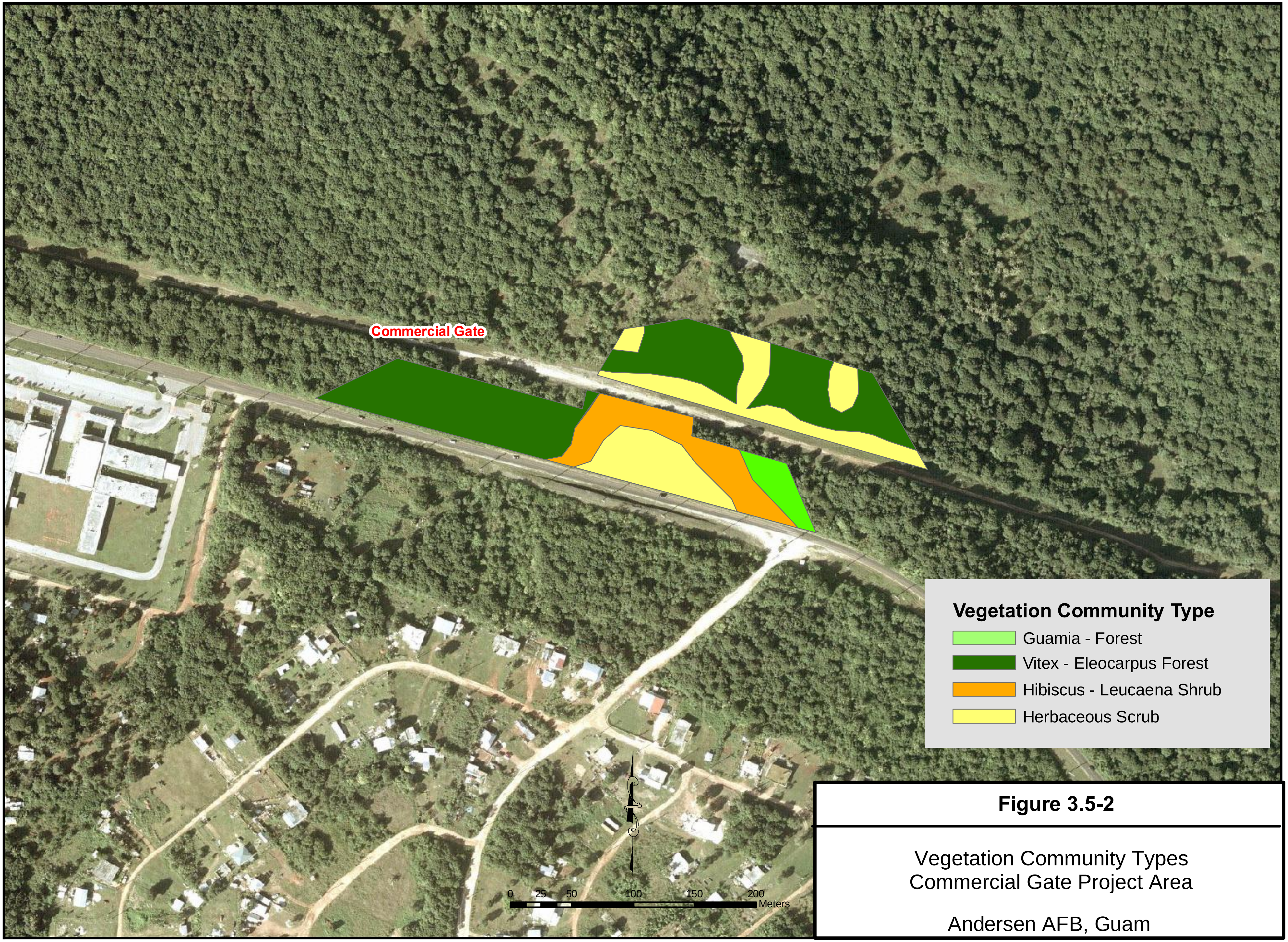

Figure 3.5-2

Vegetation Community Types
Commercial Gate Project Area

Andersen AFB, Guam

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3.5.2 Wildlife

3.5.2.1 Terrestrial Introduced Species

There are several vertebrate species that are not adversely affected by the urban environment and altered vegetation structure comprising most of Andersen AFB. These invasive, non-native species include: black drongo, black francolin, Eurasian tree sparrow, Philippine turtle dove, feral chickens, shrews, roof rats, and house mice. One native species, the yellow bittern, is also locally abundant and not sensitive to the altered environments. Several small reptiles and a single amphibian species also inhabit suitable areas within the modified forest on Northwest Field, and include the native Blue-tailed skink, native House geckos, and non-native curious skinks. An introduced snake species, the Brahminy blind snake, is also known to occur and was found during previous surveys. The introduced marine toad occurs throughout the area (Fritts and Rodda 1998; USAF 2000). See Table 3.5-3 for a complete list of English common names, Chamorro common names, and scientific names.

Table 3.5-3 English Common Names, Chamorro Common Names, and Scientific Names of Animal Species Present at Andersen AFB

English Common Name1	Chamorro Common Name1	Scientific Name[2]	Native or Introduced species	Game species?
Mammals				
Philippine deer	Binadu	*Cervus mariannus*	Introduced	Yes
feral pigs	babuen hålomtåno'	*Sus scrofa*	Introduced	Yes
feral house cats		*Catus catus*	Introduced	No
feral dogs		*Canis familiaris*	Introduced	No
shrews	Chå'ka	*Suncus murinus*	Introduced	No
black rat	Chå'ka	*Rattus rattus*	Introduced	No
house mouse	Chå'ka	*Mus musculus*	Introduced	No
Reptiles and Amphibians				
Monitor Lizard	Hilitai	*Varanus indicus*	Introduced	No
Brown tree snake	Kulepbla	*Boiga irregularis*	Introduced	No
Blue-tailed skink	achi'ak	*Emoia caeruleocauda*	Native	No
House geckos		*Hemidactylus frenatus*	Native	No
curious skinks	achi'ak	*Carlia ailanpalai*	Introduced	No
Brahminy blind snake	ulo' åttelong	*Ramphotyphlops braminus*	Introduced	No
marine toad	Tot	*Bufo marinus*	Introduced	No

Table 3.5-3 English Common Names, Chamorro Common Names, and Scientific Names of Animal Species Present at Andersen AFB (*continued*)

English Common Name1	**Chamorro Common Name1**	**Scientific Name[2]**	**Native or Introduced species**	**Game species?**
Birds				
black drongo	Salin Taiwan	*Dicrurus macrocercus*	Introduced	No
black francolin		*Francolinus francolinus*	Introduced	Yes
Eurasian tree sparrow	Ga'ga' pale'	*Passer montanus*	Introduced	No
Philippine turtle dove	Paluman Senesa	*Streptopelia bitorquata*	Introduced	No
feral chickens		*Gallus gallus*	Introduced	No
yellow bittern	Kakkak	*Ixobrychus sinensis*	Native	No

[1] *English and Chamorro names taken from http://www.guamdawr.org/*

[2] *Table does not include threatened or endangered species.*

There are two introduced reptiles that are considered top predators: the monitor lizard, a reptile whose origin on Guam appears to be tied to the first settlements by humans, and the brown tree snake. Monitor lizards are more prevalent in forested regions of Andersen AFB. In addition to these reptiles, top predators also include domestic and feral house cats and feral domestic dogs, with additional predator pressure from rats.

The BTS was probably introduced to Guam as a passive stowaway in a military cargo ship moving material after World War (WW) II. The snakes' historic range includes portions of Indonesia, New Guinea, the Solomon Islands, and Australia (Rodda, *et al.* 1999). The BTS encountered an abundant prey base in Guam as well as an absence of natural predators and pathogens. The population of native forest birds and bats has declined on Guam because of the BTS (Savidge 1987; Wiles 1994) and loss of habitat from expanding agriculture and urban development (GovGuam DAWR 2005). The BTS is directly responsible for extinction or local extirpation of 11 of 18 native bird species throughout the Island of Guam, and five native birds (of 18) have experienced population declines of greater than 90 percent and are not recovering (Wiles, *et al.* 2003). In addition to native birds, three of 12 native lizards on Guam have been extirpated, and native bat species are heavily impacted by the BTS (Wiles, *et al.* 2003; GovGuam DAWR 2005). As the range of the BTS expanded, the decline of bird species has been particularly dramatic, with a rapid decline of several common native bird species occurring over a 1 to 3-year period during the early to middle 1980s (Wiles, *et al.* 2003). BTSs have been reported at densities as high as 40 individuals per acre of forest in a formerly used and now abandoned housing area south of Andersen AFB (Vice 2005). BTSs can bear two clutches of eggs per year, each clutch typically containing four to eight eggs (Vice 2005). Larger snakes prefer warm-blooded prey, especially birds and rodents. As birds, in particular, have become more scarce in forests, several extremely abundant non-indigenous lizards have supplemented the prey base. The BTS is a nocturnal species commonly found in trees, caves, and near limestone cliffs, but may move to the ground to forage during the night, probably for abundant skinks. They do not tend to occur in open grassy areas, but will cross unpaved roads and may occur in sparsely forested areas (Tobin, *et al.* 1999). The ecological impact of the BTS on Guam has been catastrophic, and is the single greatest terrestrial ecological threat to all of the Mariana Islands and Hawaii (Engeman and Vice 2001; Wiles, *et al*. 2003).

The USDA WS operates the BTS interdiction and control program at Andersen AFB and at the commercial airport on Guam. The purpose of the interdiction and control program is to impede the spread of the BTS to other islands from the Andersen AFB passenger terminal and along flight lines. The USDA WS concluded that a two-phase effort is required to effectively reduce the possibility of off-Base transport. The first phase establishes BTS traps and nightly spotlight searches around the perimeter of areas where cargo is loaded for transport. This has proved to be effective against snakes that immigrate into cargo areas, but does not protect against snakes stowed in outbound cargo. The second phase is a program that inspects all cargo prior to leaving the island. The USDA WS uses trained dogs (Jack Russell terriers) to search for and detect snakes in outbound cargo. There are currently 14 inspection teams (a team consists of one handler and one dog) (Vice, *et al.* 2004). A review of data for 1994-1996 reveals that the use of dogs to detect BTSs in cargo departing Andersen AFB has been effective in reducing the spread of the snake to vulnerable destinations (Engeman, *et al*. 1998).

Brown tree snake control is a priority for the DoD (Kreig 2005). The 36 WI 32-7004 ensures that 100 percent of outbound craft (air and water) from Andresen AFB is inspected (USAF 2006). The 36 WI 32-7004 is contained in Appendix C of Appendix E to this EIS.

3.5.2.2 Introduced Game Species

The black francolin (see Subchapter 3.5.2) is hunted throughout Guam, but is not hunted at Andersen AFB. Therefore, the black francolin is not considered a game species for this EIS, but is considered an introduced species.

Philippine Deer

Philippine deer were brought to Guam approximately 200 years ago from the Philippines, and rapidly spread throughout Guam. The Philippine deer is a regulated game species that typically live in forested areas and browse woody species and grasses. They appear to preferentially browse native woody species over non-native species. Population surveys of deer taken in 2000-2001 in MSA 1 revealed approximately 920 individuals, or 183 deer per square kilometer (Knutson and Vogt 2002), indicating some of the highest deer densities anywhere in the world. Further, these surveys suggest that individuals within the deer population are in generally good health, as determined by females breeding before 1 year of age (Shea, as cited in Knutson and Vogt 2002). Therefore, due to the general health of the population, the local carrying capacity has not yet been reached, and there are adequate resources to sustain deer on Guam.

A census of Philippine deer in the ASA project area was taken with spotlight surveys during January 2006 (Parsons 2006). The spotlight surveys suggest a maximum deer density to be 122 deer/square kilometer in the project area. Deer locations varied by vegetation community type.

Feral Pigs

Domestic pigs were brought to Guam by the Spanish in the late 1600s. Escaping to the wild, the pigs established feral breeding populations and now occur throughout Guam. Pigs, which can eat almost anything, use their noses to root around in the forest floor searching for fallen fruits, young plants, coconuts, and animals such as worms and snails. They cause considerable damage by feeding on crops such as watermelon and taro. They also build and use wallows, which are pits that trap water when it rains. Like deer, pigs have adequate resources to support their population, and maintain very high densities. Population surveys of pigs taken in 2000-2001 in MSA 1 and Andersen AFB indicated a pig population of approximately 186 individuals, or 38 pigs per square kilometer (Knutson and Vogt 2002).

A census of feral pigs in the ASA project area was taken with spotlight surveys during January 2006 (Parsons 2006). Six pigs were observed during the spotlight surveys, which suggests a density of 21.4 pigs/square kilometer.

Public Hunting

To hunt either deer or pigs on Andersen AFB, a GovGuam Hunting License and Andersen AFB Hunting Permit are required to shoot or bow-hunt on designated segments of Northwest Field and Andersen main base. Land available for public hunting, sometimes on alternate days and others open every day, totals approximately 1,265 hectares (3,126 acres).

Gun and bow hunting are permitted on the Base; however, at most of the 3,126 acres where hunting is allowed within Northwest Field and Andersen main, it is restricted to bow hunting. Recreational hunting, especially when restricted to bow hunting, is having almost no effect on the population densities of either pigs or deer (Knutson and Vogt 2002). The current public hunting areas on Andersen AFB are shown in Figure 3.5-3. In addition to public hunting, depredation hunts for Philippine deer and feral pigs resulted in the removal of 400 deer and 100 pigs over a 5-month period in 2005 (Andersen AFB 2006).

3.5.3 Threatened and Endangered Species

3.5.3.1 Plant Species

Four plant species are considered in this EIS. Among these species, only three are thought to occur in the vicinity of the ASA and Commercial Gate project areas. Only occurrences of *Tabernaemontana rotensis* were recorded during January 2006 surveys.

Cyathea lunulata is an exceedingly rare Guam-listed endangered species. *Cyathea* generally grows along muddy drainage slopes in the hills of southern Guam (Moore and McMakin 2005). Little is known about the ecological relationships of *Cyathea* with pollinators, seed dispersers, or herbivores, and the possible reasons for its decline are unknown. *Cyathea* is not expected to occur within the ASA or Commercial Gate project areas.

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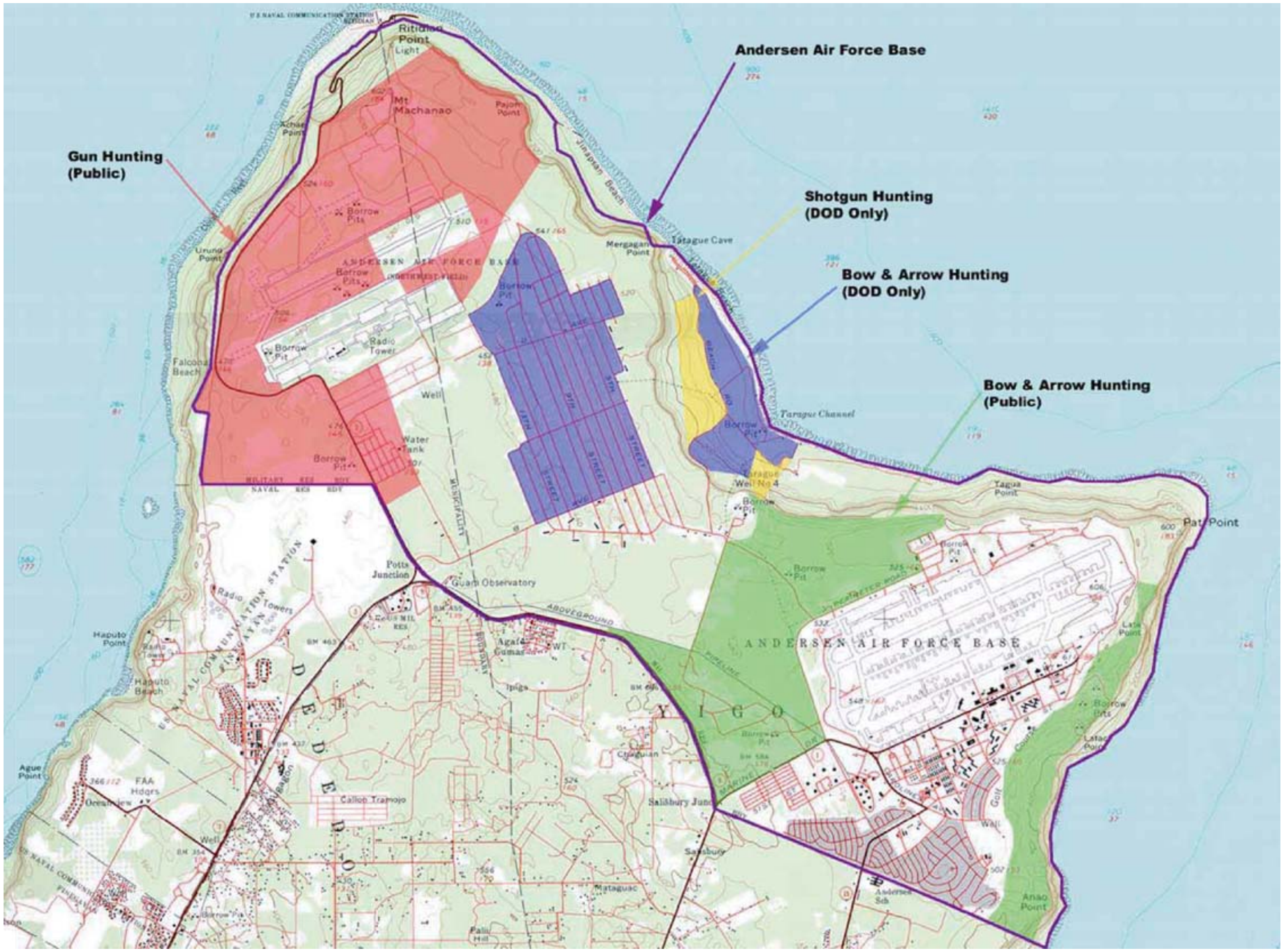

Source:
Integrated Natural Resources Management Plan, Andersen AFB, Guam - Department of the Air Force 36th Air Base Wing Civil Engineer Squadron, December 2003.

Figure 3.5-3

Public Hunting Areas

Andersen AFB, Guam

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Heritiera longipetiolata grows in primary limestone forest, generally in crevices of rough limestone, often on cliffs (Raulerson and Rinehart 1991; Quinata 1994). However, little is known about the ecological relationships of *Heritiera* with pollinators, seed dispersers, or possible herbivores. The species, listed as endangered by GovGuam, is considered locally important and is considered in this EIS. This rare tree species is known to exist from the eastern portion of the limestone plateau in the vicinity of Lafac Point and a few individuals along the northern edge of Northwest Field (Quinata 1994). Quinata (1994) identifies several *Heritiera* individuals near Anao Point, which is on the southern edge of Andersen main. There were also a few, widely scattered *Heritiera* individuals identified adjacent to the cliff line east of Andersen main (Dicke 2006). There were no individuals identified in the ASA or Commercial Gate project areas (Parsons 2006).

Serianthes nelsonii was uncommon on Guam when first reported in the early 1900s (USFWS 1994), and was federally listed in 1987 without critical habitat (USFWS 1987). *Serianthes* is one of the largest trees in the native forest, growing to over 30 meters (98 feet) high with a crown diameter of over 20 meters (66 feet) (USFWS 1994). *S. nelsonii* grows along limestone cliffs, generally in primary forest. Fosberg (1960) reported that *S. nelsonii* also occurred in low numbers in late successional secondary forest. There are six known individual *S. nelsonii* trees on Guam. Two individuals are found in the Northwest Field vicinity, and the remaining four trees are found in Tarague Basin (Brooke 2006). One mature individual of this tree species on Guam is located between Northwest Field and Ritidian Point in the GNWR overlay. A second individual was located in the southeastern portion of Northwest Field. This second individual has been damaged by typhoons, and shows the effects of browsing and rubbing from deer, and previous fencing attempts have been rendered ineffective (Brooke 2005). No *S. nelsonii* trees are found within the ASA or Commercial Gate project areas. Habitat for *S. nelsonii* is highly degraded in forested areas of Andersen main, primarily due to ungulate pressure.

Tabernaemontana rotensis was thought to be endemic to Guam and the Island of Rota, morphologically distinct from congeneric species elsewhere in the western Pacific, and was formally proposed for endangered status under provisions of the ESA (USFWS 2004a). The monograph (published 1991) synonymizes *T. rotensis* and “several dozen previously recognized species” with a widespread and variable species, *Tabernaemontana pandacaqui*. The known range of the *Tabernaemontana pandacaqui* extends from southern China to Australia and east from Australia through the Philippines at least as far as the northern Marianas. Lacking any evidence of declining *T. pandacaqui* populations, USFWS now finds no legal basis in the ESA provisions to list the taxon found on Guam and Rota (USFWS 2004e). Although the USFWS does not recognize *T. rotensis* as a separate species, it is considered locally important and is considered in this EIS. Clusters and individual mature trees and seedlings of *T. rotensis* have been recorded in portions of Andersen main and Northwest Field (USFWS 2000; Marler 2006; Parsons 2006). The *T. rotensis* individuals are typically located in primary or late successional secondary growth forests. They can be considered an “edge” species, and are often found in canopy gaps and occasionally along roadsides (USFWS 2000). The January 2006 surveys identified 15 locations of *T. rotensis* with a total of approximately 1,000 saplings within the ASA project area (Parsons 2006). No *T. rotensis* trees or saplings were recorded in the Commercial Gate project area.

3.5.3.2 Animal Species

Thirteen animal species (two mammals, seven birds), and four reptiles are federally protected on Guam. The GovGuam names 33 species as endangered or threatened status under the Guam Endangered Species Act, including 15 birds, three mammals, 10 reptiles, four mollusks, and one insect (Table 3.5-4). Many of the species appear on both lists. Table 3.5-4 lists the English common names, Chamorro common names, and scientific names of all T&E animals at Andersen AFB.

Table 3.5-4 English, Chamorro Common Names, and Scientific Names of Threatened and Endangered Animals at Andersen AFB

English Common Name[1]	Chamorro Common Name[1]	Scientific Name[2]	Listing Status (F = Federal G = Guam)	Population decline or disappearance due primarily to BTS
BIRDS				
Nightingale Reed-Warbler	ga'karisu	*Acrocephalus luscinia*	F = Endangered G = Endangered Extirpated from Guam	
Vanikoro Swiftlet (Island Swiftlet)	Yågaguak	*Aerodramus vanikorensis bartschi*	F = Endangered G = Endangered	
Mariana Mallard	Ngånga'	*Anas platyrhynchos oustaleii*	F = none G = Endangered; Extinct	
Micronesian Starling	Såli	*Aplonis opaca guami*	F = none G = Endangered	Yes
Mariana Crow	Åga	*Corvus kubaryi*	F = Endangered G = Endangered	Yes
White-throated Ground Dove	Paluman Apåka'	*Gallicolumba xanothura xanothura*	F = none G = Endangered; Likely extinct	Yes
Common Moorhen	Pulattat	*Gallinula chloropus guami*	F = Endangered G = Endangered	
Micronesian Kingfisher	sihek	*Halcyon cinnamomina cinnamomina*	F = Endangered G = Endangered Extirpated from Guam	Yes
Micronesian Megapode	Sasangat	*Megapodius laperouse*	F = none G = Endangered; Extinct	
Guam broadbill (Guam Flycatcher)	Chuguangguang	*Myiagra freycineti*	F = none G = Endangered; Extinct	Yes
Micronesian Honeyeater	Egigi	*Myzomela rubrata*	F = none G = Endangered Extinct on Guam	

Table 3.5-4 English, Chamorro Common Names, and Scientific Names of Threatened and Endangered Animals at Andersen AFB (*continued*)

English Common Name[1]	Chamorro Common Name[1]	Scientific Name[2]	Listing Status (F = Federal G = Guam)	Population decline or disappearance due primarily to BTS
Mariana Fruit Dove	Totot	*Ptilinopus roseicapilla*	F = none G = Endangered; Extinct on Guam	Yes
Guam Rail	Ko'ko'	*Rallus owstoni*	F = Endangered G = Endangered Extirpated from Guam	Yes
Rufous Fantail	Chichirika	*Rhipidura rufifrons uraniae*	F = none G = Endangered; Extinct	Yes
Bridled White-eye	Nosa'	*Zosterops conspicillatus conspicillatus*	F = none G = Endangered; Extinct	Yes
MAMMALS				
Pacific Sheath-tailed Bat	Payesyes, or Fanihin Liyang	*Emballonura semicaudata*	F = none G = Endangered; Likely extinct	
Mariana Fruit Bat	Fanihi	*Pteropus mariannus mariannus*	F = Threatened G = Endangered	Yes
Little Mariana Fruit Bat		*Pteropus tokudae*	F = Endangered G = Endangered Likely extinct	
REPTILES				
Loggerhead sea turtle	Hagan Tasi	Caretta caretta	F = Threatened G = None	
Green Sea Turtle	Haggan Bed'di	Chelonia mydas	F = Threatened G = Threatened	
Snake-eyed skink	achi'ak	Cryptoblepharus poecilopleurus	F = None G = Endangered	
Leatherback Sea Turtle	Hagan Tasi	Dermochelys coriacea	F = Endangered G = None	
Tide-pool skink	achi'ak	Emoia atrocasteta	F = None G = Endangered	
Azure-tailed skink	achi'ak	Emoia cyanura	F = None G = Endangered	
Slevin's skink	achi'ak	Emoia slevini	F = None G = Endangered	

Table 3.5-4 English, Chamorro Common Names, and Scientific Names of Threatened and Endangered Animals at Andersen AFB (*continued*)

English Common Name[1]	Chamorro Common Name[1]	Scientific Name[2]	Listing Status (F = Federal G = Guam)	Population decline or disappearance due primarily to BTS
Hawksbill Sea Turtle	haggan karai	Eretomochelys imbricata	F = Endangered G = Endangered	
Oceanic gecko		Gehyra oceanica	F = None G = Endangered	
Moth skink	achi'ak	Lipinia noctua	F = None G = Endangered	
Pacific Slender-toed skink	achi'ak	Nactus pelagicus	F = None G = Endangered	
Micronesian gecko		Perocinis ateles	F = None G = Endangered	
MOLLUSKS				
Mariana Islands Tree Snail	akaleha'	Partula gibba	F = Candidate G = Endangered Likely **extinct**	
Pacific Tree Snail	akaleha'	Partula radiolata	F = Candidate G = Threatened Likely **extinct**	
Mariana Islands Fragile Tree Snail	akaleha'	Samoana fragilis	F = Candidate G = Endangered Likely **extinct**	
INSECTS				
Mariana eight-spot butterfly		Hypolimnas octucula mariannensis	F = Candidate G = Endangered	

[1] *English and Chamorro names taken from http://www.guamdawr.org/*
[2] *Species organized alphabetically by scientific name within each category*

The four federally protected reptiles are all sea turtles and would not be present above the strand vegetation along the beach. There are seven species of lizards (skinks and geckos) listed as endangered by GovGuam. At one time, these species may have occurred in most habitats throughout Guam, but little is known about these lizards. Smaller BTSs on Guam readily prey on lizards (Rodda, *et al. 1999*), and the lizard populations have undergone rapid declines, primarily due to BTS predation (Rodda and Fritts 1992). Two species of birds, the Guam broadbill and the Mariana mallard, have not been recorded anywhere in nature in recent decades. These two species were removed by the USFWS from the federal ESA because they are thought to be extinct (USFWS 2004b), primarily due to BTS predation (see Table 3.5-4). There have been only incidental sightings of three bird species, the white-throated ground dove, the Island swiftlet, and the Mariana fruit dove (GovGuam 1999). There have been no recent sightings of three bird species, the bridled white-eye, Micronesian honeyeater, and rufous fantail, all of which are presumed either wholly extirpated from Guam or extinct everywhere throughout their historic range. There have been numerous sightings of the Micronesian starling in forested areas along the Base golf course and in family housing (Wald 2006). The Micronesian starling occurs in small numbers in several urban centers (Lujan 2005), but the population's size is presumed to be very small. Two species of birds, the Guam rail and the Micronesian kingfisher, have been wholly extirpated in the wild, primarily due to BTS predation, and persist as captive lineages in zoos (USFWS 2004d). The remaining federally listed species, the Mariana crow, is the only bird species still found in the wild near Andersen main base, although in very limited numbers.

Two mammal species, the Pacific sheath-tailed bat and the little Mariana fruit bat, have not been sighted in several decades and are likely extirpated from Guam (Wiles, *et al.* 1995). The Mariana fruit bat is the only mammal that persists in the wild on Guam, and the numbers are steadily declining, partially due to BTS predation (Wiles, *et al.* 1995).

As shown in Table 3.5-4, there are a number of federally or locally listed animal species. However, many of those species and suitable habitat are not present within the ASA or Commercial Gate project areas. In addition to the plant species described above, the animal species listed in Table 3.5-5 are considered by the USFWS and by conservation officers at Andersen AFB to be the most critically important for this area at this time. The animal species listed in Table 3.5-5 are considered in detail below.

Table 3.5-5 Animal Species of Concern

	Scientific Name	Common Name	Federal Listing	Guam Listing
Mammal	*Pteropus mariannus mariannus*	Mariana fruit bat	Threatened	Endangered
Birds	*Corvus kubaryi*	Mariana crow	Endangered	Endangered
	Halcyon cinnamomina cinnamomina	Micronesian kingfisher	Endangered	Endangered
	Rallus owstoni	Guam rail	Endangered	Endangered
Mollusks	*Partula radiolata*	Pacific tree snail	Candidate for Listing	Threatened
	Partula gibba	Mariana Islands tree snail	Candidate for Listing	Endangered
	Samoana fragilis	Mariana Islands fragile tree snail	Candidate for Listing	Endangered
Insect	*Hypolimnus octicula var. mariannensis*	Mariana eight-spot butterfly	Candidate for Listing	Endangered

Mariana Fruit Bat

The Mariana fruit bat was listed as endangered in 1984 (USFWS 1984). By 1995, the Guam population of the Mariana fruit bat was between 300 and 500 individuals (USFWS 2004c). This nocturnal mammal forages across Andersen AFB, Northwest Field, and MSA 1 (USFWS 2004c; 2005a). The last known roosting colony is located on Andersen AFB near the Pati Point Natural Area. In the past, populations of the Mariana fruit bat on Guam and the Northern Mariana Islands were considered to be separate, and the Guam population was listed as endangered. A change in the status of the Mariana fruit bat on Guam from endangered to threatened reflects the recent classification of the populations on several islands (particularly, Guam and Rota) as a single population, not as an increase in reproductive success on Guam (USFWS 2005a). The bats prefer to roost in large *Ficus prolixia*, *Neisosperma*, and *Mammea odorata* trees during the day (Wiles 1986). The bats prefer to forage for fruit in *Artocarpus mariannensis*, *Artocarpus altilis*, *Pandanus dubious*, *Cycas*, *Mammea*, *Ficus prolixia*, *Elaeocarpus*, *Ficus tinctoria*, *Erythrina variegata*, and *Pandanus tectorius* (Wiles 1986; Andersen AFB 2003c). Guam currently has fewer than 30 fruit bats (Brooke 2006; Dicke 2006) in the roosting area near Pati Point. The numbers are declining steadily, probably due, in part, to BTS predation on non-volant juveniles (*i.e.,* too old to be carried by an adult, and too young to fly) (Wiles, *et al.* 1995) and low frequency but chronic poaching (Brooke 2005; Wiles 1994). No Mariana fruit bat juveniles are thought to currently inhabit the colony at Pati Point, suggesting an alarmingly high rate of BTS predation (Dicke 2006).

A bat survey was conducted in January 2006 (Parsons 2006) to determine if Mariana fruit bats were present within the ASA and Commercial Gate project areas, but none were observed. However, six observations were recorded by survey personnel in adjacent areas within 800 meters (2,625 feet) of the ASA project area, and were provided by USFWS personnel (Brooke 2005). One female fruit bat was tracked with radio telemetry foraging in an intact forested area approaching the cliffline within the ASA project area. Figure 3.5-4 shows the locations of Mariana fruit bat observations relative to the project areas.

Although highly degraded from ungulate pressure, prior land use, and presence of the BTS, useable habitat for the Mariana fruit bat is present within the ASA and Commercial Gate project area (Wiles, *et al.* 1995). This potential habitat occupies 57.5 hectares (142.1 acres), primarily within the forest community types that contain suitable associative tree species, especially in areas overlying rocky and karst substrates that have been spared from past land clearing activities. Of the 57.5 hectares (142.1 acres) identified as potential habitat for the Mariana fruit bat, 1.4 hectares (3.5 acres) can be considered higher quality based on the canopy structure for roosting and species composition for foraging. With the main colony of Mariana fruit bats at Pati Point, it is probable that Mariana fruit bats would forage in suitable tree species found within the ASA project area.

Mariana Crow

The Mariana crow was listed as endangered in 1984 (USFWS 1984), and only a few remaining Mariana crows occur on the northern end of Guam and the Island of Rota. Many of the less than 15 birds remaining on Guam were transplanted from Rota, and all are reported to be at or near Andersen AFB (USFWS 2004b; GovGuam DAWR 2005). The Mariana crow seems to have a preference for native trees of large stature, nesting most frequently in emergent *F. prolixa* and *E. yoga* trees (Morton 1996; Lujan 1996), although there is some evidence the crow will nest in late successional secondary growth forest, including *Guamia mariannae* (paipai) and *Premna obtusifolia* (ahgao) (Andersen AFB 2003c). The crows are omnivorous, and will forage in a number of trees, including *Artocarpus mariannensis*, *C. nucifera*, *F. prolixa*, *P. dubious*, *C. equisetifolia*, and *N. oppositifolia* (Tomback 1986; USFWS 1990a; USFWS 2005b). The crows are sensitive to human disturbance, and prefer to nest in trees greater than 290 meters (951 feet) from roadways (Morton 1996; USFWS 2004b), although there has been evidence of nesting attempts approximately 10 meters (33 feet) from a road and another nest approximately 30 meters (98 feet) from a road (Lujan 2005).

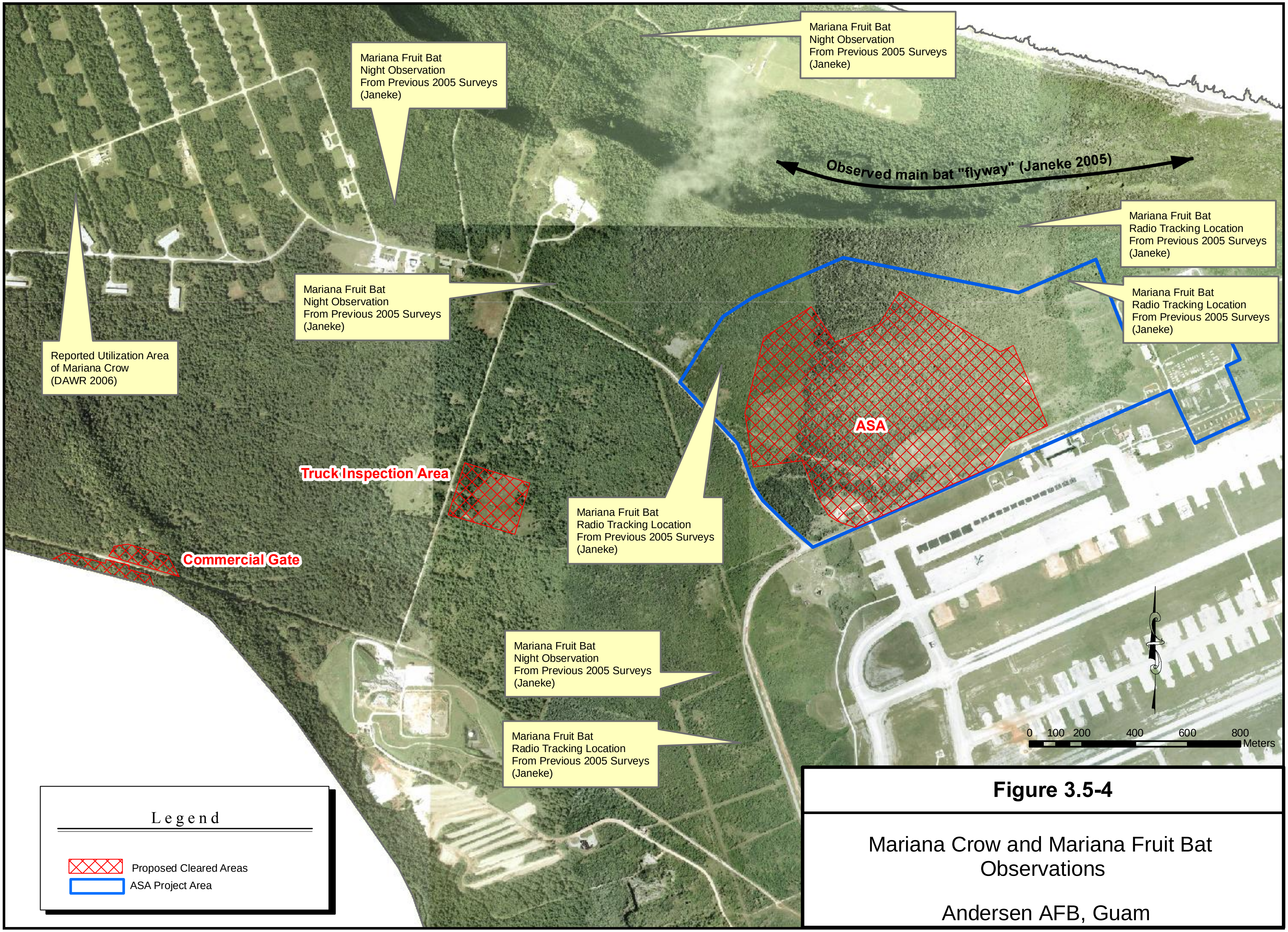

Figure 3.5-4

Mariana Crow and Mariana Fruit Bat Observations

Andersen AFB, Guam

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In addition, crows have reportedly nested at MSA 1, where blocks of forest are approximately 110 meters (361 feet) wide (Lujan 2005). Population declines of the Mariana crow are primarily the result of habitat loss and predation by the BTS (Savidge 1987; Wiles, *et al.* 2003; GovGuam DAWR 2005). Andersen AFB contains tracts of native limestone forest, some of which could be considered relatively intact (*e.g.,* the forested areas proposed for critical habitat, including Northwest Field, MSA 1, and Andersen main). The higher quality tracts are considered essential to recovery of the Mariana crow, while tracts at lower states of succession have potential for habitat restoration efforts (USFWS 2004c).

A crow survey was conducted within the ASA and Commercial Gate project areas in January 2006 to determine the presence of Mariana crows (Parsons 2006). No crows were observed. Ten juvenile crows were released by DAWR in November in MSA 1 (Dicke 2006). A crow was reported by a hunter on November 27, 2005 within Andersen main, south of Northwest Field (Brooke 2005). Figure 3.5-4 shows locations of Mariana crow observations relative to the ASA and Commercial Gate project areas. Recent data obtained from DAWR (Dicke 2006) indicate nesting and utilization areas occur mostly within MSA 1, in eastern portions of Northwest Field, and at Pati Point.

Although highly degraded from ungulate pressure, prior land use, and presence of the BTS, habitat for the Mariana crow is present within the ASA and Commercial Gate project areas (Lujan 1996; Savidge 1987; Wiles, *et al.* 1995; Lujan 2005). This potential habitat occupies 57.5 hectares (142.1 acres), primarily within the forest community types that contain suitable associative tree species, especially in areas overlying rocky and karst substrates that have been spared from past land clearing activities. Of the 57.5 hectares (142.1 acres) of potential habitat, 1.4 hectares (3.5 acres) can be considered more suited to the Mariana crow due to species composition and structure. Lujan (1996) recorded crow nests in *F. prolixa* trees in the general area of the ASA project.

Micronesian Kingfisher

The Micronesian kingfisher was listed as endangered in 1984 (USFWS 1984). It has been wholly extirpated in the wild due to habitat loss and predation by the BTS (Savidge 1987; Wiles, *et al.* 2003), and persists in zoos in captive lineages (GovGuam DAWR 2005) and at a captive breeding facility on Guam operated by DAWR. The Micronesian kingfisher nests and feeds primarily in mature limestone forests and late successional secondary growth forests, and occasionally in *Cocos nucifera* plantations. The Micronesian kingfisher feeds entirely on animal matter, and is a deliberate forager (USFWS 1990a). Its general foraging habit is to perch motionless on large trees with exposed branches and survey the ground below. Nesting behavior includes excavation of nesting cavities from large trees with “soft” or partially “rotten” wood, typical of native limestone forest. Its preferred nesting tree is the *Pisonia grandis* (GovGuam DAWR 2005), but they will also utilize *Artocarpus mariannensis*, *Cocos*, and *Ficus prolixa* if available (USFWS 1990a).

Survey data from 1981 indicate that Micronesian kingfishers were present in the northern portion of Andersen AFB. Proposed construction would remove 57.5 hectares (142.1 acres) of secondary growth forest and shrubby areas that are potential foraging and nesting habitat for the Micronesian kingfisher.

Guam Rail

The Guam rail is a flightless, omnivorous, ground-nesting bird. Although omnivorous, the Guam rail prefers animal matter over vegetable matter (*e.g.*, lizards, gastropods, and carrion). The Guam rail generally lives in brushy areas mixed with grassland or forest (USFWS 1990a), and was listed in 1984 as endangered in its entire range (USFWS 1984). It has been wholly extirpated in the wild due to predation from the BTS, and persists as captive lineages in zoos (GovGuam DAWR 2005; Wiles *et al.* 1995) and at a captive breeding facility on Guam operated by DAWR. BTSs are not present on the Island of Rota, and habitat was designated for release of Guam rails. The introduced population of Guam rails on Rota was considered an experimental, non-essential population (USFWS 1989), and was proposed to be used for future "wild" introductions to Guam. On Guam, Area 50 was fenced to exclude BTSs, and extensive trapping of BTSs has occurred. In 1988, 16 Guam rails were released into Area 50; at least four of the birds died, but four breeding pairs hatched 10 chicks. In 2000, the Guam DAWR initiated playback surveys which detected 10 Guam rails within Area 50 (GovGuam DAWR 2000a). Although fencing is preventing predation by BTSs, feral cats and rats are still able to enter the area and prey on eggs, juveniles, and adult rails (GovGuam DAWR 1999). Conservation personnel indicate that no rails are currently present in Area 50 (Lujan 2005). Construction in the ASA and Commercial Gate project areas would remove 34.2 hectares (84.5 acres) of suitable habitat.

Mollusks

None of the four partulid tree snails is listed as endangered, even though one (Mt. Alifan tree snail) recently became extinct (Wiles, *et al.* 1995). The remaining three species of tree snails occur only in very restricted environments in northern Guam. None of these three species has been observed in recent years within Andersen main or other portions of Andersen AFB (USAF 2000; Andersen AFB 2003c). Vegetation commonly associated with the tree snails include kafu, screw pine, Paipai (*Guamia mariannae*), hibiscus tree, False rattan (*Flagellaria indica*), and Wild passion flower (*Passiflora suberosa*). The snails prefer moist closed canopy forested areas, with minimal ground level disturbance. The primary reasons for decline of the three snail species are due largely to habitat alteration (exacerbated by deer and pigs), and predation by the invasive Giant African snail (*Achatina fulica*) and the invasive Black flatworm (*Platydemus manokwari*) (Hopper and Smith 1992).

None of the three candidate snails were observed within the ASA or Commercial Gate project areas during January 2006 surveys. Presence of the African tree snail, a known predator of the candidate snails, was observed in the project areas.

Habitat for the three candidate snails exists in mesic, relatively closed-canopy forest, where ground disturbance has been minimal or absent (Hopper and Smith 1992). Most potential snail habitat at Andersen main has been degraded as a result of prior land use and disturbance. Marginal habitat, however, appears to be present in a narrow band of intact secondary limestone forest near the cliff line in the northern portion of the ASA project area, as well as in a pocket of intact secondary forest on a karst substrate in the southwest portion of the ASA. This habitat occupies 6.5 hectares (16.1 acres) of the ASA project area. No habitat is present within the Commercial Gate project area.

Insects

The Mariana eight-spot butterfly (*Hyploymnus octicula mariannensis)* is a federal candidate for T&E listing (USFWS 2002). The larvae of this species feed on two native plants, *Procris pedunculata*, and *Elatostema calcareum*. These forest fleshy herbs only grow on karst limestone, and the plant species have declined due to browse pressure by the Philippine deer. In addition, decline of the species is due to very high mortality of the eggs and larvae of the butterfly due to predation by non-native wasps and ants (USFWS 2002).

No observations of the Mariana eight-spot butterfly occurred during surveys within the ASA or Commercial Gate project area. In addition, the associative plants *Procris pedunculata* and *Elatostema calcareum,* were not observed during surveys. One butterfly species *Euploea eunice hobsonii* (no known common name) was fairly common in the open herbaceous community type. Other butterfly species were observed, including the Common swallowtail (*Papilio xuthus)* and the Monarch (*Danaus archippus*).

Recent observations were reported of the Mariana eight-spot butterfly, along with *P. pedunculata* and *E. calcareum* along a rocky pinnacle karst area toward Pati Point, approximately 800 meters (2,625 feet) from the ASA project area (Lawrence 2005). A pair of Mariana eight-spot butterflies were observed, apparently defending an area from an individual *E. Eunice hobsonii.*

Critical Habitat Designation and Guam National Wildlife Refuge

The GNWR was established in 1993 to protect and recover T&E species, protect habitat, control non-native species (with emphasis on the BTS), protect cultural resources, and provide public recreational and educational opportunities. The GNWR contains eight management units. The Ritidian Unit is a 312-hectare tract composed of coral reef and terrestrial habitat wholly owned by the USFWS. The remaining seven management units contain 9,088 hectares (22,457 acres) on Air Force and Navy land, and are classified as overlay refuge units. USFWS has consulting rights and management obligations on overlay refuge land. Approximately 4,168 hectares (10,299 acres) of Andersen AFB is classified as overlay refuge land. Figure 3.5-5 shows the location of the GNWR management units on Guam, and the Overlay Refuge on Andersen AFB.

In 2004, USFWS designated 150 hectares (371 acres) of terrestrial habitat within the Ritidian Unit of the GNWR as critical habitat for the Mariana fruit bat, Mariana crow, and the Micronesian kingfisher (USFWS 2004c). Critical habitat designations are pursuant to 4(b)(B)(2) of the ESA. Before the USFWS designation of critical habitat in 2004, the 4,168-hectare portion of the GNWR overlay on Andersen AFB was proposed to be designated as critical habitat. The portion of the Andersen AFB is considered critical for recovery of the listed species, but the INRMP for Andersen AFB (Andersen AFB 2003c) exempted the GNWR overlay from the USFWS critical habitat designation. The INRMP provides provisions for USFWS to proactively manage the GNWR overlay and assist Andersen AFB with natural resource coordination at an early stage of project planning (Andersen AFB 2003c).

3.5.4 Natural Resources Planning

The Air Force prepared an INRMP for Andersen AFB (Andersen AFB 2003c) in accordance with the Sikes Act, as amended through 2003 (Title 16, USC 670a, *et seq.*), AFI 32-7064, and

DoD directive 4700.4. The INRMP provides a framework for the conservation and management of natural resources in conjunction with the military mission at Andersen AFB. Further, the INRMP provides guidelines for management in the following program areas: T&E and species of special status under federal or local statutes; fish and wildlife conservation; grounds maintenance; outdoor recreation; coastal resources; cultural resources; and water resources. The INRMP also defines a management program to ensure compliance with regulatory requirements. In accordance with the Sikes Act improvement amendments, the USFWS is a signatory agency on the Andersen AFB INRMP.

The INRMP is designed to be a tool to guide short-term resource management activities (0-2 years) and mid-range planning for resource conservation and mission needs (3-5 years). Therefore, Alternative A would need to consider the guidelines for natural resource management provided in the INRMP. The management goals described in the INRMP include utilization and management of Andersen AFB's natural resources consistent with its military mission; protection and recovery of sustainable populations of the USFWS endangered plant and animal species present on Andersen AFB; and study, evaluation, and protection of other locally threatened plant and animal species on Andersen AFB. The Andersen AFB INRMP supports the Guam National Wildlife Refuge (Refuge Overlay) in partnership with USFWS in accordance with the Cooperative Agreement of March 1994 (Andersen AFB 2003c).

3.6 GROUNDWATER RESOURCES

The Northern Guam Lens aquifer supplies up to 80 percent of the island's potable water and serves as the primary source of potable water for the island. Other potable water sources are from surface water on the island. The aquifer is replenished from precipitation that percolates through the limestone. Groundwater is typically found approximately 450 to 500 feet below ground surface (bgs) (Andersen AFB 2000). The Northern Guam Lens is being considered by the Guam EPA as "groundwater under direct influence of surface water." The aquifer has also been designated by USEPA as a Sole Source Aquifer under the Safe Drinking Water Act.

The high permeability of the limestone in northern Guam allows rapid infiltration of rainfall so surface runoff occurs locally only after intense rain. The limestone also offers little resistance to ground-water flow so only a thin freshwater lens has developed. Water levels in the freshwater lens vary several feet daily and seasonally in response to ocean tides, recharge, and ground-water withdrawal. The thickness of the freshwater lens varies seasonally, primarily in response to seasonal variations in recharge (USGS 2003). Depending on particle size, filtration occurs as surface water percolates through the soil and underlying limestone unless there is a direct conduit to the aquifer such as a UIC well or a continuous fracture. Base personnel monitor all construction activity and requires an EPP that identifies actions necessary to reduce or preclude surface contamination from entering the UIC wells.

Groundwater serves as the primary source of drinking water to Guam and other nearby islands. Groundwater is stored in highly-permeable limestone aquifers which were originally formed as coral reefs. In some areas, these limestone aquifers have been uplifted by the underlying volcanic rocks, or "high-level limestone aquifers" (Guam EPA 2006).

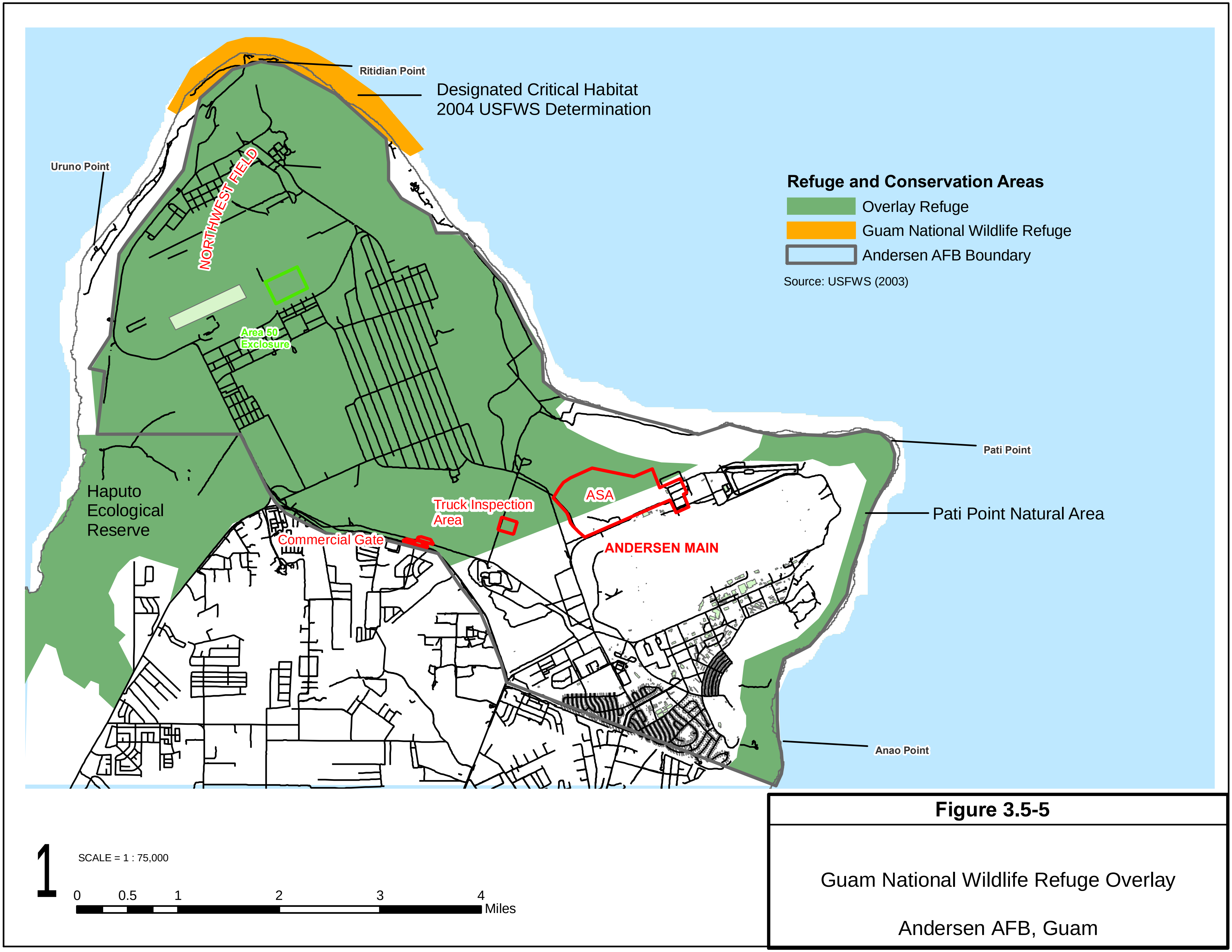

Figure 3.5-5

Guam National Wildlife Refuge Overlay

Andersen AFB, Guam

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The only source of groundwater is precipitation, which infiltrates to the subsurface and recharges the underlying water table (the upper surface of the groundwater system). Guam receives approximately 90-100 inches of rain per year. A significant portion of this is lost to evapotranspiration; some is lost to surface runoff, and the remaining portion is available as "recharge" to groundwater. This recharge is the only source of replenishment to the groundwater system. The average annual recharge rate is estimated at 35 inches per year. The thickness of the groundwater lens is directly related to the recharge rate and to water withdrawal rates (Guam EPA 2006).

Andersen AFB lies on the northern portion of three groundwater subbasins: the Finegayan subbasin under the western third of the Base; the Agafa Gumas subbasin under the central portion of the Base, which includes Northwest Field; and the Andersen subbasin under the eastern portion of the Base (Andersen AFB 2000). Over 100 dry wells were created at the Base to assist in storm water recharge into the aquifer. However, this method has the potential to cause groundwater contamination from storm water runoff (Andersen AFB 2004b). Past activities have not resulted in extensive groundwater contamination due to use of the procedures in the Base's SWPPP (Andersen AFB 2000). Groundwater in each subbasin consists of a basal or parabasal zone. Subsurface freshwater floats above the seawater within the basal zone, while in the parabasal zone, freshwater flows directly on the impermeable volcanic basement rock (Andersen AFB 2000).

In 1993, the Agency for Toxic Substances and Disease Registry (ATSDR) conducted an initial site visit on Guam to collect data and evaluate public health concerns associated with five potential exposure pathways at Andersen AFB, as well as other community concerns. The ATSDR conducted follow-up visits in January 1999 and May 2000. A public health assessment for Andersen AFB was prepared in January 2002 (ATSDR 2002).

Parts of Andersen AFB overlie the Groundwater Protection Zone, an area which supplies most of the island's population with drinking water. During IRP investigations, groundwater underlying Andersen AFB was found to be contaminated with VOCs. VOCs at levels above the ATSDR's health-based comparison values and USEPA Safe Drinking Water Standards were also found in three base production wells. These VOCs included tricholorethylene and tetrachloroethylene. Other active drinking water base production wells are either upgradient of or some distance away from areas of contamination. ATSDR evaluated past exposure to contaminants in the affected production wells and determined that drinking this water would not harm individuals or increase their likelihood of developing adverse health effects.

ATSDR also concluded the agency does not expect any public health hazards, now or in the future, for individuals drinking water from the Andersen AFB water supply or any other production wells on Guam. Several reasons for this include: 1) the military's remediation actions are further reducing contamination at the Base; and 2) the natural groundwater flow patterns dilute chemical contaminants to concentrations well below levels of public health concern. Finally, mixing of drinking water in the Base's distribution system further dilutes the levels of any contaminants in the water before the water reaches the taps.

On the basis of its evaluation of available environmental information, ATSDR concluded that exposures to contaminants in groundwater, surface soil, and local plants and animals harvested for consumption are below levels that would cause adverse health effects. ATSDR has categorized the Base as "no apparent public health hazard" because of the Air Force's education efforts, access restrictions and monitoring programs at Andersen AFB, contact with unexploded ordnance (UXO) and the possibility of harm is remote.

Approximately 43 mgd of water is withdrawn from the Northern Guam Lens aquifer (GWA 2006). The 2.5 mgd of water Andersen AFB withdraws from the aquifer equates to about 5.81 percent of the daily water withdrawal.

3.7 EARTH RESOURCES

3.7.1 Geology and Topography

Guam is located at the eastern edge of the Philippine Plate at the subduction boundary of the Pacific Plate. The deepest submarine trench in the world, the Marianas Trench, is located approximately 6 miles below the ocean surface in the subduction boundary east of Guam. Due to movement of lithospheric plates, Guam is prone to earthquakes. Between 1849 and 1911, four earthquakes with a magnitude of 7.0 or greater on the Richter Scale occurred in the vicinity of Guam. The most recent large-magnitude earthquake was recorded August 1993 and measured 8.1 on the Richter scale (Andersen AFB 2004b).

Guam is divided into four geophysical regions: (1) the volcanic remnants of south Guam; (2) the deformed beds of the Alutom formation of central Guam, composed of well-defined, fine to coarse-grained gray, green, and brown tuffaceous shale and sandstone; (3) the limestone formations of the northern plateau; and (4) coastal lowlands (Andersen AFB 2004b).

Andersen AFB lies on the limestone formations of the northern plateau. A narrow coastal lowland terrace is located at the bottom of steep cliffs that surround the plateau on the north, east, and west. This coastal zone is between 300 to 900 feet wide from the base of the cliff to the shore. Massive limestone formations from the Miocene-age (approximately 23.3 to 6.7 million years old) to the Pleistocene-age (about 5.2 to 3.4 million years old) underlie the Base. These formations were exposed by tectonic uplift and sea level fluctuations. The underlying limestone subtypes range from brittle to well-cemented (Andersen AFB 2004b).

The northern area of Guam is karst terrain that exhibits solution cavities and caves within the porous limestone bedrock. Collapses of these subterranean cavities form sinkholes, which are prominent topographic features of the limestone. The area is dominated by subsurface drainage instead of well-integrated surface drainage systems with principal stream valleys and tributaries. Rainwater easily percolates through the limestone to recharge the Northern Guam Lens aquifer, which is Guam's only drinking water aquifer (Andersen AFB 2000).

3.7.2 Soil

Five major soil types are found in Guam, including laterite (volcanic), riverine mud, coral rock, coral sand, and argillaceous (mixtures of coral and laterite soil). Guam soil is classified into three categories: bottomland; volcanic upland, and limestone upland. Soil at Andersen AFB is classified as limestone upland. This soil exhibits moderately rapid permeability and low water capacity. A thin layer (between 4 to 10 inches) of Guam cobbley clay soil overlies the northern limestone substrate, contributing to a shallow vegetation root structure at the Base (Andersen AFB 2004b).

Radon, a radioactive gas that seeps out of rocks and soil, comes from uranium that has been in the ground since the time the earth was formed. The rate of seepage is variable, partly because the amounts of uranium in the soil vary considerably (USEPA 1998a). Radon can occur in high concentrations in soil and rocks containing uranium, granite, shale, phosphate, and pitchblende. Radon may occur also in soil contaminated with industrial waste byproducts from uranium or phosphate mining (USEPA 1992). Subchapter 3.3.4 summarizes the results of radon testing at Andersen AFB.

3.8 HAZARDOUS MATERIALS AND WASTE

The 36 CES/CEV is responsible for management of hazardous materials and waste for the entire Base. A Hazardous Materials Pharmacy was instituted at Andersen AFB to oversee and minimize the procurement, use, and disposal of hazardous materials. Disposal of hazardous waste is arranged through a Defense Reutilization Marketing Office (DRMO) service contract where licensed hazardous waste contractors remove and dispose of the waste, and DRMO maintains all hazardous waste documentation in accordance with pertinent regulations. Andersen AFB has developed specific plans to manage both hazardous materials and hazardous waste at the Base.

3.8.1 Hazardous Materials

Management of hazardous materials at Air Force installations is established primarily by AFI 32-7086, *Hazardous Materials Management.* The AFI incorporates the requirements of federal regulations, other AFIs, and DoD directives, for reduction of hazardous material uses and purchases. Andersen AFB developed a Hazardous Materials Management Plan pursuant to the AFI for all Air Force personnel who authorize, procure, use or dispose of hazardous materials and to those who manage, monitor, or track any of those activities.

Hazardous materials are managed by the Base's Hazardous Materials Pharmacy. The pharmacy was established to oversee, procure, dispose, and minimize the use of hazardous materials. Use of a hazardous materials pharmacy program reduces the need to store large quantities of hazardous materials on Base and allows those materials to be ordered on an as-needed basis.

3.8.2 Hazardous Waste

Pursuant to AFI 32-7042, *Hazardous Waste Management*, the Base developed a *Hazardous Waste Management Plan* as guidance for personnel on the proper handling, storage, and disposal of hazardous waste, and implements the USEPA's "cradle-to-grave" management controls for hazardous waste.

The Base has 13 satellite accumulation points and one 90-day accumulation point. Disposal of hazardous waste is managed though the DRMO. The DRMO maintains all hazardous waste documentation and contracts with off-island licensed contractors for proper disposal of waste (Andersen AFB 2003b).

The primary types of hazardous waste generated at Andersen AFB include medical supplies, adhesives, paint-related waste, solvents, batteries, contaminated absorbents from spill cleanup, oil filters, and corrosive liquids. The existing Army and Air Force Exchange Service store outlet and cashier kiosk does not routinely generate hazardous waste; however, it stocks a variety of consumer items *(e.g.*, aerosol cans containing paints or pesticides, auto care products, house cleaning products, solvents) that are or may contain hazardous substances. Such products, if spilled or otherwise unintentionally released, could be categorized as hazardous waste. Additionally, containers of hazardous materials that remain in storage beyond their intended shelf life, or that become damaged cannot be sold, must be managed and disposed as hazardous waste (Andersen AFB 2003b).

3.8.3 Installation Restoration Program

The Air Force established the Installation Restoration Program (IRP) in 1983 to identify, characterize, and evaluate past (pre January 1984) disposal sites and remediate contamination on its installations as needed to control migration of contaminants and potential hazards to ecological resources, human health, and the environment in accordance with Comprehensive Environmental Response, Compensation, and Liability Act requirements. IRP goals are to protect human health and the environment by cleaning up and restoring Air Force sites where past activities created contamination from toxic and hazardous substances, low-level radioactive materials, and petroleum, oil, and lubricants. Current IRP efforts are aimed at characterizing all active sites, determining future remedial actions, and implementing interim removal or remediation actions to reduce risks and eliminate contamination sources. Air Force policy covers all sites where contamination occurred prior to January 1984. Sites where all contamination occurred after January 1984 are remediated under the Compliance Cleanup program.

In 1983, Andersen AFB began an investigation to identify and correct environmental contamination from past hazardous waste activities. Early stages of this investigation show that waste from past day-to-day operations and activities may have contaminated areas at the Base. Andersen AFB was placed in the National Priorities List on October 14, 1992 and entered into a Federal Facility Agreement with the USEPA and the Territory of Guam for installation environmental restoration efforts on March 30, 1993. According to the Base IRP Management Plan, 78 IRP sites and 74 solid waste management units (SWMU) have been identified Base-wide. In June 2003 three areas of concern (AOC) in MARBO Annex (which is not on Andersen main and is not in the ISR/Strike project area) were converted to IRP sites (Andersen AFB 2003b). In January 2005, all remaining AOCs (32 sites) were converted to IRP sites by PACAF directive. Two SWMU sites were deemed eligible for IRP status and were transferred in June 2006 increasing the total number of IRP site from 43 to 78. Appendix C, Installation Restoration Program Data, contains a description or nature of the contamination and the current status of each site, as well as a figure depicting the location of each site.

3.8.4 Stored Fuel

Andersen AFB accomplishes numerous fueling operations to support aircraft and vehicle operation. The majority of fuel handled at Andersen AFB is aviation jet fuel. Other activities include receiving, storage and dispensing of petroleum, oils, or lubricants, including on-Base consumption of diesel fuel and gasoline by motor vehicles, consumption of containerized lubricants and other petroleum products, and consumption of diesel fuel for emergency power generation. Fuel storage facilities at the Base have the primary and secondary containment features required by regulatory guidance to contain unintended spills and leaks from becoming an environmental issue. Andersen AFB has management plans for fuels management, spill containment, and cleanup of petroleum, oils, and lubricants.

Bulk jet fuel is sent to Andersen AFB from fuel facilities at Apra Harbor via pipeline. Diesel and gasoline are delivered to the Base by truck. Andersen AFB has the capacity to store 66,000,000 gallons of jet fuel at the Base. Approximately 2,200,000 gallons of jet fuel were dispensed to aircraft in 2004 (Andersen AFB 2005c), which equates to about 6,027 gallons per day and about 0.01 percent of the storage capacity.

3.9 CULTURAL RESOURCES

Cultural resources include prehistoric and historic archaeological sites, buildings, structures, districts, artifacts, objects, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, or religious purposes. Historic resources, under 36 CFR 800, are defined as “Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the National Register of Historic Places.” The term “eligible for inclusion in the National Register” includes both listed and eligible properties that meet NRHP listing criteria found in 36 CFR 60.

In accordance with 36 CFR 800.16(d), the area of potential effects is the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic resources, if any such properties exist. The area of potential effect is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking. In many instances, the APE is not simply the project’s physical boundaries, or right-of-way. Section 110 of the National Historic Preservation Act requires that each federal agency establish a cultural resources management program to identify, evaluate, and nominate resources to the NRHP and protect historic resources.

The Air Force prepared an Integrated Cultural Resources Management Plan (ICRMP) for Andersen AFB in accordance with AFI 32-7065 and DoD Instruction 4715.3 (Andersen AFB 2003a). The ICRMP identifies program responsibilities and management framework; defines compliance procedures related to installation mission and cultural resources; and provides an inventory of cultural resources on Andersen AFB. The ICRMP also identifies historic resources, land uses on the Base, and impacts to cultural resources; further, the ICRMP defines a management program to ensure compliance with regulatory requirements.

The Air Force has established a general division of Andersen AFB into nine, distinct Cultural Resource Management Areas (CRMA) based on survey coverage and current land use as defined in the General Plan. The APE for Alternative A on Andersen AFB overlays three of the nine CRMAs described on Table 3.9-1 and shown on Figure 3.9-1.

Table 3.9-1 CRMAs Underlying the Proposed Alternative A Project Sites

CRMA	Description (Land Use and Locale)
II	Mixed Land Use, area around Main Operations Area
III	Mixed Land Use, Main Operations Area
IV	Open Space; central area of Andersen AFB

Source: International Archaeological Research Institute, Inc. [IIARI] 2004

3.9.1 Historic Resources

The first human habitation of Guam is believed to date from about 1,000 B.C. during the arrival of the Chamorro people, a Malayo-Polynesian group from Southeast Asia. Descendants of these first settlers then lived in relative isolation in the western Pacific for 2,500 years, until the arrival of a small Spanish fleet led by Ferdinand Magellan in 1521. After being a Spanish colonial possession during the 16th century, Guam was ceded to the United States after the Spanish-American War in 1898. The island was captured in 1941 by Japanese forces and recaptured by the United States in 1944.

Historical events that hold great significance to world history have occurred on Guam. The meeting between Magellan and the Chamorro on Guam marked the first contact between the western world and Pacific Islanders. Later, Guam served as the first regular supply station in the Pacific, provisioning the Manila galleons on their travels between the New World and Asia. Guam's strategic position was also used early in this century; first by the U.S. Navy as a coaling port, and later by Pan American Airlines as a port-of-call for the first trans-Pacific air route flown by the Pan Am China Clippers. During WW II, Guam figured prominently in the Allied push toward Japan. The U.S. invasion of Guam was a major military effort, and Guam played a significant role in the latter stages of the war in the Pacific. More recently, Guam became an initial evacuation point for Vietnamese refugees fleeing during the fall of Saigon (Navy 1996).

Cultural resources surveys of Andersen AFB identified prehistoric and historic sites. Historic sites consist of housing ruins from the early 20th century and other support structures, such as a stone pier and water catchment basins. Sites associated with WW II have also been identified at Andersen AFB and include Northwest Field, the Mt. Santa Rosa Battle Area, Quonset huts, and ARMCO huts. The pre-WW II resources are considered significant and provide information about rural life in northern Guam during the early 20th century.

Known historic resources in the Andersen AFB area include Pre-WW II resources, WW II resources and post-WW II resources (*e.g.*, monuments and markers). Historic resources represent the First American Period (1898 to 1941) - Economic-Agriculture; the Japanese Period (1941 to 1944) - WW II; and the Second American Period (1944 to present). The Second American Period is subdivided into the WW II Period and the Post-1945 Cold War Period. There are 116 historic sites listed on the NRHP on the Island of Guam, and an additional 39 historic sites listed on the Guam Register of Historic Places (total of 155 historic sites) (GovGuam HRD 2005).

Historic building surveys and ground checks for NRHP property categories (buildings, structures, objects and sites) for resources dating from before 1950 have been completed for each of the three CRMAs that underlie the proposed sites for ISR/ Strike facility projects.

The Tarague Historic District (PN-1) is the only historic district on Andersen AFB. The Tarague Historic District is a large set of archaeological sites of all time periods in the Tarague embayment. The district is one of the most important areas on Andersen AFB for traditional Chamorro sites. The extensive coastal dune areas and caves contain remains of Chamorro settlement dating back at least 3,000 years, and are known to have been traditional burial areas. The APE does not include this historic district.

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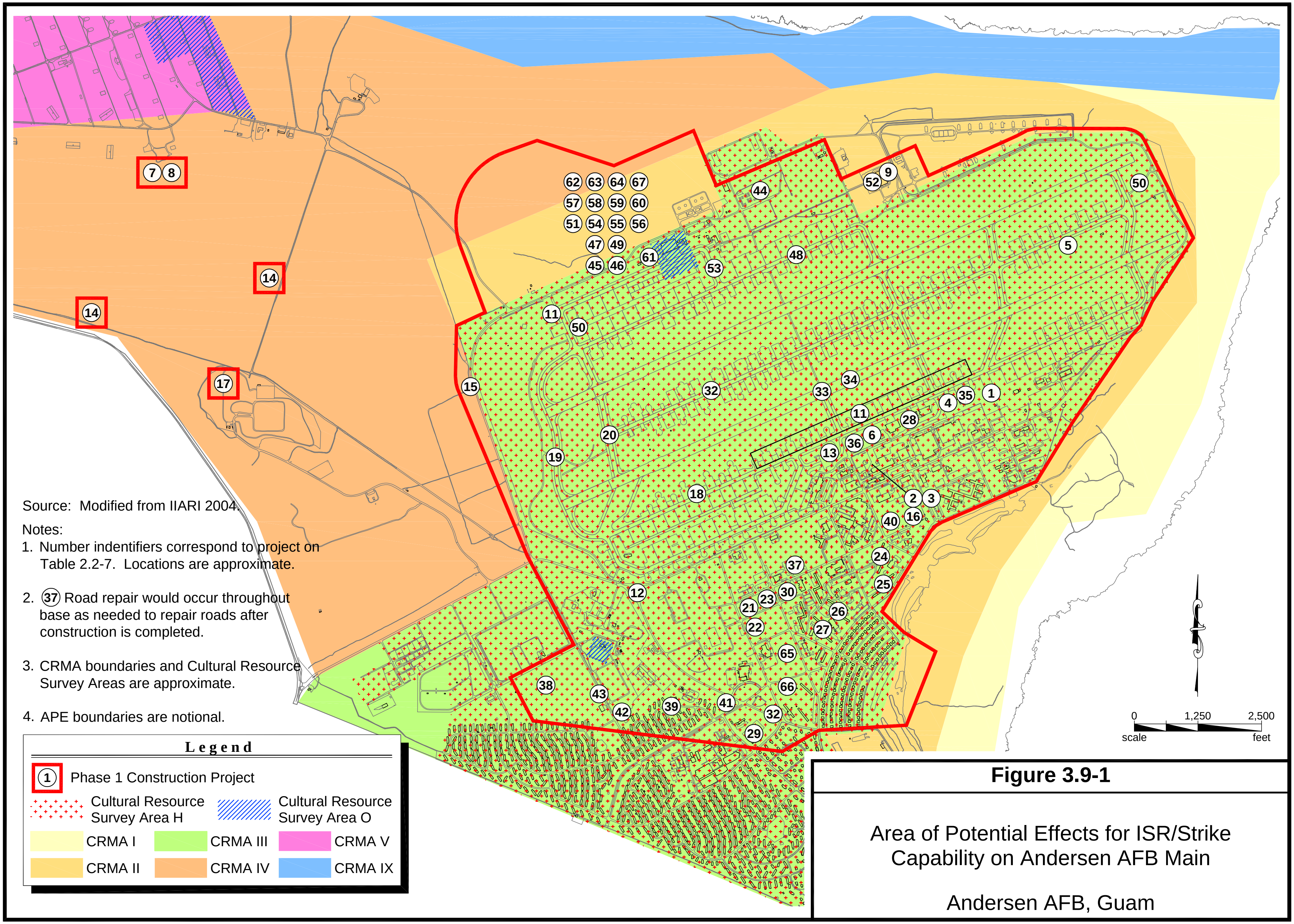

Source: Modified from IIARI 2004.

Notes:

1. Number indentifiers correspond to project on Table 2.2-7. Locations are approximate.
2. ㊲ Road repair would occur throughout base as needed to repair roads after construction is completed.
3. CRMA boundaries and Cultural Resource Survey Areas are approximate.
4. APE boundaries are notional.

Figure 3.9-1

Area of Potential Effects for ISR/Strike Capability on Andersen AFB Main

Andersen AFB, Guam

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A historic building and landscape/viewshed inventory and evaluation conducted in 2004 identified seven facilities on Andersen AFB as potentially eligible for the NRHP. These are: Facility 74, a radome tower building on Mount Santa Rosa; five storage igloos in MSA 1; and, the Munitions Support Equipment Maintenance Facility in MSA 1. With the exception of radome[1] tower constructed in 1956, all other facilities were constructed in 1954.

The igloos and munitions storage areas were built during the Cold War period when Andersen AFB was becoming the Strategic Air Command's principal base in the Pacific. The MSAs are significant under Criteria A and C, and are also a definable geographical area that can be distinguished from surrounding properties by physical separation aspects. Formation of a historic district was recommended in 2004 (Mason Architects 2004). The APE includes two proposed ISR/Strike construction projects immediately south of MSA 1: the Tactical Missile Maintenance Facility and the Conventional Missile Maintenance Facility.

The APE for proposed construction projects associated with establishment of the ISR/Strike capability is characterized by one known historic resource, a historic event site, as described on Table 3.9-2. This airfield, encompassing the entire active runway complex and located within CRMA III, meets Criterion A for inclusion on the NRHP because it is associated with events that made a significant contribution to the broad patterns of Guam history.

Table 3.9-2 Historic Resources in the APE for the ISR/Strike Capability

Site	Description	Date of Construction or Use	National Register (Date Listed)	Guam Register (Date Listed)
Munitions Storage Areas 1 and 2	Igloos and munitions storage areas constructed during the Cold War Period.	1954	Recommended as eligible in 2004	--
North Field/Andersen Airfield (Site 66-07-1064)	One of several airfields built for the U.S. Army Air Forces in WW II.	Post-Contact	Recommended eligible in 2004. based on National Register Criterion A.	Guam Register Eligibility forms prepared (undated).

Source: Navy 1996; IIARI 2004

Site 66-08-1065 comprises the site known as Northwest Field, one of five B-29 airfields built in the Marianas. Two airfields constructed on Guam were Northwest Field and North Field, in the area that is now Andersen AFB main. In August 1944, northern Guam was jungle, abandoned farms, and a few deteriorated roads. Construction of North Field began in November 1944 with the first runway completed on February 2, 1945. A second airstrip was completed in May 1956. The 314th Bombardment Wing assembled on North Field in February 1945. Its B-29s were responsible for attacks on Japan from February to June 1945. By June 1945, Northwest Field had been transformed into an operational airfield for B-29s from the 315th Bomb Wing. On 14 August 1945, B-29s from Guam left the runways for the last bombing mission of the war. The last B-29 bombs of WW II were dropped by one of the planes of the

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[1] A plastic housing sheltering the antenna assembly of a radar set, especially on an airplane.

16th Bomb Group on April 15, 1945. This plane was still in the air when Japan surrendered. North Field was converted into an Air Force installation in 1947 and was renamed as Andersen AFB in 1949.

In June 1950, B-29s from the 19th Bombardment Wing on Andersen AFB bombed targets in Korea. In June 1965, B-52s from Andersen AFB raided South Vietnam. In 1971, raids on North Vietnam were accomplished by planes from Andersen AFB. The landscape of North Field has the historic significance, integrity, and landscape characteristics for inclusion on the NRHP. North Field's association with the Cold War, beginning with its use by the Strategic Air Command in 1951, meets NRHP Criterion A (association with events that have made a significant contribution to the broad patterns of our history) (Mason Architects 2004). North Field is the only Air Force airfield from which planes flew combat missions in three wars: WW II, the Korean War, and the Indochina War (Andersen AFB 2003c).

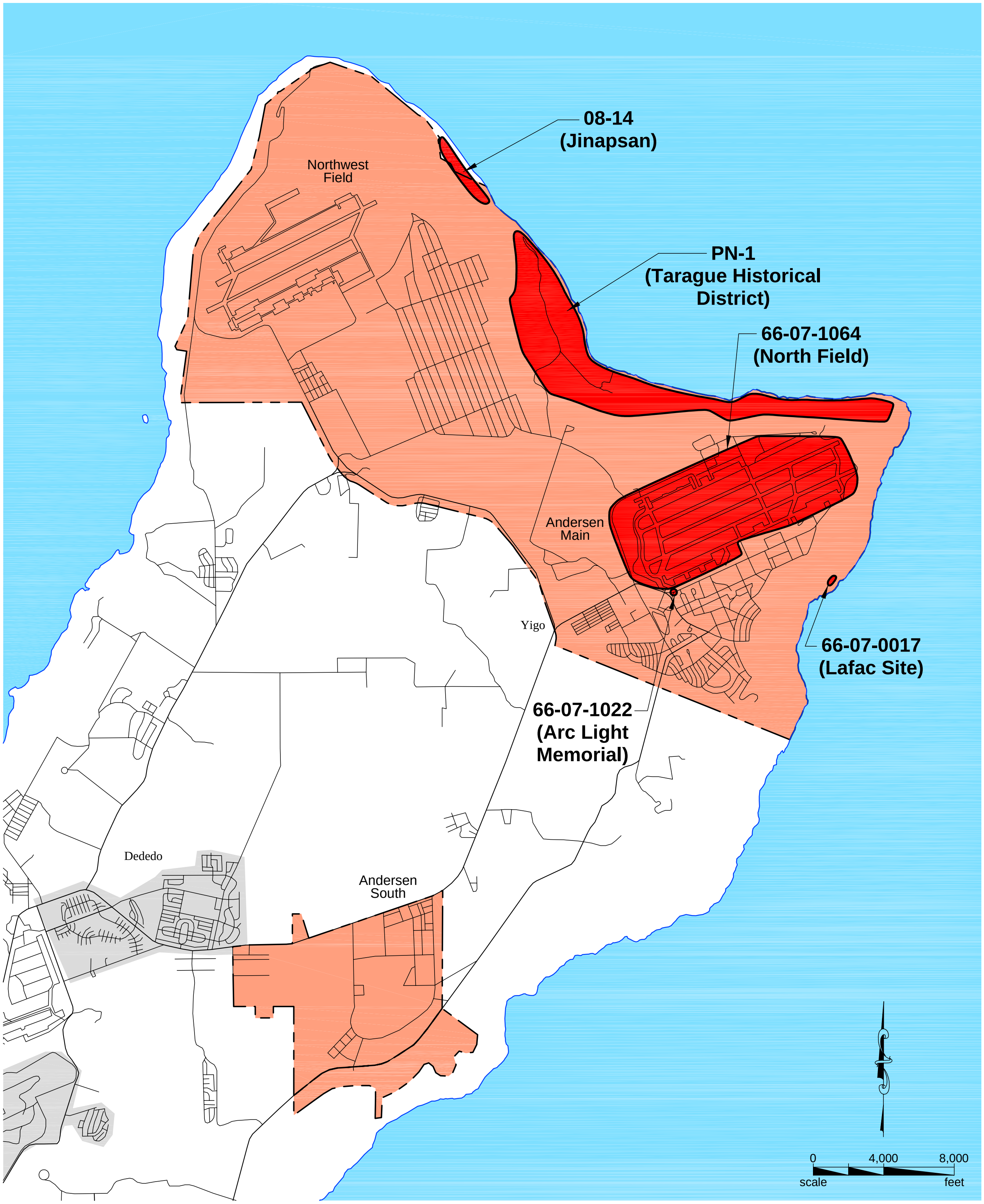
Because the original runways and taxiways of North Field have been lengthened and/or widened and other modifications made, these changes may have impaired the historical integrity associated with WW II (IIARI 2004). The boundaries of Site 66-07-1064 (North Field) are shown on Figure 3.9-2. The NRHP nomination forms for North Field were prepared in 1975. The 2004 ICRMP recommends that the Air Force complete and submit NRHP nomination forms to the GSHPO and that on-Base historic displays and commemorative plaques be considered as treatment for this maintained facility (Andersen AFB 2003c).

Both MSA 1 and MSA 2, which is on the eastern end of the north side of the airfield, meet NRHP qualifications as a historic district in that they possess a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development. Various types of storage igloos would be within the historic district. Constructed in 1954 during the Cold War period, the storage igloos are significant under Criterion A because of their association with the Air Force mission during the build-up of air power at overseas bases at the time of the Cold War in the 1950s. This was an important period as the nation defined its Cold War strategy of deterrence and as the Air Force built up its bases overseas to accommodate that strategy. MSAs 1 and 2 are also significant under NRHP Criterion C because they possess distinctive characteristics of a type of construction for ammunition storage facilities with separation distances and distinctive spatial layouts (Mason Architects 2004).

3.9.2 Archaeological Resources

Archaeological sites are places consisting of the physical remains of past human activity. Archaeological resources are fragile and non-renewable and can easily be destroyed by changes in patterns of land use.

The northern coastal flats of Guam contain a large number of cultural and archaeological sites. These sites range from midden deposits to examples of rather large *latte* villages. A *latte* is a pillar of volcanic stone or coral topped with a separate hemispherical capstone. These structures are believed to be the supporting structures for houses. They are usually found in parallel rows of similar number, length, and height. The ancient remains uncovered at Tarague date back 3,000 years, making the location one of the earliest dated sites in the Marianas. The area has been designated as the Tarague Beach Archaeological District.



Source: IIARI 2004a.

Legend

🟥 Historic Resource Location

Figure 3.9-2

Historic Sites on Andersen AFB

Andersen AFB Guam

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Archaeological investigations have been conducted for almost 90 years in the area now occupied by Andersen AFB. While most of these previous surveys covered specific and often very small areas, there still remains a vast area on Andersen AFB that has not been thoroughly surveyed. The only section of Andersen AFB that has had extensive and thorough archaeological work is the Tarague Embayment studied in 1996 (the Tarague Embayment is situated along the eastern coastal section of Andersen AFB). A summary of previous investigations conducted in the area of Alternative A is provided in Table 3.9-3.

Table 3.9-3 Cultural Resources Surveys in the ISR/ Strike Project Area

Source	Description	Date of Work
Davis	Survey of Andersen Air Field; no sites recorded.	1983
Tuggle	Surface survey of two areas near Andersen AFB airfield; no sites located.	1992

Source: IIARI 2004

Previous surveys by Kurashina, *et al.* (1987) and Haun (1989) indicate that the most commonly encountered site types at Andersen AFB are likely to be small ceramic scatters. Kurashina's inventory recovered 148 Latte period sherds from 17 sites; Haun reports 23 Latte period plain sherds from a single site. The areas of these sites were often less than 50 square meters. More recent work by PHRI in MSA 2 near the ASA project indicates a higher site density and a greater diversity of artifact and feature types, as well as larger sites, in that portion of the APE (DeFant 2005). A survey by IIARI in an area between MSA 1 and Northwest Field recovered numerous broken basalt lusong in addition to Latte period ceramics and features from the Spanish period, possibly the first American period, and the second American period (Yee, *et al.* 2004). In all of these areas, soil depth rarely exceeds about 30 centimeters, making the probability of encountering stratified deposits unlikely. Negative surveys are also reported for fairly large areas within Andersen AFB (Davis 1983; Tuggle 1993), indicating considerable variability in site density and/or preservation.

While the stages of construction and renovation on Andersen main have been documented historically, many of the areas between the airfields and along the coast lack exact location coordinates, photographic records, and thorough descriptions. The 2003 ICRMP identified 19 cultural resource properties on Andersen AFB (Andersen AFB 2003). In 2004, the Air Force conducted an overview survey to locate incompletely recorded sites with surface reconnaissance and GPS location recordings. The status of known sites was updated, and new sites were identified during the 2004 study. Among the archaeological resources identified in 2004 were: a rock wall of dry stone masonry suggesting traditional Chamorro construction; a possible helicopter pad and airplane parts; a shelter of collapsed wood and metal which was built after the Chamorro had been contacted by the Spanish (post-Contact); a wastewater treatment plant; bedrock mortars and a cave; and the Fafalog *lusong* (mortars) area.

There are 27 cultural resource properties on Andersen AFB. The Jinapsan Complex (Site 06-08-0014) is the only site listed on the NRHP. Twenty-two properties are recommended as eligible for listing, one property has been determined eligible by the GSHPO, and three properties have not been evaluated for eligibility. The project area for the proposed establishment of the ISR/Strike capability is characterized by one known cultural resource as described in Subchapter 3.9-1.

The project site includes areas on Andersen AFB that have not been thoroughly surveyed. Archaeological surveys have not been completed in CRMAs II or IV. Ethnographic surveys have not been completed for any of the three CRMAs in the project area. The remains of North Field have never been inventoried archaeologically, or been subjected to a detailed archival study.

Two of the three CRMAs in the project area (see Figure 3.9-1) are recommended for archaeological inventory and ethnographic surveys, and for Section 106 review if a planned project may affect archaeological properties. Table 3.9-4 provides a description of the cultural resources and potential for each of the three CRMAs in the project area. In accordance with Section 106 of the National Historic Places Act, the Air Force has initiated consultation with the GSHPO for establishment of the ISR/Strike capability on Andersen AFB (see Appendix D).

Table 3.9-4 CRMAs Underlying the Site for the ISR/Strike Capability

CRMA	Land Use and Locale	Description and Potential for Encountering Cultural Resources
II	Mixed Land Use, area around Main Operations Area	Located on the periphery of the Main Operations Area of Andersen AFB, this undeveloped area has some level areas to the northwest and steep karstic slopes to the east. This area has potential for cultural utilization in the form of resource procurement and the short or long-term habitation that procurement may necessitate. The less-than-desirable environment probably precluded permanent habitation sites.
III	Mixed Land Use, Main Operations Area	This fully developed Main Operations Area is unlikely to contain surface or subsurface cultural resources deposits. As recommended in the ICRMP cultural resource management should continue interpretation and commemorative programs.
IV	Open Space; central area of Andersen AFB	Sites and features from pre- and post-Contact times have been recorded in this large area, including traditional habitation sites (Fafalog *lusong* and artifacts). The area is located between known coastal sites that have been occupied. Limestone forest on this plateau is rich in plants of economic and subsistence importance to the pre-Contact Chamorro and early post-Contact inhabitants. The area has high potential for sites of permanent habitation and resource utilization. This area has been the least impacted by early historical and military development, and the least surveyed. Detailed survey followed by testing, data recovery and preservation planning should be considered before any alteration or development of this area occurs.

Source: IIARI 2004

3.10 SOCIOECONOMIC RESOURCES

3.10.1 Population

Andersen AFB is located at the northern end of Guam in the District of Yigo, and adjacent to Dededo. Table 3.10-1 portrays population trends from 1990-2003 for Guam and the major northern districts. The 1990 population of 133,152 for Guam reflected an annual population growth rate of 2.3 percent since 1980. According to the U.S. Census Bureau, the population of Guam in 2000 was 154,805, which included approximately 10,000 military personnel and their dependents. Guam's 2000 population reflected a 16 percent increase since 1990, or an annual growth rate of 1.5 percent, considerably less than the growth rate during the previous decade. The decrease in population growth during the past decade is assumed not to be the result of migration by Guam residents to Hawaii and other U.S. states for employment, but rather a decline of natural population increases. The most current population estimate (2003) is 163,593, or a 5 percent increase since 2000.

Table 3.10-1 Population Trends, 1990-2003

Geographic Area	Estimated Population, 2003[1]	Percent Population Change (1990-2000)	2000 Population[2]	1990 Population[2]
Guam	163,593	16	154,805	133,152
Dededo District	NA	35	42,980	31,728
Yigo District	NA	37	19,474	14,211
Tamuning District	NA	8	18,012	16,673

NA = Information not available at this geographic level.

1 Department of Public Health and Social Services, Government of Guam.

2 U.S. Department of Commerce, U.S. Census Bureau, 2000 Census.

Over 50 percent of Guam's population lives in the three northern districts of Dededo, Yigo, and Tamuning. Approximately 50 percent of the population increase in Guam during the 1990-2000 period occurred in the Dededo District. A shift in population from Guam's southern districts to the northern districts began in the early 1980s. This initial shift in population was partially due to annexation of land by the military and construction of bases. However, the existence of infrastructure has encouraged more development in the northern districts during the past two decades.

As indicated in Table 3.10-2, the local population of Guam is a heterogeneous mix of ethnic and cultural backgrounds that include Chamorro, Spanish, Filipino, Asian, Pacific Islanders, and Americans. Native Hawaiian and Other Pacific Islanders, the majority of which are descendents of the original aboriginal settlers called Chamorro, comprise 45 percent of the Island's population. Asian, primarily Filipino, account for one-third of the population, while persons consisting of a mix of races/ethnic groups comprise 14 percent of the Island's population. Only 7 percent of the local population is Caucasian. The foreign-born population has increased substantially during the past two decades, with almost one-third of the Island's population being classified as foreign-born. The majority of the foreign-born population migrated to the Island subsequent to the passage of the U.S. Compact of Free Association Act of 1985. This Act authorized unrestricted immigration of people in the Federated States of Micronesia and the Marshall Islands to the United States and its territories.

The on-Base population at Andersen AFB fluctuated widely during the past two decades as a result of military buildups and downsizings. During the 1980s, Air Force personnel stationed at the Base approached 4,000, accompanied by almost 5,000 family members. During the mid-1990s the number of military personnel at the Base began to gradually decrease. The current on-Base daytime population of Andersen AFB approximates 5,900 persons.

Table 3.10-2 Population Distribution by Ethnic Origin and Race, 2000

Ethnic Origin/Race	Number	Percent of Total Population
One Ethnicity or Race		
Native Hawaiian and Other Pacific Islander	69,039	45
(Chamorro)	(57,297)	
Asian	50,329	33
(Filipino)	(40,729)	
Caucasian	10,509	7
African American	1,568	1
Other Race or Ethnic Group	1,807	1
Two or More Races or Ethnic Groups	21,553	14
TOTAL	**154,805**	

Source *U.S. Department of Commerce, U.S. Census Bureau, Population and Housing Profile, Guam 2000.*

3.10.2 Housing

Table 3.10-3 portrays housing characteristics for the Island of Guam and the three most populated northern districts. According the 2000 U.S. Census, there were 47,677 housing units in Guam, a 35 percent increase from 1990. Over 50 percent of the housing units are in the northern three districts of Dededo, Yigo, and Tamuning. Only 48 percent of the housing units in Guam are owner-occupied, with a slightly higher owner-occupancy rate in the Dededo District and a significantly lower owner-occupancy rate in the Tamuning District. Approximately 19 percent of the housing units were classified as vacant in the 2000 U.S. Census.

Table 3.10-3 Housing Characteristics, 2000

Jurisdiction	Total Housing Units	Percent Owner-Occupied	Percent Vacant	Median Value (Owner-Occupied)	Median Monthly Contract Rent	Median Household Income
Guam	47,677	48	19	$171,900	$645	$39,317
Dededo District	12,119	55	17	$163,100	$590	$37,654
Tamuning District	8,108	25	27	$273,600	$720	$35,343
Yigo District	5,489	43	16	$161,800	$609	$37,415

Source: U.S. Department of Commerce, U.S. Census Bureau, 2000 Census.

The median value of owner-occupied housing varies widely throughout Guam. The overall median value for owner-occupied housing in Guam was $171,900 according to the 2000 U.S. Census, with median values ranging from a low of $152,100 in the Umatac District to a high of over $270,000 in the Piti and Tamuning Districts. Median household income in Guam also widely varies, with a median household income of $39,317 in 2000 as compared to $41,994 in the United States. The Island’s median household income decreased 2 percent between 1990 and

2000. Median household incomes ranged from a low of $31,130 in the Mongmong-Toto-Maite District and Hagatna District to over $50,000 in the Piti and Yona Districts.

The percentage of the population below the level of poverty in 2000 in Guam was 23 percent, compared to 11 percent for the United States. In the more populated districts, poverty rates ranged from a high of 33 percent in the Mongmong-Toto-Maite District in the central region, to a low of 10 percent in the Santa Rita District in the southern region of the Island.

According to the Guam Multiple Listing Service, there were 152 single-family homes listed for sale on the island in April 2005. In addition, there were 90 condominiums and townhouses listed for sale. The median asking price for single-family homes approximated $150,000, while the median price for condominiums/townhouses was approximately $120,000. A total of 242 single-family homes, condominiums, townhouses and apartments were also listed for rent in the Guam Multiple Listing Service. Median monthly rents ranged from $900-$1,000 for condominiums, townhouses, and apartments, to $1,200-1,300 for single-family homes.

The current on-Base housing inventory at Andersen AFB consists of 1,705 family housing units and dormitory quarters with 754 spaces for unaccompanied personnel, including visiting quarters. The family housing units include the approved 2003 Housing Requirements and Market Analysis total inventory of 1,388 units, plus 360 vacant units at Andersen South and six units at Tumon Tank Farm. The baseline Housing Community Profile existing requirement is 1,093 units, resulting in a surplus of 612 family housing units. Over 75 percent of the Andersen AFB active duty personnel live on Base, with 90 percent of the dependents living on-Base.

3.10.3 Education

Education for DoD dependents in Guam is supplied by the DoD Education Agency (DoDEA) which is operated as DoD Domestic Elementary and Secondary Schools; an island-wide public school system; and private schools. The DoDEA schools on Guam were established in September 1997 and consist of two elementary/middle schools (grades K-8), and one high school (grades 9-12). North Elementary/Middle School is located on Andersen AFB, while McCool Elementary/Middle School is located on COMNAVMARIANAS property. The DoDEA high school is located on Nimitz Hill, in the former COMNAVMARIANAS headquarters. Total DoDEA school enrollment on the Island for the 2003-2004 academic year was 2,561 students. North Elementary/Middle School, completed in 2001, has an enrollment capacity for over 1,300 students, 950 elementary grades, and 350 middle school.

The Island-wide Guam Public School System is composed of five high schools; six middle schools; and 24 elementary schools. Total public school enrollment was 30,299 in the 2003-2004 academic year. A recent initiative to construct seven new public schools was announced by GovGuam. The schools are planned for northern Guam, and funding has been identified.

There are also a number of private schools on the Island. The Catholic Archdiocese of Agana operates a school system composed of 15 schools, including six elementary, six middle schools, and three high schools. Several other religious denominations also operate schools in Guam. Additionally, there are two Japanese schools, one Chinese school, and one Korean school operating on the island. Total private school enrollment in 2003-2004 was 6,266 students.

The Guam Community College, located in Mangilao, provides 11 academic and professional programs and 40 technical and vocational programs that award Associate Degrees or Certificates of Completion. Enrollment in 2003-2004 approximated 4,600 students. The University of Guam, also located in Mangilao, offers five Baccalaureate and five Masters Degree programs through five different colleges. Total enrollment at the university was 2,988 during the 2003-2004 academic year.

3.10.4 Economy

Guam's economy is cyclical, and has been volatile since the early 1990s, suffering major economic downturns that continue into the 21st century. Contributing factors to the Island's economic downturn included Japan's weakening economy and financial problems; a decline in U.S. defense spending and cutbacks in military personnel on the Island; devastating typhoons; and post-September 11, 2001 travel/security concerns.

Japanese visitors to Guam totaled over 1 million in 1997, but declined to less than 800,000 in 2002. In addition, post September 11, 2001 terrorist attacks in New York City contributed to a decline in the tourism industry as monthly tourist traffic declined 50 percent or more. More recently, the Iraq War and the Severe Acute Respiratory Syndrome epidemic in Asia further contributed to a decline in the local tourist industry.

Typhoons also adversely impacted the Island's economy in 1992, 1997, and 2002, and inflicted major damages to Guam's infrastructure and ecosystem.

U.S. defense spending in Guam also decreased significantly, from $735 million in 1994 to $451 million in 2000. The number of active duty military personnel declined from over 11,000 in 1992 to less than 6,000 in 2000, and many civilian jobs, directly and indirectly dependent on the military, were also subsequently lost.

Guam's economy, however, has begun to stabilize from its years-long economic slump. Beginning in 2001, Federal military and civilian spending on the Island began to increase. In 2002, Federal defense and non-defense spending increased to over $1.1 billion, approximately the same level of spending as in 1994. The total impact of federal dollars, including both defense and non-defense expenditures on Guam is greater than the revenue received from Japanese tourists. The local impact of Federal dollars is further realized as military and civilian employees pay federal income taxes to the Guam Treasury rather than the U.S. Treasury.

Table 3.10-4 presents the civilian labor force, employment, and unemployment rate for Guam for the 1999-2004 period. The 2004 civilian labor force of 61,520 represented a decrease of almost 15 percent 1999. Total employment in Guam in March 2004 was approximately 57,000, or an 8 percent decrease from 1999. Guam's unemployment rate in March 2004 was 7.7 percent compared to an unemployment rate of 6.0 percent in the United States. However, the Island's 2004 unemployment rate decreased significantly from the preceding years as indicated in Table 3.11-4. Of the total who were employed, the number of immigrant workers increased from 2002 to more than 20 percent of civilian employment in 2004. These recent gains in overall employment are primarily due to typhoon recovery construction projects and recovery of other economic factors from previously depressed levels.

Table 3.10-4 Civilian Labor Force, Employment, and Unemployment Rate Trends, 1999-2004

	2004[2]	2002	2001	2000	1999
Civilian Labor Force[1]	61,520	62,050	64,800	70,800	72,700
Total Employment	56,810	54,980	56,040	59,950	61,640
Unemployment Rate	7.7	11.4	13.5	15.3	15.2

1 Includes civilians 16 years of age and over, but excludes non-immigrant aliens and members of U.S. Armed Forces and their dependents living on military bases.
2 As of March 2004.
Source: Government of Guam, Department of Labor, Bureau of Labor Statistic; State of Hawaii, Labor Area News.

In addition to the decline in the civilian labor force during this 4-year period, the civilian labor force as a share of the total population also declined. The decrease in the civilian labor force is consistent with the decrease in the population growth rate of the 1990s. As a result of the employment slump in construction industry related to the overall economic downturn, there has been some out-migration of workers to Hawaii and other states. The lack of a sufficient labor pool, especially skilled workers, presents a major obstacle, especially for the construction industry. Consequently, the shortage of local labor has resulted in the need to bring in contract workers from outside Guam. Table 3.10-5 displays the distribution of employment in Guam by industry sector for 2004.

Table 3.10-5 Payroll Employment By Industry Sector, 2004

Industry Sector	Payroll Employment, 2004[1]	Percent of Total Employment
Agriculture	260	<1
Construction	4,960	8.6
Manufacturing	1,560	2.7
Transp., Comm., Util.	4,620	8.0
Wholesale Trade	1,800	3.1
Retail Trade	12,350	21.5
Fin., Ins., Real Est.	2,360	4.1
Services	14,560	25.2
Federal Government	3,320	5.8
Guam Government	11,610	20.2
Total	**57,400**	**100.0**

[1] As of December 2004.
Source: Government of Guam, Department of Labor Bureau of Labor Statistics.

Table 3.10-6 presents the number of building permits issued and total construction costs for Guam for the period from 1995-2004. Over 15,000 permits, with associated construction costs close to $2.1 billion, were issued during this period. Approximately one-third of the total permits issued were for residential structures.

Andersen AFB is a major contributor to Guam's economy by way of direct military and civilian employment, subsequent creation of indirect employment, and the purchase of goods and services from local businesses. The total annual estimated economic impact by Andersen AFB to Guam is approximately $314 million. The annual military payroll is $95 million, while the annual civilian payroll is $28 million. In addition, the Base has annual construction programs, contracts, and procurement for materials, equipment, and services totaling $175 million. As a result of the 3,267 military and civilian jobs directly created by Andersen AFB, an additional 1,056 indirect jobs are created with an annual payroll value of $23 million.

Table 3.10-6 Building Permits Issued and Construction Costs, 1995-2004

Year	Total Permits Issued	Total Construction Cost ($million)
2004	1,348	100.9
2003	1,578	125.6
2002	856	95.3
2001	1,082	147.9
2000	1,279	151.7
1999	1,892	174.1
1998	2,554	352.3
1997	1,615	280.1
1996	1,839	334.5
1995	1,754	348.9
Total	**15,797**	**2,111.3**

Source: Government of Guam, Department of Public Works, Building Permits and Inspection Section.

3.11 AIRFIELD OPERATIONS, AIRCRAFT SAFETY, AND BIRD/WILDLIFE-AIRCRAFT STRIKE HAZARD

3.11.1 Airfield Operations

The airspace around Andersen AFB used for analysis is the airspace allocated to the Andersen AFB air traffic control tower and which extends out to about 5 miles and up to about 2,500 feet AGL. Guam Approach and Departure Control provides radar service to aircraft arriving and departing the Base, and the air traffic control tower controls airfield operations at the Base. There are four instrument approaches available for arrivals to the airfield. The airfield has two runways, 06Left/24Right (06L/24R) and 06Right/24Left (06R/24L). Runway 06R/24L is 10,594 feet long and 200 feet wide, while Runway 06L/24R is 11,168 feet long and 150 feet wide.

Tower-controlled traffic patterns are flown at approximately 1,000 feet AGL for rectangular patterns (typically flown by large aircraft), 1,500 feet AGL for overhead patterns (flown by fighter aircraft), and 500 feet AGL for helicopters. The airfield elevation is 627 feet above MSL and the air traffic control tower is operational 24 hours a day year around. Aircraft overflight along the Andersen AFB cliff line is restricted to 1,000 feet AGL or above due to environmental sensitivity (FLIP 2005). The following overflight conditions were negotiated with the USFWS in May 1997 (USPACOM 1999).

- There will be no overflight of MSA 1 below 1,000 feet AGL at any time.
- There will be no overflight of Mariana crow territories below 1,000 feet AGL from September to May. Overflight below 1,000 feet AGL is allowed between June and August, the crow non-breeding season. Crow nesting territories are identified by DAWR and updates will be provided to Andersen AFB environmental (36 CES/CEV) and aircraft operations (36th Operations Support Squadron) staffs.
- Helicopters will remain 0.5 mile from the perimeter of the Mariana fruit bat colony at Pati Point, with the exception of flights originating from the end of the runways.
- This information will be briefed to all aircrews and air traffic controllers.

Approximately 86 percent of the annual airfield operations at Andersen AFB are accomplished by based Navy HSC-25 UH-60 helicopters, and about 81 percent of the UH-60 operations are closed pattern operations. The remaining 14 percent of the airfield operations are accomplished by transient fighter, bomber, tanker, transport, and civil aircraft. Table 2.3-1 presents the Andersen AFB airfield operations. Based on information in the Air Force Handbook 32-1084, *Facility Requirements*, it is estimated the capacity of the Andersen AFB airfield is 355,000 annual operations. The 85,734 annual operations accomplished under the baseline condition equate to about 24 percent of airfield capacity

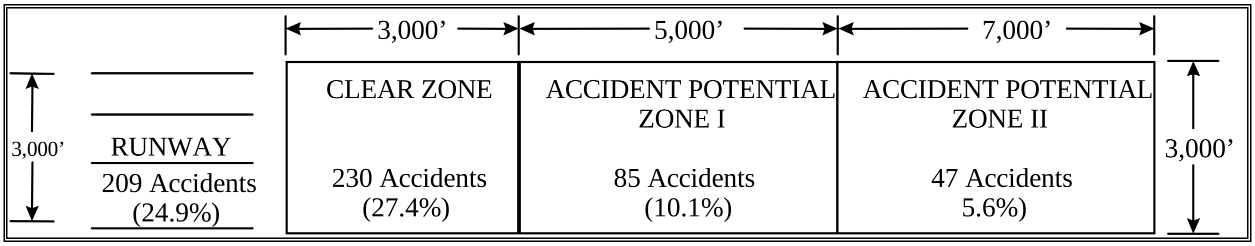
3.11.2 Aircraft Safety

Areas around airports are exposed to the possibility of aircraft accidents, even with well-maintained aircraft and highly trained aircrews. Despite stringent maintenance requirements and countless hours of training, past history makes it clear that accidents are going to occur.

The risk of people on the ground being killed or injured by aircraft accidents is miniscule. However, an aircraft accident is a high-consequence event and, when a crash does occur, the result is often catastrophic. Because of this, the Air Force does not attempt to base its safety standards on accident probabilities. Instead, the Air Force approaches safety from a land-use-planning perspective through its AICUZ program. Designation of safety zones around the airfield and restriction of incompatible land uses reduces the public’s exposure to safety hazards.

Subchapter 3.2 describes the CZ and APZs developed from analysis of over 800 major Air Force accidents that occurred within 10 miles of an Air Force installation between 1968 and 1995. The study found that 61 percent of the accidents were related to landing operations and 39 percent occurred during takeoff. Fighter and trainer aircraft accounted for 80 percent of the accidents, with large aircraft and helicopters accounting for the remaining 20 percent. Figure 3.11-1 depicts the three safety zones and summarizes the location of the accidents within a 10 nautical mile (NM) radius of the airfield.

Figure 3.11-1 Air Force Aircraft Accident Data (838 Accidents - 1968-1995)



Other Accidents Within 10 NM: 267 Accidents, 32.0%

The Air Force defines five categories of aircraft flight mishaps: Classes A, B, C, E, and High Accident Potential. Class A mishaps result in loss of life, permanent total disability, a total cost in excess of $1 million, destruction of an aircraft, or damage to an aircraft beyond economical repair. Class B mishaps result in total costs ranging between $200,000 and $1 million or result in permanent partial disability, but do not involve fatalities. Class C mishaps result in more than $100,000 (but less than $200,000) in total costs, or a loss of worker productivity exceeding 8 hours. Class E mishaps represent minor incidents not meeting the criteria for Classes A through C. High Accident Potential events are significant occurrences with a high potential for causing injury, occupational illness, or damage if they occur and do not have a reportable mishap cost. Class C and E mishaps, the most common types of accidents, represent relatively unimportant incidents because they generally involve minor damages and injuries, and they rarely affect property or the public.

Class A mishaps are the most serious of aircraft-related accidents and represent the category of mishap most likely to result in a crash. Table 3.11-1 lists the 10-year Class A mishap rates for the aircraft associated with establishment of the ISR/Strike capability at Andersen AFB. The table reflects the Air Force-wide data for all elements of all missions and sorties for each aircraft type.

Table 3.11-1 10-Year Fighter, Tanker, and Bomber Class A Aircraft Mishap Information

Aircraft	10-Year Average Class A Mishap Rate
F-15	2.04
KC-135	0.09
B-1	2.40
B-2	0.00
B-52	0.41

Note: The mishap rate is a 10-year (FY93-FY02) average based on the total mishaps and 100,000 flying hours. Data for the F-15 are used for the fighter aircraft because the Air Force Class A Mishap data do not include the F-22. No data are available for the Global Hawk.
Source: USAF 2005b.

3.11.3 Bird/Wildlife-Aircraft Strike Hazard

Bird strikes constitute a safety concern because of the potential for damage to aircraft, injury to aircrews, or local populations if an aircraft strike and subsequent aircraft accident should occur in a populated area. Aircraft may encounter birds at altitudes of 30,000 feet MSL or higher; however, most birds fly close to the ground. Over 95 percent of reported bird strikes occur below 3,000 feet AGL. Approximately 49 percent of bird strikes occur in the airport environment, and 15 percent during low-level cruise (USAF 2003c). About 90 percent of the low-level cruise strikes occur between 300 and 5,000 feet AGL, the altitude range for most military training route operations (USAF 2003d). Table 3.11-2 contains the distribution by of Air Force bird/wildlife aircraft strikes by altitudes at airports.

Table 3.11-2 Air Force Bird/Wildlife Aircraft Strikes by Altitudes at Airports

Altitude (feet AGL)	Percent of Total
0-49	28.90%
50-99	10.88%
100-199	6.71%
200-299	6.81%
300-399	5.40%
400-499	2.48%
500-599	5.85%
600-699	1.46%
700-799	1.34%
800-899	1.76%
900-999	0.64%
1,000-1,499	7.21%
1,500-1,999	6.78%
2,000-2,999	7.01%
3,000-3,999	4.58%
4,000-4,999	0.98%
5,000 and greater	1.22%

Source: AFSC 2006..

AFI 91-202 requires that Air Force installations supporting a flying mission have a BASH plan for the base. The Andersen AFB plan provides guidance for reducing the incidents of bird strikes in and around areas where flying operations are being conducted. The plan is reviewed annually and updated as needed.

Table 3.11-3 lists the 8-year average (1997 through 2004) bird/wildlife aircraft strike information for Andersen AFB and the average strikes per airfield operation (see Table 2.3-1 for airfield operations data). None of the bird/wildlife aircraft strikes resulted in a Class A mishap.

Table 3.11-3 Andersen AFB Bird/Wildlife-Aircraft Strike Information

Quarter	8-Year Average	Average Strikes per Airfield Operation
January-March	0.875	0.00004
April-June	0.625	0.00003
July-September	0.250	0.00001
October-December	1.250	0.00006
Total	**3.000**	**--**

Note: Average strikes per quarter based on the 8-year average quarterly BASH strikes (1997-2004) divided by average quarterly aircraft operations.

Source: Andersen AFB 2005b.

3.12 ENVIRONMENTAL JUSTICE

On February 11, 1994, the President issued EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. According to EO 12898, federal institutions are required to make environmental justice concerns a part of their mission. In addition, they are to identify any disproportionately adverse affects to human health or the environment that their programs, activities, and policies have on minority or low-income populations. Accompanying EO 12898 was a Presidential transmittal memorandum, which referenced existing federal statutes and regulations to be used in conjunction with EO 12898. One of the items in that memorandum was the use of the policies and procedures of NEPA, specifically that, "…each Federal agency shall analyze the environmental effects, including human health, economic, and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by the NEPA 42 USC Section 4321, *et seq.*" In this subchapter, relevant data regarding "environmental justice" is presented, along with an analysis of census tracts that would be affected by establishing the ISR/Strike capability at Andersen AFB. This method follows the Air Force interim guidance for environmental justice analysis dated November 1997.

3.12.1 Regional Definition

Since the analysis considers disproportionate impacts, two areas must be defined to facilitate comparison between the area actually affected and a larger regional area that serves as a basis for comparison and includes the area actually affected. The larger regional area is defined as the smallest political unit that includes the affected area and is called the community of comparison. For purposes of this analysis, the community of comparison is the Island of Guam.

The affected area is the Resource Adverse Impact Footprint (RAIF), which is the footprint of potential adverse impacts based on planned activity. For purposes of this analysis, the RAIF for the proposed action encompasses the villages (districts on the island of Guam) that could be affected by noise levels greater than a DNL of 65 dBA. These are the areas that could be affected not only by noise, but also by other effects such as air emissions during aircrew training operations. Determination of affected villages was accomplished by overlaying noise contours on village boundary data. Villages that intersected noise contour isopleths of greater than a DNL of 65 dBA, were considered to be within the RAIF.

3.12.2 Demographic Analysis

The demographic analysis provides information on the approximate locations of low-income and minority populations in the RAIF. In developing statistics for the Census of Population and Housing, the U.S. Department of Commerce, Bureau of the Census, identified small subdivisions used to group statistical census data. There are five villages in the Andersen AFB area (three on the north and two in central portions of the island.

Information from the 2000 Census of Population and Housing (International Data Base) was used to identify low-income and minority populations within the affected area. To determine whether an individual area contains a disproportionately high low-income or minority population, data for each area were compared to data for the community of comparison. Of the five villages located near Andersen AFB, 60 percent had higher percentages of minorities, and 40 percent had higher percentages of low-income persons, than Guam, as shown in Table 3.13-1.

Table 3.13-1 Percentages of Minority and Low-Income Persons in the Project Area

Location	Percent Minority	Disproportionate	Percent Low-Income	Disproportionate
United States	10.00	--	13.10	--
Guam	93.11	Yes	23.0	Yes
Villages Near Andersen AFB				
Barrigada	95.40	Yes	17.8	No
Dededo	96.79	Yes	22.8	No
Mangilao	96.00	Yes	26.3	Yes
Tamuning	92.09	No	26.0	Yes
Yigo	85.33	No	21.6	No
Percent Disproportionate	**--**	**60.0%**	**--**	**40.0%**

Notes: (a) Disproportionality exists if the location percentage is higher than the community of comparison percentage.

(b) Low-income is defined as below poverty level in 1999, as reported in the 2000 Census of population and housing.

(c) Ethnicity and Income data are not available for the villages, and therefore was assumed to be reflective of the Guam data.

Source: USCB 2005

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CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

This chapter provides analysis of the environmental consequences, including cumulative impacts, of Alternative A, Alternative B, and the No Action Alternative. For analysis purposes, FY07 (beginning October 2006) through FY22 are assessed by year, to represent the potential annual impacts associated with the construction, aircraft beddown, and recurring aspects of the alternatives. Those impacts associated with flying operations would continue beyond FY22.

Current planning would establish the ISR/Strike capability over an estimated 16-year period. Additional aircraft and personnel would be added throughout the project, with the greatest number of aircraft and personnel occurring when the ISR/Strike capability is fully established. As the number of aircraft increases, the number of aircraft operations correspondingly increases. Thus, there would be increased potential for additional air emissions from aircraft operations and a larger area affected by aircraft noise as establishment of the ISR/Strike capability progresses. Likewise, the number of personnel would increase over time, thereby increasing the potential for impacts to infrastructure and utilities and socioeconomic resources.

As mentioned in Subchapter 2.1.1.2, there could be times when the numbers of fighters, tankers, and bombers could be less than 48, 12, and 6 aircraft, respectively. However, the greatest potential for impact to the environmental resources evaluated in this EIS would occur from the operation of 48 fighter, 12 tanker, six bomber, and four Global Hawk aircraft. The potential impacts associated with operation of reduced numbers of aircraft would be less than that from operation of the greater number of aircraft. Therefore, this EIS assesses the potential impacts from the operation of as many as 48 fighters, 12 tankers, six bombers, and four Global Hawks, and the personnel associated with these numbers of aircraft, after full ISR/Strike operational capability is established at Andersen AFB.

4.1 NOISE

The following evaluation criteria were used to determine the impacts of noise:

- The extent, if any, that the action would generate noise levels from aircraft operations and construction activities that would be greater than ambient noise levels;
- The extent, if any, that the action would cause annoyance, hearing loss, speech interference, effects on structures, and effects on wildlife; and
- The extent, if any, that the proximity of noise-sensitive receptors, such as housing and schools, to the noise source would be affected.

4.1.1 Alternative A

Noise associated with Alternative A would be generated by aircraft operations and construction activities.

4.1.1.1 Aircraft Noise

Figure 4.1-1 shows the aircraft ground tracks and Figure 4.1-2 depicts the noise exposure area at the Base after Alternative A would be fully established. Figure 4.1-3 compares

Alternative A and the No Action Alternative noise contours. The aircraft operations modeled include the average busy day aircraft operations for Alternative A (see Table 4.1-1). Approximately 5 percent of the operations would occur during the nighttime (10:00 p.m. to 7:00 a.m.), or no change when comparing Alternative A nighttime operations to the No Action Alternative.

Table 4.1-1 Alternative A Annual and Average Busy Day Airfield Operations

	Arrival and Departure Operations		Closed Pattern Operations		Total Operations	
Aircraft	**Annual**	**Avg. Daily**	**Annual**	**Avg. Daily**	**Annual**	**Avg. Daily**
ISR/Strike Aircraft						
Fighter						
F-22	5,530	23.04	16,589	69.12	22,119	92.16
F-15E	1,382	5.76	4,147	17.28	5,529	23.04
Fighter Subtotal	6,912	28.80	20,736	86.40	27,648	115.20
KC-135	1,920	8.00	5,760	24.00	7,680	32.00
Global Hawk	440	2.00	220	1.00	660	3.00
Bomber						
B-1	432	1.80	864	3.60	1,296	5.40
B-2	96	0.40	192	0.80	288	1.20
B-52	432	1.80	864	3.60	1,296	5.40
Bomber Subtotal	960	4.00	1,920	8.00	38,868	12.00
Subtotal ISR/Strike Aircraft	10,232	42.80	28,636	119.40	38,868	162.20
Other Military	25,144	68.88	59,648	163.42	84,792	232.30
Transient Civil	942	2.58	0	0.00	942	2.58
Total	**36,318**	**114.26**	**88,284**	**282.82**	**124,602**	**397.08**

Note: See Table 2.3-1 for detailed transient military and civil aircraft for the baseline condition.

The CEQ regulations implementing NEPA recognize that a situation may occur in which data are incomplete (*i.e.*, noise data for the Global Hawk) or unavailable at the time the environmental analyses are completed. This situation is managed in accordance with 40 CFR Part 1502.22, *Incomplete or Unavailable Information*, which provides the following guidance:

When an agency is evaluating reasonably foreseeable adverse effects on the human environment in an EIS and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.

> (a) If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the EIS.

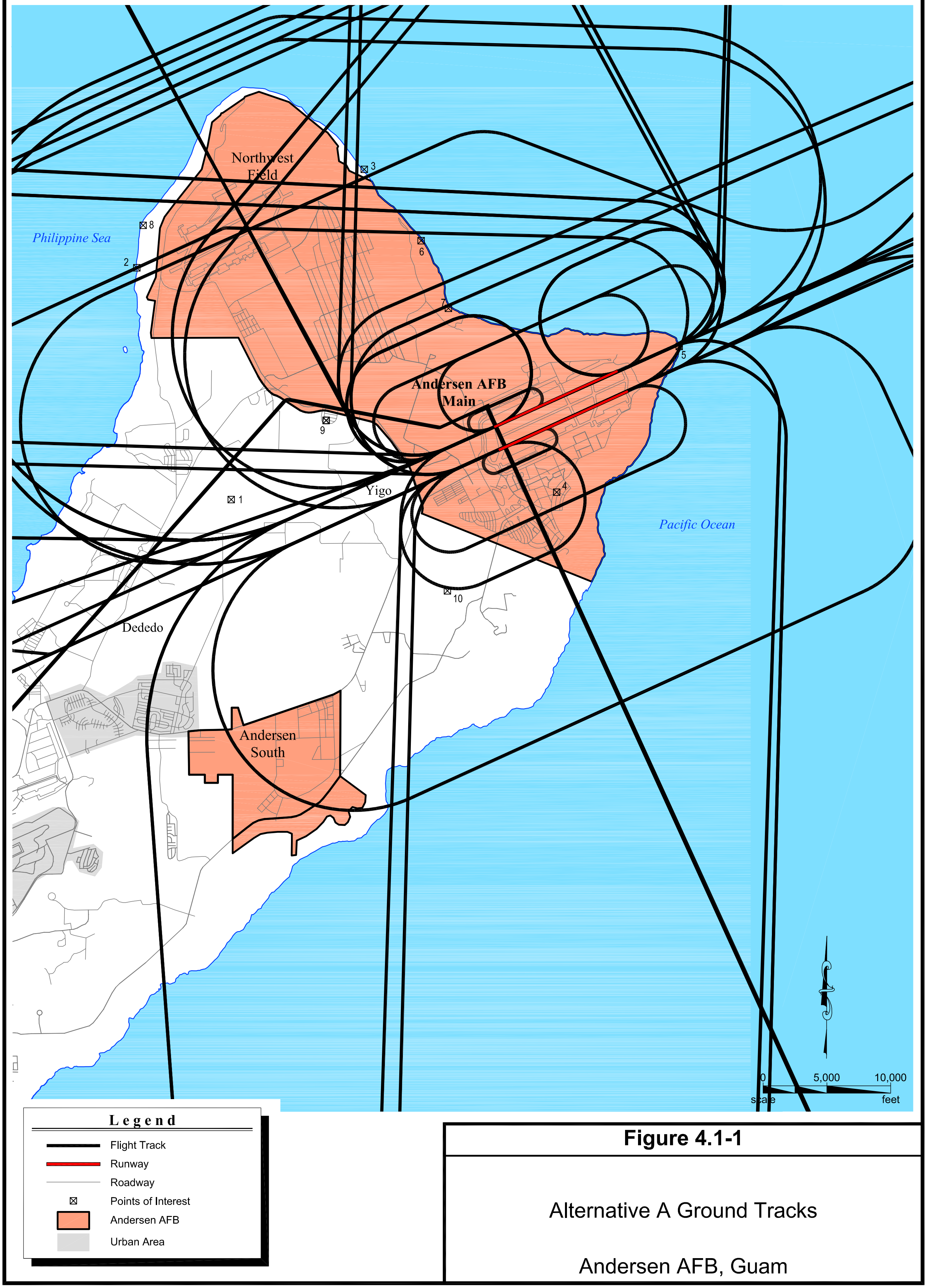

Figure 4.1-1

Alternative A Ground Tracks

Andersen AFB, Guam

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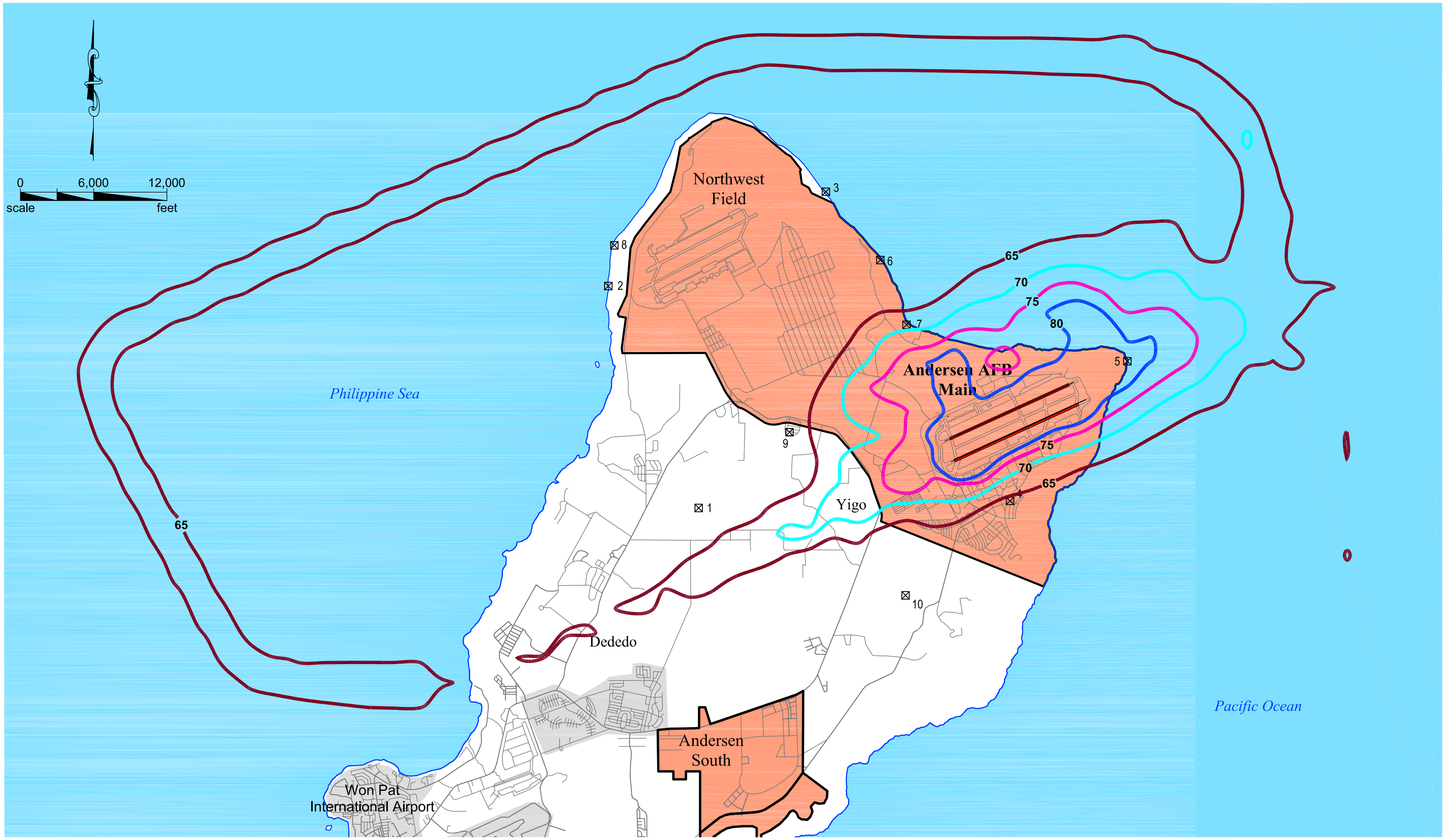

Figure 4.1-2

Alternative A Noise Contours

Andersen AFB, Guam

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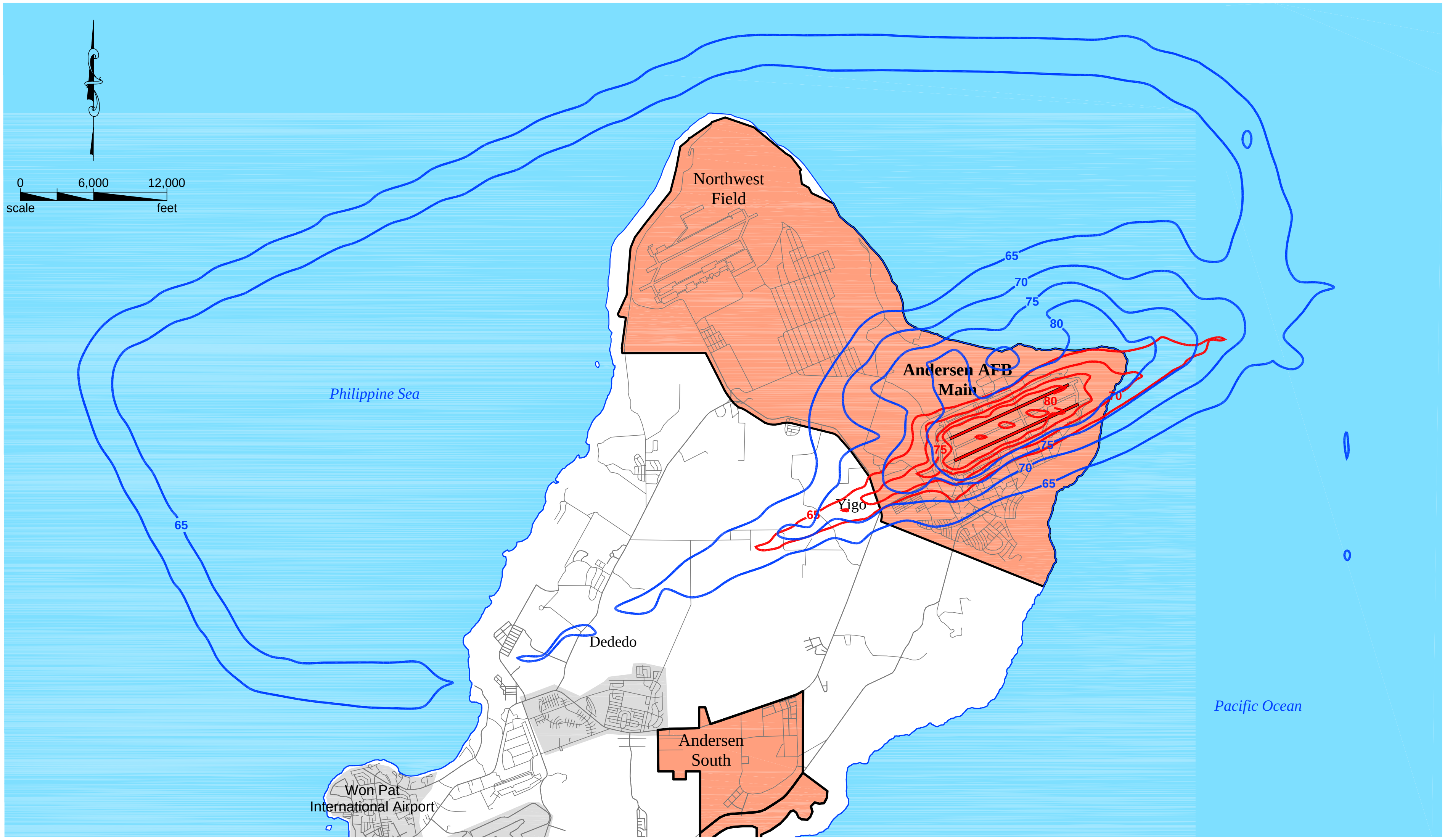

Figure 4.1-3

Comparison of No Action Alternative and Alternative A Noise Contours

Andersen AFB, Guam

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(b) If the information relevant to reasonably foreseeable adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the EIS the following:

(1) A statement that such information is incomplete or unavailable;

(2) A statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;

(3) A summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and

(4) The agency's evaluation of such impacts based upon theoretical approaches research methods generally accepted in the scientific community. For the purposes of this Section, "reasonably foreseeable" includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided the analysis of the impacts is supported with credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.

The Global Hawk is a recent production aircraft. Because of its newness, complete sound data collection has not been accomplished. Therefore, it was necessary to identify a surrogate aircraft that could be used to estimate Global Hawk flight noise data. After reviewing the flight data in NOISEMAP files, Air Force acoustic scientists selected the T-45 aircraft to estimate the Global Hawk noise data. Accordingly, the T-45 aircraft was used to model the Global Hawk aircraft in the noise model [40 CFR Part 1502.22(b)(4)].

Ten representative analysis points were selected around the airfield to determine the SEL from aircraft overflight. Table 4.1-2 compares the No Action Alternative (*i.e.*, baseline) and Alternative A DNL at the 10 analysis points, and Table 4.1-3 compares the SEL at the points. There would be no change to the SEL for non-ISR/Strike aircraft because the aircraft ground tracks used by those aircraft would be the same for both Alternative A and the No Action Alternative. Table 4.1-4 compares Alternative A off-Base land area (excluding water surface) and population exposed to noise of DNL 65 dBA and greater, as well as the population potentially highly annoyed, with the No Action Alternative (*i.e.*, baseline). Table 4.1-5 provides SEL and maximum sound level values for ISR/Strike aircraft at a distance of 1,000 feet from the aircraft at takeoff thrust. The maximum sound level at the analysis point would typically be 5 to 10 dBA below the SEL value for aircraft overflight.

Table 4.1-2 Comparison of DNL from Alternative A Airfield Operations at Analysis Points

		DNL (dBA		
Number	**Description**	**BL**	**AA**	**Chg**
1	Dededo	49	56	+7
2	Falcona Beach	47	48	+1
3	Jinapsan Beach	47	54	+7
4	Andersen AFB Middle School	55	62	+7
5	Pati Point	66	83	+17
6	Tarague Beach	44	53	+9
7	Tarague Channel	44	62	+18
8	Uruno Point	36	46	+10
9	Off-Base School	41	62	+21
10	Yigo	54	58	+4

Note:BL=baseline (i.e., No Action Alternative).

AA=Alternative A.

Chg=change.

The analysis point number and description correspond to the point as reflected on the noise contour and aircraft ground track figures. There may be minor differences when comparing the DNL for a point from the table to the DNL for the point as depicted on the noise contour figure. This difference is a result of small misalignments during the process of overlaying the noise contours on the background map.

Table 4.1-3 Comparison of SEL from Alternative A Airfield Operations at Analysis Points

			SEL (dBA for ISR/Strike Aircraft							Comparison of Loudest ISR/Strike Aircraft to No Action Alternative
Number	**Description**	**No Action Alternative SEL (dBA**	**F-22**	**F-15E**	**KC-135**	**B-1**	**B-2**	**B-52**	**Global Hawk**	
1	Dededo	99	101	97	--	103	--	--	--	-+2
2	Falcona Beach	108	98	86	90	91	79	--	85	-10
3	Jinapsan Beach	111	97	97	92	96	--	96	88	-14
4	Andersen AFB Middle School	103	93	89	--	102	--	--	--	-1
5	Pati Point	116	119	116	--	122	--	109	--	+6
6	Tarague Beach	98	93	96	--	83	--	--	90	-2
7	Taraque Channel	97	101	96	--	92	--	98	--	+4
8	Uruno Point	90	96	91	--	87	--	--	--	+6
9	Off-Base School	106	105	106	--	102	--	--	--	0
10	Yigo	108	98	100	--	97	92	--	--	-8

Note: The No Action Alternative also is the baseline. The SEL shown in the table is the loudest SEL for only those aircraft flying the top 20 flight tracks events contributing the most DNL at each location. NOISEMAP determines the SEL for the 20 flight track events contributing the most DNL at each analysis point. These SEL values may not necessarily be the loudest SEL values occurring at each point. It is possible for an aircraft to produce a larger SEL, but because of the infrequency of occurrence, the aircraft would not be among the top 20 contributors to the DNL level at the location. The analysis point number and description correspond to the point as reflected on the noise contour and aircraft ground track figures. See Table 3.1-1 for the aircraft producing the baseline SEL. Comparison reflects SEL from noisiest Alternative A aircraft with the baseline SEL. The maximum sound level would typically be 5 to 10 dBA below the SEL value or aircraft overflight.

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Table 4.1-4 Summary of Off-Base Land Area and Population Exposed to, and Population Potentially Highly Annoyed by DNL 65 dBA and Greater, Alternative A

	DNL Interval (dBA)				
Category	**65-70**	**70-75**	**75-80**	**80+**	**Total**
Acres					
No Action Alternative	353	22	0	0	375
Alternative A	1,672	483	0	0	2,155
Change	+1,319	+461	0	0	+1,780
Percent Change	+374%	+2,095%	0%	0%	+475%
Population					
No Action Alternative	242	14	0	0	256
Alternative A	2,266	300	0	0	2,566
Change	+2,024	+286	0	0	+2,310
Percent Change	+836%	+2,043%	0%	0%	+902%
Population Potentially Highly Annoyed					
No Action Alternative	53	5	0	0	58
Alternative A	499	111	0	0	610
Change	+446	+106	0	0	+552
Percent Change	+842%	+2,120%	0%	0%	+952%

Note: *The No Action Alternative also is the baseline. Acres reflect only off-Base land area (excluding water surface). People highly annoyed determined by multiplying the total number of people in the noise zone times the higher percent number for the interval in Table 3.1-2.*

Table 4.1-5 Sound Exposure Level and Maximum Sound Level at 1,000 Feet from ISR/Strike Aircraft

Aircraft Type	Sound Exposure (SEL) (dBA	Maximum Sound Level (dBA
F-22	120	116
F-15E	113	105
KC-135	94	87
B-1	124	118
B-2	109	103
B-52	111	105
Global Hawk	106	97

Note: *At nominal takeoff thrust and airspeed and at a slant distance of 1,000 feet from the aircraft.*
.

Single Event Noise Analysis

Each aircraft overflight near an analysis point yields a single-event noise level, presented as SEL. As indicated in Table 4.1-3, the SEL from ISR/Strike aircraft would be as much as 14 dBA less than the baseline condition at five of the analysis points, would be as much as 6 dBA greater at four of the analysis points, and would not change at one point. The current SEL would continue at the five points that would experience a lower SEL from ISR/Strike aircraft because the aircraft producing the SEL under the No Action Alternative would continue to operate under Alternative A and would continue to use the existing flight tracks. A change of 3 dB is just perceptible, while a change of 5 dB is clearly noticeable (Bies and Hanson 1988).

Table 4.1-6 contains at-ear noise exposure levels that produce negligible hearing loss of no more than 5 dB for both an 8-hour and 24-hour exposure on a yearly and working day basis. The 8-hour data assumes the remaining 16 hours of the day are spent in relative quiet (USEPA 1974). According to USEPA (1974), changes in hearing levels of 5 dB are generally not considered noticeable or significant. Based on the data in the table and the level of noise exposure from the Alternative A aircraft operations in areas where people live, it is doubtful that an individual would be exposed to noise that would produce hearing loss.

Table 4.1-6 At-Ear Exposure Levels that Produce No More than 5 dB Noise Induced Hearing Damage over a 40-Year Period

Exposure	Steady (continuous) Noise	Intermittent Noise	With Margin of Safety
L_{eq} 8-Hour			
250 days per year	73.0	78.0	--
365 days per year	71.4	76.4	75.0
L_{eq} 24-Hour			
250 days per year	68.0	73.0	--70.0
365 days per year	66.4	71.4	

Source: USEPA 1974.

The nearby off- and on-Base schools would continue to be exposed to noise from aircraft operations. Research on the effects of aircraft noise on student learning suggests that aircraft noise can interfere with learning in the following areas: reading; motivation; language and speech acquisition; and memory (FICAN 2000). Research to date supports the following findings:

- "Reading. The strongest finding of a relationship between aircraft noise and learning is in the area of reading. More than 20 studies have found that children in noise impact zones are negatively affected by aircraft noise." (FICAN 2000).
- "Motivation. Approximately a dozen laboratory and field studies indicate reduced task persistence in relation to uncontrollable noise." (FICAN 2000).
- "Language and Speech. A small number of studies suggest delayed language acquisition and interference with speech perception in noisy areas." (FICAN 2000).
- "Memory. A few studies suggest deficits in short- and long-term memory recall in the presence of noise, particularly for more complex material under noise." (FICAN 2000).

As mentioned in Subchapter 2.2.1.1, the ANSI standard to achieve an hourly A-weighted average sound level of 40 dB, which must not be exceeded for more than 10 percent of the hour in classrooms, would be incorporated into the design and construction of the new on-Base high school and when existing schools on Andersen AFB are modernized. Interior noise at existing schools could be minimized by: installing additional insulation; adding a second window pane;

sealing gaps or leaks in windows and doors; replacing windows and doors with windows and doors that offer better attenuation; installing baffles in vents; and improving the exterior roofing.

Effects of Noise on Structures

Possible noise-related impacts on structures should be considered in the context of accepted research results. The recent development of larger commercial and military aircraft has prompted research into the effects of noise vibrations on both modern and historic structures.

Some building materials are more sensitive than others to external pressures and induced vibrations. Windows with large panes of glass are most vulnerable. Plaster walls in frame buildings are susceptible to cracking. Components that are least likely to experience damage are masonry walls of stone, concrete block, adobe, or brick. Appropriate building design can also reduce the possibility of damage from vibration. Research has not proven categorically that old buildings are more vulnerable to vibration than newer buildings, but prudence dictates special consideration be given to unique structures of historical significance. Table 4.1-7 lists the effects of sound on structures.

Table 4.1-7 Effects of Sound on Structures

dBA	Effects Summary	
0-127	Typical community exposures	No damage to structures No significant public reaction
127-131	(generally below 2 psf)	Rare minor damage Some public reaction
131-140	Window damage possible, increasing public reaction, particularly at night	
140-146	Incipient damage to structures	
146-171	Measured booms at minimum altitudes experienced by humans; no injury	
185	Estimated threshold for eardrum rupture (maximum overpressure)	
194	Estimated threshold for lung damage (maximum overpressure)	

Source: Speakman 1992.

Studies show that damage to structures (*e.g.*, window breakage, wall cracks, foundation cracks) from external pressures and induced vibrations would not occur at 127 dB and below (see Table 4.1-7). The highest L_{max} produced by any of the ISR/Strike aircraft at Andersen AFB at a distance of 1,000 feet would be 118 dBA generated by the B-1 aircraft (see Table 4.1-5). The L_{max} is the highest instantaneous sound pressure during a single noise event, no matter how long the sound may persist. The L_{max} is different than SEL, which is the A-weighted sound level integrated over the duration of the noise event and adjusted to a length of 1 second. No damage would occur to structures in the area surrounding Andersen because the L_{max} produced by the aircraft (*i.e.*, 118 dBA) would not exceed the level at which structural damage could occur.

Day-Night Noise Analysis

Overall, Alternative A noise contours would increase in all directions from the airfield (see Figure 4.1-2), with the number of off-Base acres (excluding water surface) in the DNL 65 dBA and greater exposure area increasing by 475 percent when compared to the No Action Alternative (*i.e.*, baseline). As indicated in Figure 4.1-3, the DNL 70 dBA contour from Alternative A southwest of the Base is nearly the same as the DNL 65 dBA contour from the No

Action Alternative (*i.e*., baseline). The "tail" of Alternative A DNL 65 dBA contour extends about 2 miles farther southwest to Dededo, with a "detached" area of exposure beyond. The reason for the additional noise exposure is the increased number of operations by noisier ISR/Strike fighter and bomber aircraft when compared to the No Action Alternative (*i.e*., baseline).

As indicated in Table 4.1-2, the DNL would increase at all analysis points when compared to the No Action Alternative (*i.e*., baseline), with the greatest increase (21 dBA) occurring at Analysis Point 9 (off-Base school). Although the DNL would increase at all points, the DNL at the analysis points would exceed 65 dBA at only one point (Pati Point). The DNL at Pati Point would be 66 dBA, or 1 dBA greater than the level at which community noise effects are compared.

People would be exposed to aircraft noise in two of the four noise zones (see Table 4.1-4), with the DNL 65-70 dBA noise zone containing 2,266 of the 2,566 persons exposed to DNL 65-dBA and greater. These 2,566 persons would equate to 6.0 percent of the estimated 42,681 persons (based on 2000 census data) who live within the approximate 5-mile radius area associated with airfield airspace environment, and increase of 4.3 percent when compared to the No Action Alternative (*i.e*., baseline). This approximate 5-mile radius area includes the airspace allocated to the air traffic control tower and is the area in which closed patterns and maneuvering for takeoffs and landings is accomplished. The density of residences in the newly exposed area would be consistent with adjacent residential areas exposed to aircraft noise under the No Action Alternative (*i.e*., baseline). The overall number of persons who could be potentially highly annoyed by noise exposure would be 610 people, or 552 additional persons when compared to the No Action Alternative (baseline).

The contribution of outdoor noise to indoor noise is usually small. The affect of an outdoor noise source inside a building depends on the intensity of the source and the noise level reduction of the building. Noise level reduction provided by a building can be categorized into those constructed in warm climates and those in cold climates. Additionally, the noise level reduction of a building also depends on whether the windows are opened or closed (USEPA 1974). Table 4.1-8 presents typical noise level reduction for the two categories of buildings and the window open/closed condition and approximate national average noise level reduction. Based on Guam's location in a tropical climate, the warm climate data would apply to buildings on and in the area surrounding Andersen AFB. As mentioned in Subchapter 2.2.1.1, new facilities and family housing would be constructed to achieve an indoor noise level of DNL 45 dBA or less.

Table 4.1-8 Typical Noise Level Reductions of Buildings

Climate/National Average	Windows Open	Windows Closed
Warm Climate	12 dB	24 dB
Cold Climate	17 dB	27 dB
Approximate National Average	15 dB	25 dB

Source: USEPA 1974.

Speech interference from environmental noise can occur in many settings. The primary concern is the effect of noise on face-to-face conversations, telephone conversations, and during entertainment of watching television or listening to the radio. Speech interference depends on physical factors such as noise levels, vocal effort, distance between the talker and listener, and room acoustics and non-physical factors (speaker's enunciation, speaker's vocabulary and accent, and listener's motivation). Predictions of speech intelligibility can be based on noise levels and distances between speakers and listeners (USEPA 1974).

The highest noise level during indoor speech that permits relaxed conversation with 100 percent sentence intelligibility throughout the room is 45 dB. People raise their voices when the background noise exceeds 45-50 dB (USEPA 1974).

The sound level of speech outdoors decreases with increased distance between the speaker and listener. Table 4.1-9 presents the distances between the speaker and listener for satisfactory outdoor speech intelligibility at two levels of vocal effort at steady background noise levels. The levels for normal and raised voice satisfactory conversation presented in the table permit sentence intelligibility of 95 percent at each distance. This level of intelligibility usually permits reliable communication. If the noise levels in Table 4.1-9 are exceeded, the speaker and listener must either move closer together or expect reduced intelligibility (USEPA 1974). Based on the data in the table, listeners in normal communication at a distance of 10 feet in a steady background noise of 56 dB and who experience an increase in a background noise of 66 dB would have to move to about 3 feet apart to maintain the same intelligibility or raise their voices. Their speech intelligibility would decrease considerably if they remain at 10 feet of separation.

Table 4.1-9 Steady A-Weighted Sound Levels that Allow Communication with 95 Percent Intelligibility over Distances Outdoors for Different Voice Levels

	Distance (feet)					
	1.5	**3**	**6.5**	**10**	**13**	**16**
Normal Voice	72	66	60	56	54	52
Raised Voice	78	72	66	62	60	58

Source: USEPA 1974.

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 protective 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 dBA for complete protection against hearing loss for an 8-hour day). At the 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).

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. Yet, even those studies, which purport to find such health effects, use time-average noise levels of 75 dBA 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 and increased mortality rates among the exposed residents by using an average noise exposure level greater than 75 dBA for the "noise-exposed" population (Meacham and Shaw 1979). Nevertheless, three other UCLA professors analyzed those same data and found no relationship between noise exposure and mortality rates (Frericks, *et al* 1980). In summary, there is no scientific basis for a claim that potential health effects exist for aircraft DNL below 75 dBA.

In summary, the following noise levels for the various conditions are sufficient to protect public health and welfare if they are not exceeded (USEPA 1974):

- DNL 55 dBA in sensitive areas (residences, schools, and hospitals);
- DNL 45 dBA inside buildings;
- Maintaining DNL 55 dBA outdoors provides protection for indoor living; and
- The 24-hour Leq should not exceed 70 db to protect against hearing damage.

Effect of Aircraft Noise on Wildlife

Subchapter 4.5 contains a detailed description of the effects of aircraft noise on wildlife, especially for the species of concern (Mariana crow and Mariana fruit bat).

4.1.1.2 Construction Noise

Assuming that noise from equipment radiates equally in all directions, the sound intensity would diminish inversely as the square of the distance from the source. Therefore, in a free field (no reflections of sound), the sound pressure level decreases 6 dB with each doubling of the distance from the source. Under most conditions, reflected sound will reduce the attenuation due to distance. Doubling the distance in a reflected sound condition may only result in a decrease of 4 to 5 dB. Table 4.1-10 shows the sound pressure levels at a distance of 50 feet for miscellaneous heavy equipment used for construction.

Numerous facilities would be constructed at Andersen AFB under Alternative A. The primary source of noise from construction activity would be from equipment and vehicles involved in construction work. Typical noise levels generated by these activities range from 75 to 89 dBA at 50 feet from the source. Noise receptors in the vicinity of these short-term activities could include persons outside the Base boundary and individuals near the facility construction projects.

For analysis purposes, it is estimated the shortest distance between a construction noise source and a receptor would be about 100 feet. Conservatively, outdoor noise for a receptor could range from as high as 71 to 85 dB at 100 feet from the source (see note in Table 4.1-10). However, the noise level could be lower if the sound is not reflected. Indoor noise levels are generally 18 to 27 dBA lower than outdoor noise levels because building structures attenuate the outdoor noise levels. Construction and demolition activities likely would occur between 7:30 a.m. and 4:30 p.m., 5 days per week for the duration of the construction activities. The noise would be temporary and occur only during the hours that construction and demolition activity would occur and would cease when the project is completed.

Table 4.1-10 Heavy Equipment Noise Levels Measured at 50 Feet

Equipment Type	Number Used[1]	Generated Noise Levels, L_p (dB[2]
Bulldozer	1	88
Backhoe (rubber tire)	1	80
Front Loader (rubber tire)	1	80
Concrete Truck	1	75
Concrete Finisher	1	80
Crane	1	75
Asphalt Spreader	1	80
Roller	1	80
Flat Bed Truck (18 wheel)	1	75
Scraper	1	89
Trenching Machine	1	85

Note: *Assuming that noise from the construction and demolition equipment radiates equally in all directions, the sound intensity would diminish inversely as the square of the distance from the source. Therefore, in a free field (no reflections of sound), the Lp decreases 6 dB with each doubling of the distance from the source. Under most conditions, reflected sound will reduce the attenuation due to distance. Therefore, doubling the distance may only result in a decrease of 4 to 5 dB (AIHA 1986).*

[1] *Estimated number in use at any time.*

[2] *L_p = sound pressure level*

Source: *CERL 1978.*

Based on data in Table 3.1-2, 61 percent of the persons exposed to DNL 85 dBA could be potentially highly annoyed from the demolition noise. No hearing loss would occur for persons outdoors because they would not be exposed to DNL equal to or greater than 75 dBA for 40 years of exposure at 16 hours per day, the level at which hearing loss could occur. Sleep interference is unlikely because construction and demolition activities would occur during daytime.

Elevated noise levels can interfere with speech, causing annoyance or communication difficulties. Based on a variety of studies, DNL 75 dBA indicates a good probability for frequent speech disruption. This level produces ratings of “barely acceptable” for intelligibility of spoken material. Persons conducting conversations within the project area could have their speech disrupted by construction-generated noise. Speech disruption would be temporary, lasting only as long as the noise-producing event.

4.1.2 Alternative B

The only difference between Alternative B and Alternative A relative to aircraft operations, and therefore aircraft noise, is that KC-135 aircraft would be in a rotational status under Alternative B rather than being permanently based at Andersen AFB. The result of the difference is there would be about 16 fewer average daily KC-135 aircraft airfield closed pattern operations. Additionally, Alternative B facilities construction and activities are identical to Alternative A except that family housing units and family housing management facilities would not be constructed under this alternative.

The types of ISR/Strike aircraft, the flight tracks that would be used, and the percent of nighttime operations under Alternative B would be the same as that for Alternative A. Noise modeling for Alternative B indicated there is no discernable difference in the Alternative B noise contours and noise exposure when compared to Alternative A (see Figure 4.1-4). Thus, the DNL for the analysis points listed in Table 4.1-2 apply to Alternative B. The SEL at analysis points would be identical to Alternative A because the aircraft flight tracks would be the same for Alternative A and Alternative B. Under Alternative B, the types of facilities that would be constructed and the spatial relationship of the facilities to nearby existing facilities would be the same as Alternative A. Therefore, the discussion, analysis, and conclusions for Alternative A for noise from aircraft operations and construction activities apply to Alternative B.

4.1.3 No Action Alternative

Under the No Action Alternative, the ISR/Strike capability would not be established at Andersen AFB. Noise would continue to be generated by aircraft operations and construction and demolition activities associated with individually programmed facility actions and O&M activities.

4.1.3.1 Aircraft Noise

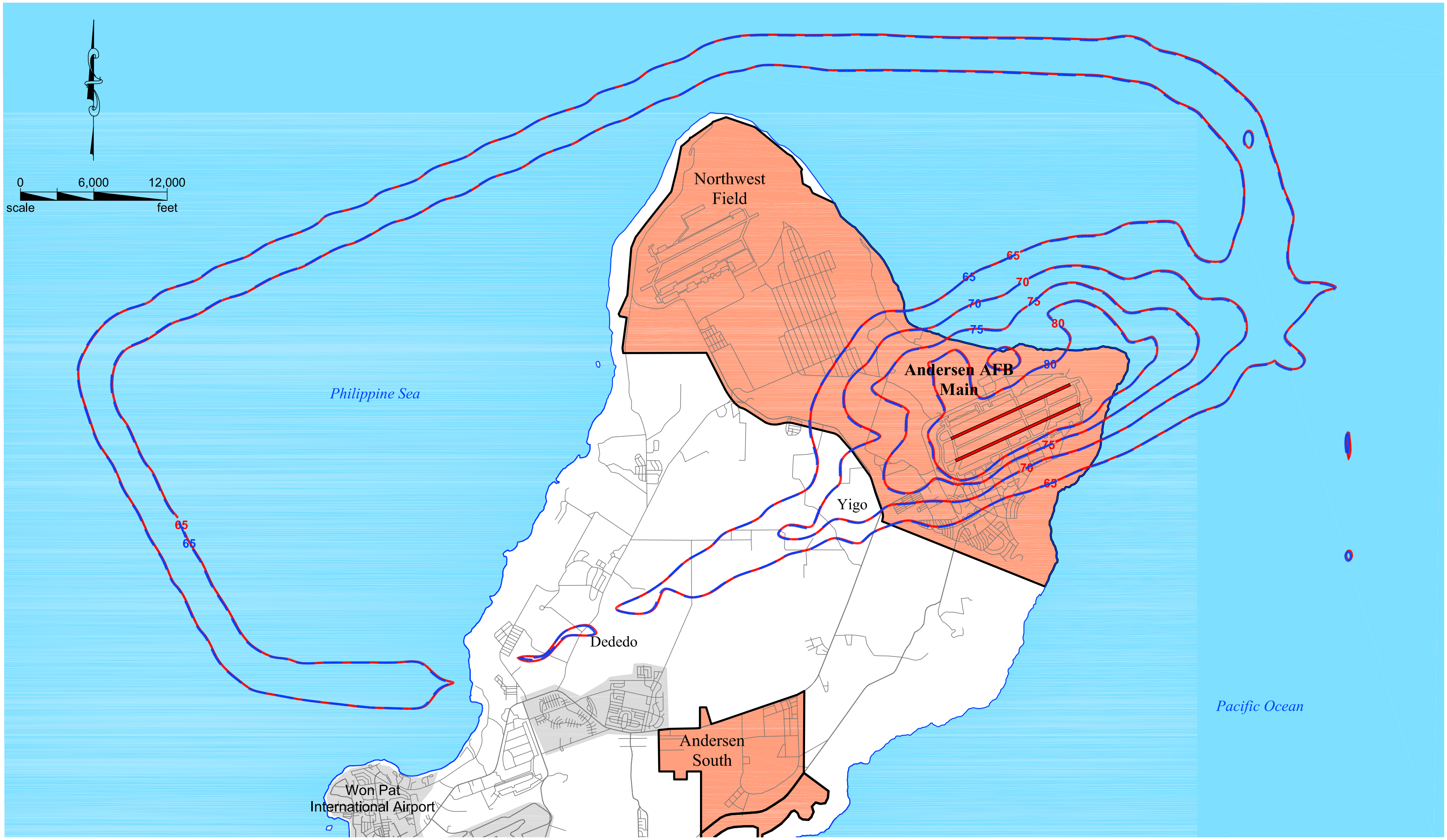
The types and levels of activities at the Base, including airfield operations, would remain at current conditions (see Table 2.3-1). Aircraft operating at the airfield would continue to use the flight tracks depicted on Figure 3.1-3 and the noise from the operations would remain as shown on Figure 3.1-4. Approximately 5 percent of the operations would occur during the nighttime (10:00 p.m. to 7:00 a.m.). The DNL and SEL values listed in Table 3.1-1 for the analysis points would continue. Approximately 375 acres of off-Base land (not including water surface) and 256 off-Base persons would continue to be exposed to DNL 65 dBA and greater (see Table 3.1-3).

Single Event Noise Analysis

Each aircraft overflight near an analysis point yields a single-event noise level, presented as SEL. The current SEL (see Table 3.1-1) would continue at the 10 analysis points because the aircraft operating at the airfield would remain the same and they would continue to use the existing flight tracks. The hearing loss and learning discussion for Alternative A apply to the No Action Alternative.

Effects of Noise on Structures

The highest L_{max} produced by any of the aircraft operating at Andersen AFB under the No Action Alternative at a distance of 1,000 feet would continue to be 118 dBA generated by B-1 aircraft. No damage to structures in the area surrounding Andersen AFB would occur because the sound pressure produced by the aircraft would not exceed the level at which structural damage could occur (*i.e.*, 127 dBA).



Legend

🟥	Alternative A Noise Contour
▬ ▬	Alternative B Noise Contour
▬	Runway
—	Roadway
🟧	Andersen AFB
▨	Urban Area

Figure 4.1-4

Comparison of Alternative A and Alternative B Noise Contours

Andersen AFB, Guam

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Day-Night Noise Analysis

The noise exposure would remain as depicted in Figure 3.1-4. People would continue to be exposed to aircraft noise in two of the four noise zones (see Table 3.1-4), with the DNL 65-70 dBA noise zone containing 242 of the 256 persons exposed to DNL 65-dBA and greater. The other 14 people would be in the DNL 70-75 dBA noise zone. The 256 persons would equate to 0.6 percent of the estimated 42,681 persons (based on 2000 census data) who live within the airfield airspace environment.

The noise level reduction, hearing loss and nonauditory health effects discussion for Alternative A apply to the No Action Alternative. Noise-induced hearing loss would not occur from airfield operations associated with the No Action Alternative and there is no scientific basis that potential health effects exist for aircraft DNL below 75 dBA.

Effect of Aircraft Noise on Wildlife

Aircraft operations would continue to occur directly over or near some of the critical nesting habitat for the Mariana crow and the critical roosting habitat for the Mariana fruit bat. Aircraft altitude when overflying the Mariana fruit bat nesting colony at Pati Point is 900 feet AGL and greater. Aircraft altitude above the areas to the north and northwest of the airfield where Mariana crow and Mariana fruit bat nesting and/or foraging are known to occur would continue to be 1,000 feet AGL and greater.

The maximum sound levels produced under the No Action Alternative (*i.e.*, 108 dBA by the C-5 aircraft at Pati Point) would be about 2 dBA less than the maximum noise from the Morton (1996) study (*i.e.*, 110 dBA) of Mariana crow reaction to aircraft noise. Additionally, the maximum No Action Alternative sound level at any of the four other points north and northwest of the airfield where Mariana crow nesting and/or foraging is known to occur would be 104 dBA, which is approximately 6 dBA less than the Morton (1996) study. As mentioned in the Morton (1996) study, noise from aircraft overflight did not cause nest abandonment for one pair of Mariana crows when the aircraft were restricted to altitudes greater than 1,000 feet AGL. The reactions to noise the Mariana crow experiences under the baseline would continue under the No Action Alternative because the type and level of aircraft operating at Andersen AFB be similar to that found in the 1996 Morton study.

The maximum sound levels produced under the No Action Alternative (*i.e.*, 108 dBA) at Pati Point would be about 8 dBA less than the Morton (1996) study (*i.e.*, 116 dBA) of Mariana fruit bat reaction to aircraft noise. Additionally, the maximum No Action Alternative sound level at any of the four other points north and northwest of the airfield where Mariana fruit bat nesting and/or foraging is known to occur would be 104 dBA, which is approximately 12 dBA less than the Morton (1996) study. The reactions to noise that the Mariana fruit bat experiences as described in the Morton study would continue under the No Action Alternative. Subchapter 4.5 contains additional discussion and analysis for the Mariana crow and the Mariana fruit bat.

4.1.3.2 Construction Noise

Construction noise would be generated by construction and demolition activities associated with individually programmed facility actions and O&M activities. As with Alternative A, it is estimated that the shortest distance between a construction noise source and a receptor would be about 100 feet. Therefore, the annoyance, hearing loss, sleep interference, and speech disruption discussion and analysis for construction noise for Alternative A apply to the No Action Alternative.

4.1.4 Mitigation

There is potential for noise effects on the Mariana crow and the Mariana fruit bat. Subchapter 4.5 contains the impact analysis for these two species.

4.1.5 Cumulative Impacts

Alternative A

None of the other actions contain changes to aircraft operations. Therefore, there would be no cumulative noise impacts from aircraft operations. The other actions would construct facilities near the locations at which Alternative A facilities would be constructed. Receptors in the vicinity of facility construction projects associated with Alternative A and the other actions could include persons within 100 feet of noise from operating construction and demolition equipment at two adjacent construction sites. Based on the similarity of the construction and demolition activities that would occur under the other actions and for Alternative A, the analysis and conclusions associated with equipment operation for Alternative A apply to the cumulative noise environment that would occur from simultaneous construction equipment under Alternative A and other actions.

Alternative B

Except for the family housing units and family housing management facilities that would not be constructed under Alternative B, the alternative action facilities construction and activities are identical to Alternative A. Therefore, the cumulative impacts discussion and analysis for Alternative A apply to the cumulative impacts associated with Alternative B.

4.2 LAND USE

Factors considered in land use analysis include:

- The extent, if any, to which the action would require new land use category(s) in the Base General plan;
- If a land use re-categorization would be required, the extent to which the land use re-categorization would cause incompatible land uses;
- The extent, if any, that the action would preclude existing uses of adjacent or nearby properties; and
- The extent, if any, to which the action would conflict with applicable land use plans, ordinances, and/or permit requirements.

4.2.1 Alternative A

Alternative A land use activities would be consistent with the land use categories in the Base General Plan. Therefore, land uses would be compatible with the character of Base land use patterns that exist under the No Action Alternative. Facility construction and alteration activities may have a temporary minor constraint on existing operations and land uses; however, after construction, these facilities would not impact any adjacent land use.

None of the structures proposed for construction under Alternative A would be taller than the existing Base facilities. Therefore, there would be no change to the aesthetic view from adjacent off-Base properties that occurs under the No Action Alternative.

None of the facilities proposed for construction and none of the ISR/Strike activities would interfere with existing access to non-Air Force land between Andersen AFB, the Pacific Ocean, or the Philippine Sea. The existing access procedures that occur under the No Action Alternative would be continued.

Subchapter 4.10, Socioeconomics Resources, identifies the possibility of skilled U.S. workers temporarily relocating to Guam to work on ISR/Strike projects. Options for temporary housing are discussed in full in Subchapters 4.10.1.2 and 4.10.2.2. One of the options discussed includes one or more temporary housing facilities to be established and operated by construction contracting companies. These facilities could include construction of new, and/or upgrade of existing, temporary housing facilities. Such facilities have been utilized in Guam since shortly after WW II. GovGuam has extensive experience in permitting temporary housing. Construction of new facilities would be based on regulations set forth and enforced by the Guam Bureau of Statistics and Planning, the Departments of Public Health & Social Services, and Land Management. Upgrade of existing facilities would be based on the same regulations. However, upgrading existing temporary facilities may require less administrative and regulatory processing if the previous land use as temporary lodging is in force when upgrade or renovation work is considered by the construction contracting company(s). Housing facilities for temporary workers should be discouraged if the facilities are not in a compatible land use surroundings and are not supported by the availability of adequate infrastructure to the local community.

Alternative A would increase the noise exposure when compared to the No Action Alternative and the noise contours in the 2001 AICUZ Report (see Figures 4.1-3 and 3.2-2). The area southwest of the Base could experience land use noise impacts due to the increased noise exposure. As mentioned in Subchapter 3.2, most of the off-Base land in the immediate vicinity of Andersen main base is undeveloped or residential with low to moderate density. Based on the increased area of exposure and the AICUZ program guidance for updating the most recent AICUZ report, Andersen AFB would prepare an update to the 2001 AICUZ Report to identify potential land use incompatibility from aircraft noise.

There would be no change in the location or the dimensions of CZs, APZ Is, and APZ IIs associated with Runways 06 Left and Right. As mentioned in Subchapter 3.2, development in APZ II would continue to be limited because of the importance of the recharge capability of the land. The 56.66 hectares (140 acres) of residential land in the APZ II associated with Runways 06

Comment. Is the AICUZ zone being widened in light of the additional runways that are being considered?

Response: The analysis in the FEIS was improved and modified by adding CZs and APZs I the text in Subchapter 4.2.1.

Left and Right under the No Action Alternative would continue to be considered incompatible under the safety element of the AICUZ program. For these reasons, there should be no change to the 2001 AICUZ Report when considering the safety element of the AICUZ program and the assumption there has been no substantial growth in the APZ II associated with Runways 06 Left and Right.

In accordance with AICUZ program guidance, Andersen AFB would provide the proposed action noise contours and land use sections of NEPA documentation and any other relative data to local planning agencies to serve as an interim AICUZ report within 90 days of the decision to proceed with the proposed action. A full update to the AICUZ Report would be provided to the community within 1 year after the completed mission change.

4.2.2 Alternative B

Except for the family housing units and family housing management facilities that would not be constructed under Alternative B, the alternative facilities construction and activities are identical to Alternative A. Therefore, the discussion and analysis for Alternative A apply to Alternative B.

4.2.3 No Action Alternative

The ISR/Strike capability would not be established at Andersen AFB and the Base activities would continue at baseline conditions. Continuation of the current activities would be consistent with the land use categories in the General Plan. Any facilities actions at Andersen AFB would be accomplished in accordance with the Base’s General Plan.

As indicated in the note on Figure 3.2-2, the noise contours used to prepare the current Andersen AFB AICUZ Study are not the same as the baseline noise contours in this EIS. This condition occurs because the aircraft operations used to prepare the noise contours for the 2001 AICUZ Study reflect operations for 1998, and the baseline contours in this EIS (*i.e.*, No Action Alternative) are based on the more recent 2003 operations. As indicated in Figure 4.2-1, the DNL 65 dBA noise contour for the No Action Alternative extends over one mile farther to the southwest when compared to the DNL 65 dBA noise contour in the AICUZ Study. Therefore, the No Action Alternative exposes additional land area to aircraft noise when compared to that reflected in the current AICUZ Study.

The additional land area could be affected by the increased noise exposure. As mentioned in Subchapter 3.2, most of the off-Base land in the immediate vicinity of Andersen main base is undeveloped or residential with low to moderate density. Based on the increased area of exposure and the AICUZ program guidance for updating the most recent AICUZ report, Andersen AFB would prepare an update to the 2001 AICUZ Report to identify potential land use incompatibility from aircraft noise.

There would be no change in the location or the dimensions of APZ II associated with Runways 06 Left and Right. Therefore, no change to the 2001 AICUZ Report would be necessary when considering the safety element of the AICUZ program.

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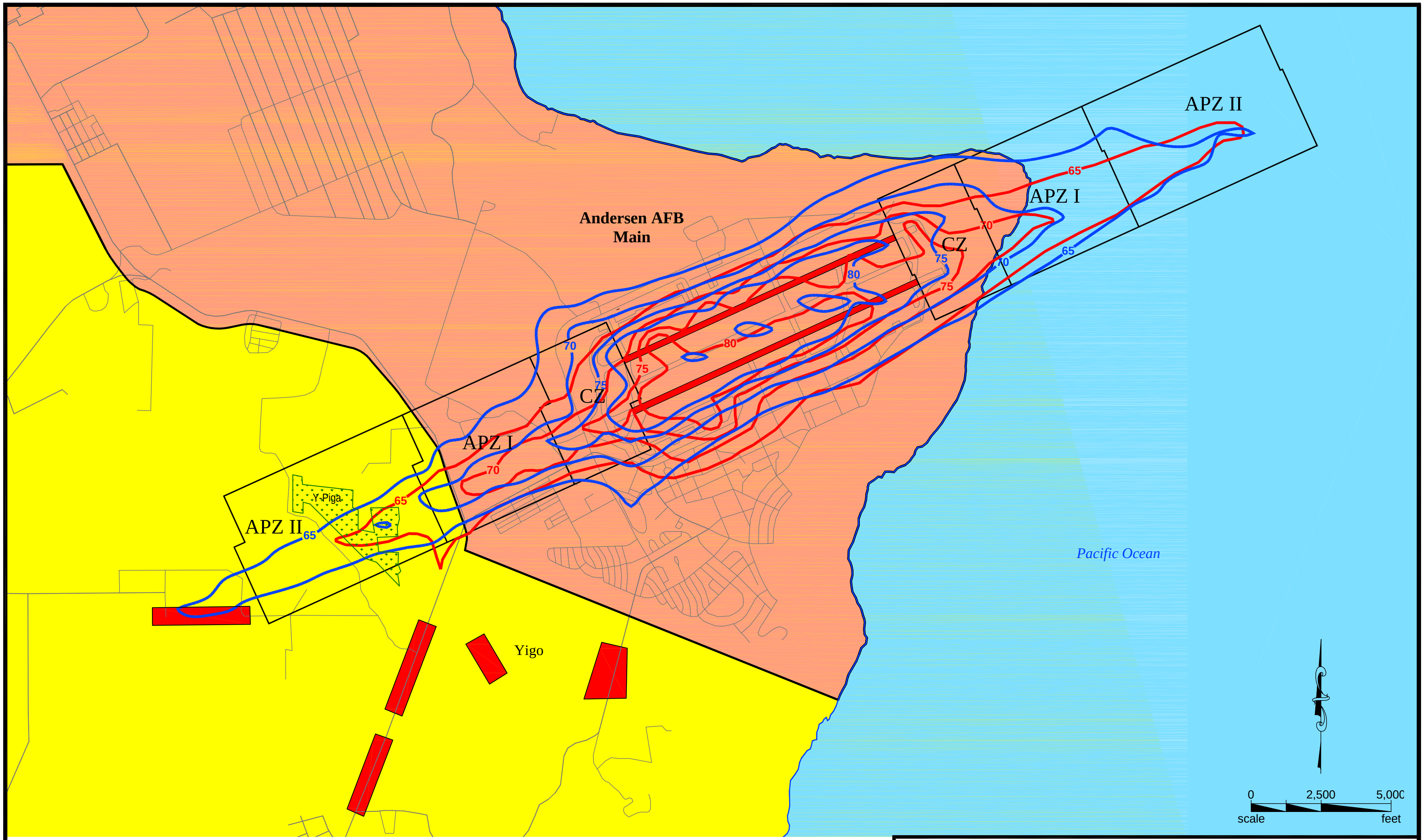

Legend

▬	No Action Alternative Noise Contours	▨	Andersen AFB
▬	2001 AICUZ Studay Noise Contours	🟨	Commercial Land Use
▬	Runway	🟥	Residential Land Use
─	Roadway	▨	Conservation Reserve

Note:
The 2001 noise contours on this figure are from the AICUZ report that was released to the public in 2001. These contours are not used for the Baseline Noise of the No Action Alternative.

Source for 2001 Contours: Andersen AFB 1998.

Figure 4.2-1

Comparison of No Action Alternative and 2001 AICUZ Study Noise Contours

Andersen AFB, Guam

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4.2.4 Mitigation

There would be no land use impacts from either Alternative A or Alternative B that require mitigation.

4.2.5 Cumulative Impacts

Alternative A

Other facilities would be constructed on Andersen AFB and some of the other actions would be in the general area associated with construction of ISR/Strike facilities. As with the ISR/Strike facilities, the other facility actions would be accomplished in accordance with the Andersen AFB General Plan. Thus, ISR/Strike and the other action facility construction would be consistent with land use plans and programs identified in the General Plan. None of the other facilities that would be constructed would interfere with existing access to non-Air Force land between Andersen AFB, the Pacific Ocean, or the Philippine Sea. The existing access procedures that occur under the No Action Alternative would be continued.

Alternative B

Except for the family housing units and family housing management facilities that would not be constructed under Alternative B, facilities construction and activities are identical to Alternative A. Therefore, the cumulative impact discussion and analysis for Alternative A apply Alternative B.

4.3 AIR QUALITY

Evaluation criteria considered in air quality analysis include:

- The extent, if any, that the emissions from the action would cause or contribute to a violation of any national or Guam ambient air quality standard; and
- The extent, if any, that emissions from the action would be 10 percent or more of the affected AQCR or air basin emissions inventory and be considered regionally significant.

Normally, criteria air pollutant emissions would be compared to a regional air pollutant emissions inventory to determine significance. If emissions from the action equaled or exceeded 10 percent of the region’s total emissions, the emissions would be considered significant. Because Guam does not have a regional emission inventory to determine whether emissions from the action would be significant, the major source threshold for new major sources in attainment areas – the 250 tpy PSD threshold – is the criteria used for determining significance of air emissions from Alternatives A and B.

4.3.1 Alternative A

Under Alternative A, facilities would be constructed, altered, and expanded; aircraft operations would increase; and the on-Base population would increase. Construction, alteration, and expansion project emissions would be considered short-term emissions. Emissions from aircraft, AGE, and POV operations would be considered recurring emissions.

Facility construction, addition, and alteration projects would begin in FY07. A project duration of 12 months was used to determine construction emissions if a project duration was not listed for a specific project. Because construction activities would occur over a 16-year period, the total construction/demolition emissions were calculated for all proposed projects and then divided by 16 to determine the average annual emissions.

Aircraft operations were calculated using the emission factors from the United States Air Force Institute for Environmental, Safety, & Occupational Health Risk Analysis document *Air Emissions Inventory Guidance for Mobile Sources at Air Force Installations, January 2002 (Revised December 2003)* and the aircraft operations listed in Table 2.2-2. AGE emission estimates were calculated using the Emissions Dispersion Modeling System computer program. The number and type of AGE units associated with aircraft were taken from the default list used for each type of aircraft by the computer program.

Neither the *Emissions Inventory Guidance for Mobile Sources at Air Force Installations* nor the Emissions Dispersion Modeling System have the emissions factors for the Global Hawk aircraft, which has a variation of the C-130J engine. However, the guidance does not have emissions factors for the C-130J engine either. Thus, the emissions factors for the C-130H engine were used to calculate the emissions from Global Hawk operations [40 CFR Part 1502.22(b)4]. The on-Base population would increase by 3,000 personnel as a result of the Proposed Action. Emissions from POVs include vehicle operation by permanently based personnel and their dependents. POV emission estimates were based on data from the 2003 Mobile Source Air Emission Inventory (USAF 2005c). The POV values for this analysis were based on a ratio of personnel for the 2003 analysis to the personnel for the 2005 analysis.

Construction emissions presented in Table 4.3-1 include the estimated annual emissions from construction equipment exhaust, paving operations, and dust from ground-disturbing activities associated with Alternative A. It is estimated the construction, demolition, renovation, and paving activity would last about 16 years and that ground-disturbing activities would occur for about half of the project duration. Construction emissions would produce slightly elevated air pollutant concentrations. However, the effects would be temporary, fall off rapidly with distance from the proposed construction site, and would not result in any long-term impacts. None of the short term emissions associated with Alternative A exceed PSD levels.

Review of data in Table 4.3-1 for Andersen AFB indicates that emissions from full ISR/Strike capability recurring activities (*i.e.*, aircraft, AGE, and POV operations) would cause an increase in the criteria pollutants when compared to the No Action Alternative. The greatest portion of the recurring PM_{10} emissions would be caused by POV emissions. None of the full ISR/Strike capability recurring emissions associated with Alternative A would exceed PSD levels.

Table 4.3-1 Alternative A Air Emissions

Criteria Air Pollutant	CO (tpy)	VOC (tpy)	NOx (tpy)	SOx (tpy)	PM_{10} (tpy)
Total No Action Alternative Emissions	433.6	201.8	299.6	36.9	134
Alternative A Emissions					
Short Term Emissions					
Construction/Demolition	5.8	1.2	13.2	1.4	3.9
Full ISR/Strike Capability Recurring Emissions					
Aircraft Emissions	31.0	7.8	14.8	2.5	4.4
AGE Emissions	1.2	0.4	4.3	0.5	0.3
POV Emissions	56.6	4.1	6.5	0.7	40.7
Fuel Cell Maintenance Emissions	0.0	0.3	0.0	0.0	0.0
Corrosion Control Emissions	0.0	0.4	0.0	0.0	0.3
Total Recurring Alternative A Emissions	88.8	13.0	25.6	3.7	45.7
PSD Levels*					
	250	250	250	250	250

** Guam Regulations 1105*

Note: VOC is not a criteria air pollutant. However, VOC is reported because, as an ozone precursor, it is a controlled pollutant

According to the Pilot Testing and Resource Capability and Resource Valuation Assessment conducted in 2005 (Andersen 2005c), aggregate HAP emissions could increase from the 2003 inventory amount by as much as nine times before reaching the regulatory limit of 25 tpy. None of the aspects of Alternative A would result in an increase of nine times the current processes; therefore, the aggregate HAP emissions would not exceed the 25 tpy threshold.

Except for the 2-mile radius around three power plants which are nonattainment for SO_2, the entire Island of Guam is in attainment or unclassified for all criteria pollutants. Andersen AFB is outside the 2-mile radius for each of the three power plants. As indicated in Table 4.3-1, the additional SO_2 emissions would not exceed PSD thresholds. As mentioned in Subchapter 3.3.1, federal actions occurring in air basins that are in attainment of the NAAQS are not subject to the Conformity Rule, and a Conformity Determination would not be required.

Radon

Testing would be accomplished at each site where an enclosed structure would be constructed prior to initiation of the facility design process if it is expected that radon occurs at the site. Should radon be detected, the new facilities would be constructed with radon-resistant techniques that would keep indoor radon levels below the action level (4 pCi/L) (USAF 1998). There are five major parts to a passive radon-resistant system:

- A layer of gas-permeable material under the foundation (usually 4 inches of gravel);
- Plastic sheathing over that material;
- Sealing and caulking of all openings in the concrete foundation floor;
- Installation of a gas-tight 3-or 4-inch vent pipe that runs from under the foundation through the building to the roof; and
- A roughed-in electrical junction box for future installation of a fan, if needed (USEPA 1998b).

These features create a physical barrier to radon entry. The vent pipe redirects the flow of air under the foundation, preventing radon from seeping into the building. As stated in Subchapter 3.3.4, radon is not an outdoor problem.

4.3.2 Alternative B

The number of aircraft operations would increase under Alternative B when compared to baseline. Additionally, facility construction, addition, and alteration projects would be accomplished to support the alternative. Facility construction projects would begin in FY07 and occur over an approximate 16-year period. The on-Base population would increase by 1,850 personnel. The methods used to calculate emissions for Alternative A were used to determine Alternative B emissions. Table 4.3-2 details the average annual emissions for Alternative B.

Table 4.3-2 Alternative B Air Emissions

Criteria Air Pollutant	CO (tpy)	VOC (tpy)	NOx (tpy)	SOx (tpy)	PM_{10} (tpy)
Total No Action Alternative Emissions	433.6	201.8	299.6	36.9	134
Alternative B Emissions					
Short Term Emissions					
Construction/Demolition	4.8	0.8	8.0	0.9	2.7
Full ISR/Strike Capability Recurring Emissions					
Aircraft Emissions	30.4	7.8	13.0	2.2	4.2
POV Emissions	34.9	2.5	4.0	0.4	25.1
Fuel Cell Maintenance Emissions	0.0	0.3	0.0	0.0	0.0
Corrosion Control Emissions	0.0	0.4	0.0	0.0	0.3
Total Recurring Alternative B Emissions	65.3	11.0	17.0	2.6	29.6
PSD “Significant” Levels*					
	250	250	250	250	250

* *Guam Regulations 1105*

Note: VOC is not a criteria air pollutant. However, VOC is reported because, as an ozone precursor, it is a controlled pollutant

Construction emissions presented in Table 4.3-2 include the estimated annual emissions from construction equipment exhaust, paving operations, and dust from ground-disturbing activities associated with Alternative B. It is estimated the construction, demolition, renovation, and paving activity would last about 16 years and that ground-disturbing activities would occur for about half of the project duration. Construction emissions would produce slightly elevated air pollutant concentrations. However, the effects would be temporary, fall off rapidly with distance from the proposed construction site, and would not result in any long-term impacts. None of the short term emissions associated with Alternative B exceed any “significant” PSD levels.

Review of data in Table 4.3-2 for Andersen AFB indicates that emissions from full ISR/Strike capability recurring activities (*e.g.*, aircraft, AGE, and POV operations) would cause an increase in the criteria pollutants when compared to the No Action Alternative. The greatest portion of the recurring PM_{10} emissions would be from operations of POVs. None of the full ISR/Strike capability recurring emissions associated with Alternative B would exceed PSD levels.

The Alternative A discussion for HAPs applies to Alternative B. Therefore, the aggregate HAP emissions would not exceed the 25 tpy threshold. Except for the 2-mile radius around three power plants which are nonattainment for SO_2, the entire Island of Guam is in attainment or unclassified for all criteria pollutants. Andersen AFB is outside the 2-mile radius for each of the three power plants. As mentioned in Subchapter 3.3.1, federal actions occurring in air basins that are in attainment of the NAAQS are not subject to the Conformity Rule, and a Conformity Determination would not be required.

4.3.3 No Action Alternative

Under the No Action Alternative, the ISR/Strike capability would not be established at Andersen AFB. Emissions from aircraft operations, aircraft maintenance, AGE, and POV and GOV vehicle operation, boilers, generators, fueling operations, and industrial processes, would continue to be generated by Andersen AFB. However, there would be an increase in aircraft operations for the No Action Alternative when compared to aircraft operations associated with the baseline. Therefore, the No Action Alternative Emissions consist of 2003 emissions for fuel tanks and fuel facilities, POV, GOV, and stationary source emissions and the emissions from the aircraft operations in Table 2.3-1. The Alternative A discussion for HAPs applies to the No Action Alternative, and the aggregate HAP emissions would not exceed the 25 tpy threshold. Table 4.3-3 shows the updated emissions inventory for the No Action Alternative.

Table 4.3-3 No Action Alternative Air Emissions

Criteria Air Pollutant	CO (tpy)	VOC (tpy)	NOx (tpy)	SOx (tpy)	PM_{10} (tpy)
Fuel Tanks[a]	0.0	2.5	0.0	0.0	0.0
Fuel Facilities[a]	0.0	23.0	0.0	0.0	0.0
POV[a]	111.2	8.0	12.8	1.2	80.1
GOV[a]	28.4	3.4	9.1	0.7	8.6
Stationary Sources[a]	27.0	11.1	122.1	14.4	6.9
Aircraft[b]	261	152	134	18	37
AGE[b]	6.0	1.8	21.6	2.6	1.4
Total No Action Alternative Emissions	**433.6**	**201.8**	**299.6**	**36.9**	**134**

a USAF 2005c.
b Emissions calculated based on 2004 aircraft data
Note: VOC is not a criteria air pollutant. However, VOC is reported because, as an ozone precursor, it is a controlled pollutant

4.3.4 Mitigation

There are no air quality impacts from either Alternative A or Alternative B that require mitigation.

4.3.5 Cumulative Impacts

Alternative A

As with Alternative A, facility construction, addition, and alteration projects would be accomplished under the other actions. However, none of the other actions include aircraft operations. The cumulative on-Base population would increase by 4,248 personnel. The methods used to calculate Alternative A air emissions were used to determine the cumulative emissions for Alternative A and the other actions. Table 4.3-4 presents the cumulative emissions from Alternative A and other action projects and activities.

Table 4.3-4 Alternative A Cumulative Air Emissions

Criteria Air Pollutant	CO (tpy)	VOC (tpy)	NOx (tpy)	SOx (tpy)	PM10 (tpy)
Total No Action Alternative Emissions	433.6	201.8	299.6	36.9	134
Cumulative Emissions					
Short Term Emissions					
Alternative A Construction/Demolition Emissions	5.8	1.2	13.2	1.4	3.9
Other Actions Construction/Demolition Emissions	2.5	0.5	5.6	0.6	4.1
Total Short Term Emissions	8.3	1.7	18.8	2.0	8.0
Recurring Emissions					
Alternative A Recurring Emissions (POV, aircraft, *etc*.)	88.8	13.0	25.6	3.7	45.7
Other Actions POV Emissions	23.5	1.7	2.7	0.3	16.9
Total Recurring Emissions	112.3	14.7	28.3	4.0	62.6
PSD "Significant" Levels*					
	250	250	250	250	250

** Guam Regulations 1105*

Note: VOC is not a criteria air pollutant. However, VOC is reported because, as an ozone precursor, it is a controlled pollutant

Construction emissions presented in Table 4.3-4 include the estimated cumulative annual emissions from construction equipment exhaust, paving operations, and dust from ground disturbing activities. It is estimated the construction, demolition, renovation, and paving activity would last about 16 years and that ground-disturbing activities would occur for about half of the project duration. Construction emissions would produce slightly elevated air pollutant concentrations. However, the effects would be temporary, fall off rapidly with distance from the proposed construction site, and would not result in any long-term impacts.

Review of data in Table 4.3-4 for Andersen AFB indicates that cumulative emissions from recurring activities (*e.g.*, aircraft, AGE, and POV operations) after FY19 would cause an increase in the criteria pollutants when compared to the No Action Alternative. However, none of the recurring emissions would exceed PSD levels.

The Alternative A discussion for HAPs applies to the Alternative A cumulative impacts analysis. The aggregate HAP emissions would not exceed the 25 tpy threshold. Except for the 2-mile radius around three power plants which are nonattainment for SO_2, the entire Island of Guam is in attainment or unclassified for all criteria pollutants. Andersen AFB is outside of the 2-mile radius for each of the three power plants. As mentioned in Subchapter 3.3.1, federal actions occurring in air basins that are in attainment of the NAAQS are not subject to the Conformity Rule, and a Conformity Determination would not be required.

Alternative B

As with Alternative B, facility construction, addition, and alteration projects would be accomplished under the other actions. None of the other actions include aircraft operations. The on-Base population would increase by 3,098 personnel. The methods used to calculate Alternative A cumulative air emissions were used to determine the cumulative emissions from Alternative B and the other actions. Table 4.3-5 presents the cumulative emissions from Alternative B and other action projects and activities.

Table 4.3-5 Alternative B Cumulative Air Emissions

Criteria Air Pollutant	CO (tpy)	VOC (tpy)	NOx (tpy)	SOx (tpy)	PM10 (tpy)
Total No Action Alternative Emissions	433.6	201.8	299.6	36.9	134
Cumulative Emissions					
Short Term Emissions					
Alternative B Construction/Demolition Emissions	4.8	0.8	8.0	0.9	2.7
Other Actions Construction/Demolition Emissions	2.5	0.5	5.6	0.6	4.1
Total Short Term Emissions	7.3	1.3	13.6	1.5	6.8
Recurring Emissions					
Alternative B Recurring Emissions	65.3	11.0	17.0	2.6	29.6
Other Actions POV Emissions	23.5	1.7	2.7	0.3	16.9
Total Recurring Emissions	88.8	12.7	19.7	2.9	46.5
PSD “Significant” Levels*					
	250	250	250	250	250

** Guam Regulations 1105*

Note: *VOC is not a criteria air pollutant. However, VOC is reported because, as an ozone precursor, it is a controlled pollutant*

Construction emissions presented in Table 4.3-5 include the estimated cumulative annual emissions from construction equipment exhaust, paving operations, and dust from ground-disturbing activities. It is estimated the construction, demolition, renovation, and paving activity would last about 16 years and that ground-disturbing activities would occur for about half of the project duration. Construction emissions would produce slightly elevated air pollutant concentrations. However, the effects would be temporary, fall off rapidly with distance from the proposed construction site, and would not result in any long-term impacts.

Review of data in Table 4.3-5 for Andersen AFB indicates that cumulative emissions from recurring activities (*e.g.*, aircraft, AGE, and POV operations) after FY19 would cause an increase in the criteria pollutants when compared to the No Action Alternative. However, none of the recurring emissions would exceed PSD levels.

The Alternative A discussion for HAPs applies to the Alternative B cumulative impacts analysis. The aggregate HAP emissions would not exceed the 25 tpy threshold. Except for the 2-mile radius around three power plants which are nonattainment for SO_2, the entire Island of

Guam is in attainment or unclassified for all criteria pollutants. Andersen AFB is outside of the 2-mile radius for each of the three power plants. As mentioned in Subchapter 3.3.1, federal actions occurring in air basins that are in attainment of the NAAQS are not subject to the Conformity Rule, and a Conformity Determination would not be required.

4.4 INFRASTRUCTURE AND UTILITIES

Effects on infrastructure and utilities were evaluated using the following criteria:

- The extent, if any, that the action would cause changes in consumption, generation, and usage; and
- The extent, if any, that the action would case changes in demand to the existing system.

Subchapter 4.10, Socioeconomics Resources, identifies the possibility of skilled U.S. workers temporarily relocating to Guam to work on ISR/Strike projects. Housing for these workers could potentially be provided by a combination of:

- The current private housing inventory on Guam;
- Existing hotel properties through several potential processes: conversion to long term lodging by using existing hotels; acceptance of long term rental occupants by existing hotels; and renovating and reoccupying currently vacant hotel properties; and
- Construction and/or upgrade of one or more temporary housing facilities established and operated by construction contracting companies for the sole use of the temporary construction workers.

The loads and impacts on infrastructure for the first two types of housing (*i.e.*, current private housing inventory and existing hotel properties) were addressed when these units were planned, designed, and permitted.

Temporary housing facilities dedicated to construction workers could have a varying level of impact on existing utilities. Use of existing temporary housing facilities would be advantageous because the infrastructure (*i.e.*, roads, wastewater, and water) would be in place. Use of these utilities may increase the load on existing infrastructure and such an increase would require evaluation of specific sites and existing utility systems. New temporary housing facilities would require the normal evaluation for siting, access and infrastructure, and approval and permitting by GovGuam agencies. The optimal sites for temporary housing would likely be those that could use existing utility systems that have verifiable existing utility capacities. Potential sites and the existing conditions vary greatly, and would require evaluation should they be used for temporary housing.

4.4.1 Alternative A

4.4.1.1 Water Supply

As mentioned in Subchapter 2.2.1, aircraft wash racks and clear water rinse facilities would be constructed, and the on-Base population would increase by a total of 3,000 personnel. Table 4.4-1 summarizes the water consumption from aircraft wash rack and clear water rinse facility operations. Table 4.4-2 presents the water use for Alternative A. As indicated in Table 4.4-2, Base water consumption would be 51 percent greater than the No Action Alternative consumption. The 0.89 mgd of water consumption would equate to 20 percent of the new water supply system.

Table 4.4-1 Water Consumption for Aircraft Wash Racks and Clear Water Rinse Facility

Aircraft Type	**Number of Aircraft Washed/Rinsed per Year**	**Gallons of Water per Aircraft Wash/Rinse**	**Annual Gallons of Water**
Aircraft Wash Racks			
F-22	115	250	28,750
F-15E	29	250	7,250
KC-135	18	500	9,000
Global Hawk	36	250	9,000
B-1	36	2,000	72,000
B-2	12	2,000	24,000
B-52	18	2,000	36,000
subtotal	264	--	186,000
Clear Water Rinse Facility			
F-22	230	1,000	230,000
F-15E	58	1,000	58,000
KC-135	36	1,000	36,000
RQ-4	72	1,000	72,000
B-1	72	1,000	72,000
B-2	24	1,000	24,000
B-52	36	1,000	36,000
subtotal	528	--	528,000
total	--	--	714,000
Total (mgd)			**0.002**

mgd=million gallons per day

Table 4.4-2 Alternative A Water Supply Analysis

Line	Condition	Volume	Value
1	Additional personnel	3,000	personnel
2	Per capita consumption	100	gallons per person per day
3	Consumption for additional Alternative A personnel	300,000	gallons per day
4	Consumption for additional Alternative A personnel (line 3)	0.30	mgd
5	Aircraft washing/rinsing consumption	0.002	mgd
6	Baseline personnel consumption (*i.e.*, excluding water associated with system loss)	0.59	mgd
7	Alternative A water consumption (lines 4+5+6)	0.892	mgd
8	Alternative A consumption compared to No Action Alternative (line 7/line 6)	+51	%
9	System capacity	4.5	mgd
10	Alternative A consumption as % of system capacity (line 7/line 9)	20	%

To comply with EO 13123, newly constructed buildings would have low-flow water saving devices (toilets, shower heads, and faucets) installed. Common low-volume appliances include the 1.6 gallons-per-flush toilets (uses 54 percent less water), 2.2 gallons per minute (gpm) faucet aerators, 2.5 gpm showerheads, and front-loading washing machines (uses 40 percent less water per load). It is estimated that the use of water saving devices reduces indoor consumption by as much as 39 percent (TWRI 2002).

The Base has a significant supply of high quality water which can be utilized to absorb the proposed mission. However, to meet an increased demand the Base would have to upgrade its water system to meet the worst-case fire demand. The installation is meeting all of its current water demands. As stated in Subchapter 3.4.1, the Base has taken steps to correct the capacity problems with a $15.0M project that would construct a new well field in Northwest Field. In addition, a 3.0 million gallon ground level storage tank and booster station would be constructed on the main base to provide storage and convey water to the Base distribution system. Calculations for additional capacity, assuming the Base takes advantage of all storage available as well as the two additional water connections available, indicate that a resource opportunity of 8.3 mgd exists, which could support 61,556 people at a consumption rate of 135 gallons/person/day (Andersen AFB 2005c).

4.4.1.2 Wastewater Treatment

As mentioned in Subchapter 2.2.1, aircraft wash racks and clear water rinse facilities would be constructed and the on-Base population would increase by a total of 3,000 personnel. Water used at rinse facilities would be discharged to the WWTP. Table 4.4-3 presents the wastewater generation for Alternative A. As indicated in the table, wastewater generation would be 74 percent greater than the No Action Alternative generation. The total wastewater discharge at the WWTP when combining the Base's wastewater and the existing flow would be 9.9 mgd, or about 82 percent of the plant design capacity. The service contract under which contractors pump out existing Base grease traps and oil/water separators would be expanded to include those oil/water separators that would be added as a result of the new facilities. Surface water discharges of water from the oil/water separators would not be allowed. All new wastewater systems are evaluated to determine if necessary, what size and type of treatment would be required before wastewater is sent to the sewer system. Evaluations and upgrades to the existing sewer system are in process to accommodate new construction. All wastewater systems upgrades and individual wastewater disposal systems would comply with Guam EPA wastewater regulations. The Base will continue negotiating with the GWA to determine the amount of wastewater the Base will be allowed to send to the Northern District WWTP. Base personnel would continue to monitor waste water flow rates on a monthly basis at the Base's final lift station.

Table 4.4-3 Alternative A Wastewater Analysis

Line	Condition	Volume	Value
1	Additional personnel	3,000	personnel
2	Per capita generation	35	gallons per person per day
3	Generation for additional Alternative A personnel	105,000	gallons per day
4	Generation for additional Alternative A personnel (line 3)	0.105	mgd
5	Aircraft washing/rinsing generation	0.002	mgd
6	Additional industrial generation	0.055	mgd
7	Baseline generation	0.220	mgd
8	Alternative A generation (lines 4+5+6+7)	0.382	mgd
9	Alternative A generation compared to No Action Alternative (line 8/line 7)	+74	%
10	Average daily WWTP flow	9.5	mgd
11	Projected WWTP flow (line 8+line 10)	9.9	mgd
12	WWTP design capacity	12.0	mgd
13	Alternative A generation as % of WWTP design capacity (line 11/line 12)	82	%

Note: *Design of the wash racks and clear water rinse facility indicate wastewater from the facilities would be discharged to the wastewater collection system. Therefore, the volume of water that would be used at the facilities (see Table 4.4-1) would be discharged to the wastewater collection system.*

Alternative A would increase wastewater treatment at the plant to 82 percent of capacity. The current waiver application from secondary wastewater treatment requirements under Section 301(h) of the Clean Water Act does not include an increase in flow from Andersen AFB. Therefore, GWA would submit a new permit application for renewal of its permit under the proposed project. Andersen AFB would coordinate with GWA the amount of Base wastewater that would be allowed for treatment at the WWTP. Plans must be approved between the Air Force and GWA to share in the up-grade and maintenance costs of sewer distribution and treatment.

Draft EIS Comment: The Final EIS should also include a review of GWA's draft Water Resources Master Plan for compatibility. These discussions should include the impact the increase wastewater flow will have on GWA's 301(h) permit renewal and whether upgrades to secondary wastewater treatment will be needed.

Response: The analysis in the FEIS was improved and modified by considering and further analyzing the issues in this comment by expanding the second paragraph of Subchapter 4.4.1.2 to include data from the draft Water Resources Master Plan and GWA's 301(h) permit.

Andersen AFB currently has sufficient wastewater discharge capacity to meet its current demand and sufficient capacity for expansion. If the

USEPA imposes stricter discharge limitations on the GWA wastewater treatment plant and, as a result GWA imposes restrictions on its dischargers, the Base may be required to implement pre-treatment technology to meet its effluent concentration limits. In addition, the Base would increase its management oversight of the wastewater program (Andersen AFB 2005c).

4.4.1.3 Energy and Communications

Energy

Under Alternative A, building space would increase by 1,918,089 ft^2. Based on the baseline consumption of 0.0027 kWH per square foot per day and the increase in space, Alternative A would increase usage by 5,179 kWH per day. This would equate to an approximate 27.4 percent increase when compared to the average daily No Action Alternative electrical consumption of 18,913 kWH per day and 0.94 percent of the GPA generation capacity. The Andersen AFB electricity use resulting from Alternative A and the existing condition would be 24,092 kWH, which equates to 4.4 percent of the GPA generation capacity. The GPA's power plant 100 percent generation capacity reserve (USAF 2004c) would accommodate the increase in electrical consumption. Repair of the Base distribution as described in Subchapter 3.3 and installation of another 20 MW substation as planned for the ISR/Strike capability would ensure the additional generation could be distributed on the Base.

Where practicable, facilities would be constructed in an energy-efficient and sustainable manner as discussed in Subchapter 2.2.1.1.

Communications

According to a systems assessment conducted in June 2004, there are no significant problems or capacity issues with the current Base communications system. However, to accomplish missions in the future and accommodate mission growth, the Base should continue to implement communications system expansions and improvements (USAF 2004c).

4.4.1.4 Storm Water Management

Alternative A would construct a total of 4,733,634 ft^2 (108.7 acres) of buildings, new pavements, and other improvements, which represent an increase in impervious cover of 18.8 percent when compared to the No Action Alternative. All proposed demolition and construction activities would occur within the boundaries of Andersen AFB. There are no perennial or intermittent streams on the Base and no developed drainage infrastructure. Runoff is slow and the hazard of water erosion is slight (Andersen AFB 2000). The existing drainage basins within Andersen AFB and the current storm water management systems would accommodate the increase in run off due to the additional impervious cover. Upgrades to UIC stormwater systems (to include new UIC wells) to accommodate the increase in runoff would be accomplished for construction projects such as runways and other impervious surfaces that are susceptible to petroleum leaks and spills. New designs that incorporate devices to increase ponding and retention (pre-treatment for the initial portion of the storm event) would be implemented. New oil/water separator systems would also be required.

Draft EIS Comment: Upgrades to stormwater systems will be required to accommodate any additional increases to the capacity of the system.

Response: The FEIS was improved as suggested by the commenter by revising Subchapter 4.4.1.4 of the EIS with the information in the comment.

Based on current location plans for facility sites 1, 4, and 35 on Figure 2.2-4, three of the 103 dry wells on the Base could be lost. The loss of the three wells should not present a problem because there are other nearby wells that are currently under capacity. These nearby wells could accommodate the flow that goes to the three wells that might be lost as a result of construction. Some terrain design work may be necessary to channel water from the area of the three wells to the nearby, under-capacity wells (Clark 2005). The Base would continue to monitor 12 of the wells twice a year during and after construction to ensure that water entering the wells meets drinking water standards. As required by Guam EPA, all stormwater would be addressed on-site whenever possible.

Construction contractors would ensure an EPP is prepared, provided to Andersen AFB for submittal to Guam EPA, and approved before initiating activities. The EPP would likely include complying with erosion control techniques that would be used during demolition and construction to minimize erosion. The construction sites would have silt fences and other erosion control features down gradient, such as absorbent booms for oil and grease. Hay bales or other absorbent materials would be installed around storm drainage system inlets to prevent sediment or other contaminants from entering the storm water system (to include the dry wells that utilize the karst features to migrate stormwater to the aquifer) during the project. The rate of runoff from the construction site would be retarded and controlled mechanically. Diversion ditches would be constructed to retard and divert runoff to protected drainage courses. If site characteristics present the potential for storm water sediment to enter the storm water system, drains in the area would be protected with silt fences, hay bales, or an approved equivalent.

4.4.1.5 Solid Waste Management

Solid waste would be generated from implementation of Alternative A. This waste would consist of building debris and construction materials such as concrete, asphalt, metals (roofing, reinforcement bars, conduit, piping, *etc*.), fiberglass (roofing materials and insulation), cardboard, plastics (PVC piping, packaging material, shrink wrap, *etc*.), and lumber. Solid waste would also be generated by residential and daily mission activities. Analysis of the impacts associated with Alternative A is based on the following assumptions:

- Approximately 4 pounds of construction debris are generated for each square foot of floor area for new structures (Davis 1995);
- Approximately 92 pounds of demolition debris are generated for each square foot of floor area of demolished structures (U.S. Army Corps of Engineers [USACE] 1976);
- Approximately 1 pound of construction debris is generated for each square foot of new asphaltic concrete pavement; and
- Debris would be disposed 6 days per week (312 days per year) over the 16-year project.

Under Alternative A, there would be an additional 3,000 personnel working and residing on Base. Thus, approximately 7,500 additional pounds per day (3.75 tpd) of solid waste would be generated above the No Action Alternative by mission and residential activities when considering the increase in personnel and the baseline generation rate of 2.5 lbs per person per day, excluding the amount of household recycling materials. Combining the 3.75 tpd with the baseline 7.4 tpd results in 11.15 tpd of solid waste (3,479 tpy) being disposed in a landfill

312 days per year. The increase in disposal equates to 51 percent above the No Action Alternative rate.

It is estimated the landfill would reach 100 percent capacity by December 2007, regardless of Alternative A activities. A study is currently being conducted to investigate the possibility of vertically extending the current landfill for use beyond 2009. The study is scheduled for completion in January 2007. Thus, Andersen AFB plans to use the expanded on-Base landfill until 2009 or later if the current study supports expansion, and then use a permitted landfill. Although it is not known at this time which landfill would be used, there are three possible options: (1) the proposed GovGuam landfill after it becomes available in 2009-2010; (2) the on-Base landfill that would be constructed as an ISR/Strike project; and (3) the Navy landfill. Planning for the GovGuam and ISR/Strike landfills has not progressed to the point where the capacities or life spans are known. Therefore, quantitative analysis of the impact of the ISR/Strike project on the landfill cannot be accomplished.

Andersen AFB would submit the permit application for Guam EPA coordination to ensure the landfill expansion project is not delayed. Likewise, the Base would submit the permit application for Guam EPA coordination for the ISR/Strike landfill project. A permitting concern is whether Guam EPA would approve and issue a permit because the landfill project would be located over a Sole Source Aquifer. Characteristics of the leachate from the proposed landfill would not change from that for the existing landfill because the current and future waste steams would be the same. Recent monitoring results of the leachate effluent from the existing landfill do not show contaminate levels above required standards, and BOD_5 levels were very low. Additionally, monitoring wells located down gradient of the landfill are sampled to ensure that leachate is not migrating into the aquifer (Sherrill 2006b). The ISR/Strike landfill project would be designed and constructed with environmental controls to prevent contamination of the aquifer.

All green waste would continue to be segregated and collected for mulching, chipping, and composting or burned in small piles on site after obtaining a burning permit from the local fire department. Additionally, Andersen AFB would continue its aggressive pollution prevention and recycling program to divert solid waste.

Based on information in Subchapter 2.2.1.1, 5,116,059 ft^2 of structures would be constructed, 228,769 ft^2 would be demolished, 112,500 ft^2 would be renovated, and 3,081,701 ft^2 of new pavement would be constructed under Alternative A. Based on these data and the assumptions listed above, it is estimated that 27,700 tons of construction and demolition debris would be generated by Alternative A. Approximately 5.6 percent of this amount would be due to concrete or asphalt paving projects (*e.g.*, realign Arc Light Boulevard, taxiway networks, *etc.*).

Any materials that could be recycled or re-used would be diverted from the waste stream to extend the lifespan of the MSW landfill. Contracts issued for construction activities would require the contractor to recycle construction and demolition debris (*e.g.*, concrete, asphalt, scrap metal, roofing, reinforcement bars, conduit, piping, fiberglass, insulation, cardboard, plastics [PVC piping, packaging material, shrink wrap, *etc*.], and lumber) to the maximum extent possible, thereby reducing the amount of construction and demolition debris disposed in the landfill. The exact amount of debris that would be recycled cannot be estimated at this time because the amount that would be recycled is unknown.

Alternatives are available to Andersen AFB in the event the new GovGuam landfill is not permitted in time for implementation of the proposed project. These include incineration (waste-to-energy [WTE) and a new technology that grinds, shreds, and utilizes pressurized heat to reduce MSW (approximately 95 percent) to "fluff." The alternatives are further discussed below.

Waste-to-energy solutions are increasingly being considered as a viable cost effective option to conventional landfilling, especially with the relatively recent increase in energy cost. WTE facilities are widely used in Japan and in many European countries. GovGuam considered using an incinerator for the past decade. However, since 1996, GovGuam and Guam Resource and Recovery Partners have been entrenched in court battles over a contract to build a WTE incinerator facility due to concerns about the legality of the contract, as well as the cost and environmental impact of an incinerator. Therefore, the long delays have prompted the USEPA to press through a lawsuit ordering the closure of the Ordot Dump and the siting of a new landfill. Since large scale WTE facilities require significant amounts of MSW generation, Andersen AFB would need to partner with GovGuam and the Navy to create a plant; however, this may not be an attractive option with the potential political and public resistance. Additionally, smaller scale modular WTE facilities could potentially be developed with less controversy and could be an attractive option for the Base. A company in Agat is developing an incinerator to burn garbage from vessels and aircraft arriving on Guam, although its capacity is very small compared to what would be required for Andersen AFB (Andersen AFB 2005c).

The island environment of Guam with its constrained land availability, dependence on water supply through the high water table aquifers, and fairly high population density, indicate that WTE facilities should be considered as an important alternative for waste disposal. WTE facilities alleviate the need for the considerable land mass associated with landfilling while simultaneously providing alternative energy sources generated locally. Private production costs of WTE options are typically more expensive than traditional landfill options. However, with the scarcity (*i.e.*, more valuable) of available land on island environments, landfill production costs can also be considerable (Andersen AFB 2005c).

A company called "WastAway" developed a recycling process that recycles unsorted household garbage. The by-product, fluff, is similar to wood pulp which can be processed into a growing medium or be extruded to make products such as park benches and construction materials (WastAway 2006). The recycled fluff can also be used as a soil amendment and soil substrate growing medium. The U.S. Army was the first to use the new equipment, and tests were held in Fort Campbell, Kentucky, and Fort Benning, Georgia, to validate the system. A number of counties and one corporation recently purchased a WastAway facility and began processing their MSW into fluff (Andersen AFB 2005c).

4.4.1.6 Transportation

Short-term traffic congestion from the construction and demolition projects would occur in the construction areas. This congestion would be eliminated when the project activity would be completed, thereby minimizing the potential for long-term impacts. Commuting patterns of workers and residents would change as some of the roads undergo construction; however, alternative roads and arteries within the Base could be used to access the area. Additionally, most of the heavier traffic from construction activities would occur in less congested areas of the

Base. Some roads near construction sites could also be closed at various times throughout the project due to demolition and construction activities. Efforts would be taken to keep construction related traffic off the roads by re-directing it to other areas of the installation. Additionally, a construction and parking management plan would be developed that minimizes traffic interference and maintains traffic flow.

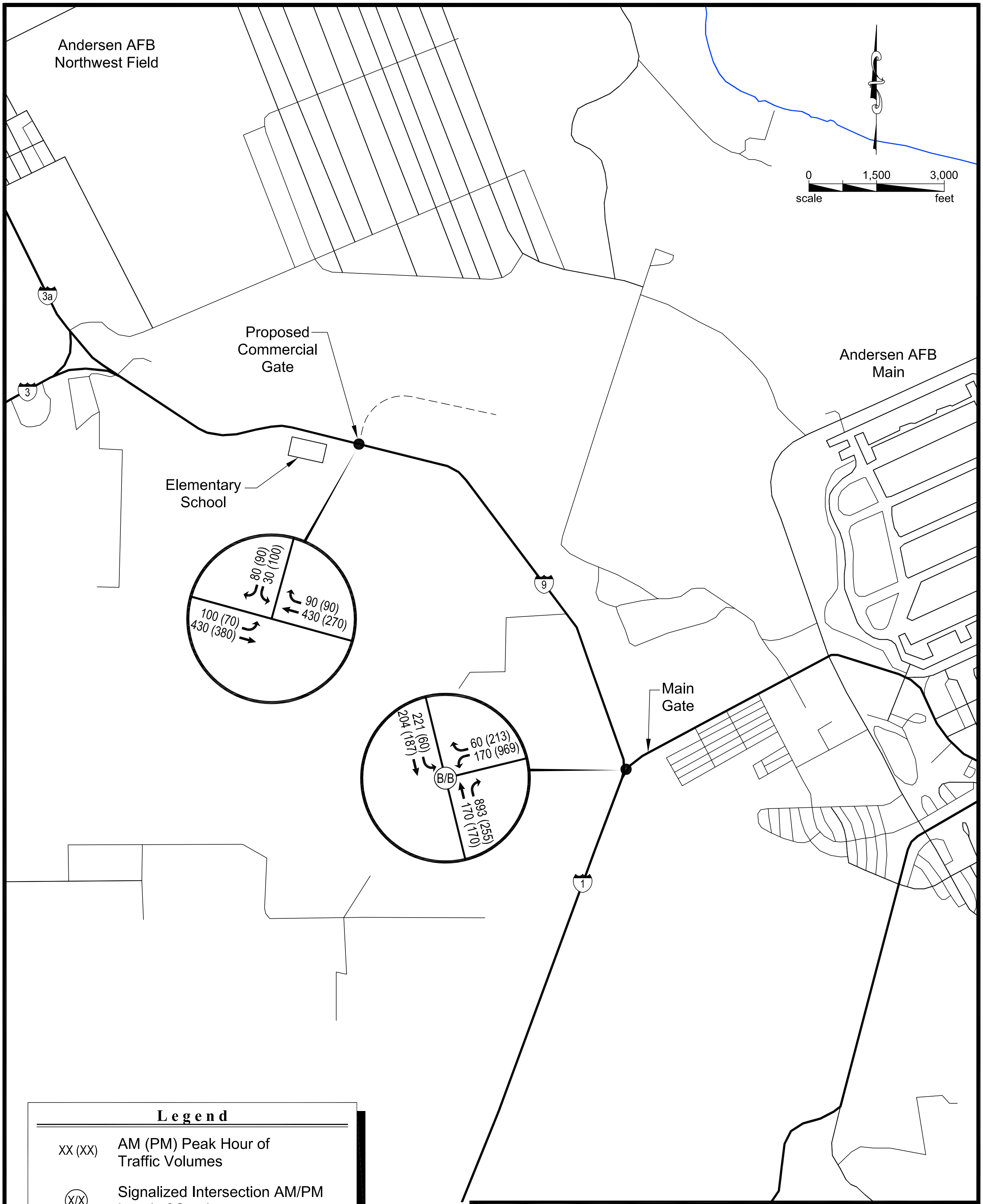
The traffic study completed for the Commercial Gate project estimated that vehicle volumes would double (Austin, Tsutsumi & Associates 2006) when considering the ISR/Strike Alternative A and other projects. Figure 4.4-1 presents the estimated traffic volumes at the intersections of Arc Light Boulevard and Highway 1 and Route 9 and the Commercial Gate for the morning (6:30-7:30 a.m.) and afternoon (3:30-4:30 p.m.) peak hours of traffic for Alternative A. The estimated levels of traffic are prorated on the assumption that the doubling of traffic applies to the condition that would result from the combination of the ISR/Strike project and the other actions identified in Subchapter 2.4. Adding the 3,000 additional persons associated with Alternative A to the current base population would equate to 85 percent of the doubled condition estimated by Austin, Tsutsumi & Associates 2006. Therefore, the traffic estimates for the Arc Light Boulevard intersection with Highway 1 and Route 9 on Figure 4.4-1 reflect 85 percent of the doubled baseline data for the intersection (see Figure 3.4-1). Data for the intersection of Route 9 and the Commercial Gate reflect 10 vehicles per hour for an 8-hour work day (Austin, Tsutsumi & Associates 2006).

Based on the volume data depicted on Figure 4.4-1 for the intersection of Arc Light Boulevard and Highway 1 and Route 9, and the LOS definitions in Subchapter 3.4.6, it is estimated that the LOS for the intersection would be LOS C or better during the peak hours of traffic. The baseline condition for the intersection is LOS B. At LOS C most experienced drivers are comfortable, roads remain safely below but efficiently near capacity, and posted speed is maintained. The 2006 traffic study found that a traffic signal is not warranted for the intersection of the Commercial Gate and Route 9 and the intersection would operate at LOS B or better (Austin, Tsutsumi & Associates 2006).

4.4.2 Alternative B

4.4.2.1 Water Supply

As mentioned in Subchapter 2.2.1, aircraft wash racks and clear water rinse facilities would be constructed and the on-Base population would increase by a total of 1,850 personnel. The number of aircraft under Alternative B would be the same as Alternative A. Therefore, the water consumption for aircraft washing and the clear water rinse facility under Alternative B would be the same as Alternative A (see Table 4.4-1). Table 4.4-4 presents the water use for Alternative B. As indicated in the table, water consumption would be 32 percent greater than the No Action Alternative consumption. The 0.777 mgd of water consumption would equate to 17.3 percent of the new water supply system. The discussion and analysis for water conservation measures, fire demand, water quality, and water storage in Alternative A apply.



AM Peak Hour:
6:30-7:30 AM

PM Peak Hour:
3:30-4:30 AM

Source: Austin, Tsutsumi & Associates 2006

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Figure 4.4-1

Estimated Traffic Volumes
Alternative A

Andersen AFB, Guam

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Table 4.4-4 Alternative B Water Supply Analysis

Line	Condition	Volume	Value
1	Additional personnel	1,850	personnel
2	Per capita consumption	100	gallons per person per day
3	Consumption for additional Alternative B personnel	185,000	gallons per day
4	Consumption for additional Alternative B personnel (line 3)	0.185	mgd
5	Aircraft washing/rinsing consumption	0.002	mgd
6	Baseline personnel consumption (*i.e.*, excluding water associated with system loss)	0.59	mgd
7	Alternative B water consumption (lines 4+5+6)	0.777	mgd
8	Alternative B consumption compared to No Action Alternative (line 7/line 6)	+32	%
9	System capacity	4.5	mgd
10	Alternative B consumption as % of system capacity (line 7/line 9)	17.3	%

4.4.2.2 Wastewater Treatment

As mentioned in Subchapter 2.2.1, aircraft wash racks and clear water rinse facilities would be constructed and the on-Base population would increase by a total of 1,850 personnel. Water used at rinse facilities would be discharged to the WWTP. Table 4.4-5 presents the wastewater generation for Alternative B. As indicated in the table, wastewater generation would be 55 percent greater than the No Action Alternative generation. The total wastewater discharge at the WWTP when combining the Base's wastewater and the existing flow would be 9.841 mgd, or about 82 percent of the plant design capacity. The service contract, surface water discharge, wastewater system evaluation, wastewater disposal upgrades, MOU, Section 301(h) of the Clean Water Act, wastewater pre-treatment, and wastewater flow monitoring discussion for Alternative A apply.

4.4.2.3 Energy and Communications

Energy

Under Alternative B, building space would increase by 1,452,940 ft^2. Based on the baseline consumption of 0.0027 kWH per square foot per day and the increase in space, Alternative B would increase usage by 3,923 kWH per day. This would equate to an approximate 20.7 percent increase when compared to the average daily No Action Alternative electrical consumption of 18,913 kWH per day and 0.71 percent of the GPA generation capacity. The Andersen AFB electricity use resulting from Alternative B and the existing condition would be 22,836 kWH, which equates to 4.1 percent of the GPA generation capacity. The GPA's power plant 100 percent generation capacity reserve (USAF 2004c) would accommodate the increase in electrical consumption. Repair of the Base distribution as described in Subchapter 3.3 and installation of another 20 MW substation as planned for the ISR/Strike capability would ensure the additional generation could be distributed on the Base.

Where practicable, facilities would be constructed in an energy-efficient and sustainable manner as discussed in Subchapter 2.2.1.1.

Table 4.4-5 Alternative B Wastewater Analysis

Line	Condition	Volume	Value
1	Additional personnel	1,850	personnel
2	Per capita generation	35	gallons per person per day
3	Generation for additional Alternative B personnel	64,750	gallons per day
4	Generation for additional Alternative B personnel (line 3)	0.065	mgd
5	Aircraft washing/rinsing generation	0.002	mgd
6	Additional industrial generation	0.054	mgd
7	Baseline generation	0.220	mgd
8	Alternative B generation (lines 4+5+6+7)	0.341	mgd
9	Alternative B generation compared to No Action Alternative (line 8/line 7)	+55	%
10	Average daily WWTP flow	9.5	mgd
11	Projected WWTP flow (line 8+line 10)	9.841	mgd
12	WWTP design capacity	12.0	mgd
13	Alternative B generation as % of WWTP design capacity (line 11/line 12)	82	%

Note: Design of the wash racks and clear water rinse facility indicate wastewater from the facilities would be discharged to the wastewater collection system. Therefore, the volume of water that would be used at the facilities (see Table 4.4-5) would be discharged to the wastewater collection system.

Communications

The discussion and analysis for Alternative A apply.

4.4.2.4 Storm Water Management

Alternative B would construct a total of 4,268,485 ft^2 (98 acres) of buildings, new pavement, and other improvements, which represents an increase in impervious cover of 17 percent when compared to the No Action Alternative. All proposed demolition and construction activities would occur within the boundaries of Andersen AFB. The stormwater system upgrade, pre-treatment, UIC stormwater controls, and EPP discussion and analysis for Alternative A apply to Alternative B.

4.4.2.5 Solid Waste Management

Under Alternative B, the Air Force proposes construction and demolition projects similar to Alternative A. The analysis for the alternative is based on the same assumptions and data used to evaluate Alternative A. Based on information in Subchapter 2.2.2.1 and assumptions listed in this subchapter for solid waste management, solid waste would be generated from implementation of Alternative B.

Under Alternative B, there would be an additional 1,850 personnel working and residing on Base. Thus, approximately 4,625 additional pounds per day (2.3 tpd) of solid waste would be generated above the No Action Alternative by mission and residential activities when considering the increase in personnel and the baseline generation rate of 2.5 pounds per person per day, excluding the amount of household recycling materials. Combining the 2.3 tpd with the baseline 7.4 tpd results in 9.7 tpd of solid waste (3,026 tpy) being disposed in a landfill 312 days per year. The increase in disposal equates to 31 percent above the No Action Alternative rates.

It is estimated the landfill would reach 100 percent capacity by December 2007, regardless of Alternative B activities. A study is currently being conducted to investigate the possibility of vertically extending the current landfill for use beyond 2009. The study is scheduled for completion in January 2007. Thus, Andersen AFB plans to use the expanded on-Base landfill until 2009 or later if the current study supports expansion, and then use a permitted landfill. Although it is not known at this time which landfill would be used, there are three possible options: (1) the proposed GovGuam landfill after it becomes available in 2009-2010; (2) the on-Base landfill that would be constructed as an ISR/Strike project; and (3) the Navy landfill. Planning for the GovGuam and ISR/Strike landfills has not progressed to the point where the capacities or life spans are known. Therefore, quantitative analysis of the impact of the ISR/Strike project on the landfill cannot be accomplished. The landfill permitting and environmental controls discussion for Alternative A applies.

All green waste would continue to be segregated and collected for mulching, chipping, and composting or burned in small piles on site after obtaining a burning permit from the local fire department. Additionally, Andersen AFB would continue its aggressive pollution prevention and recycling program to divert solid waste.

Based on information in Subchapter 2.2.2.1, 4,650,910 ft^2 of structures would be constructed, 228,769 ft^2 would be demolished, 112,500 ft^2 would be renovated, and 3,081,701 ft^2 of new pavements would be constructed under Alternative B. Based on these data and the assumptions listed above, it is estimated that 26,766 tons of construction and demolition debris would be generated. Approximately 5.6 percent of this amount is due to concrete or asphalt paving projects (*i.e.*, realign Arc Light Boulevard, taxiway networks, *etc.*). Alternative A construction and demolition debris recycling and WTE technologies discussions and analysis apply to Alternative B.

4.4.2.6 Transportation

Alternative B facilities construction and activities are identical to Alternative A except that family housing units and family housing management facilities would not be constructed under this alternative. The discussion and analysis for on-Base traffic at and around construction sites for Alternative A applies to Alternative B.

The traffic study completed for the Commercial Gate project estimated that vehicle volumes would double (Austin, Tsutsumi & Associates 2006) when considering Alternative B. Figure 4.4-2 presents the estimated traffic volumes at the intersections of Arc Light Boulevard and Highway 1 and Route 9 and the Commercial Gate for the morning (6:30-7:30 a.m.) and afternoon (3:30-4:30 p.m.) peak hours of traffic for Alternative B. The estimated levels of traffic are prorated on the assumption that the doubling of traffic applies to the condition that would result from the combination of the ISR/Strike project and the other actions identified in Subchapter 2.4. Adding the 1,850 additional persons associated with Alternative B to the current base population would equate to 72 percent of the doubled condition estimated by Austin, Tsutsumi & Associates 2006. Therefore, the traffic estimates for the Arc Light Boulevard intersection with Highway 1 and Route 9 on Figure 4.4-2 reflect 72 percent of the doubled baseline data for the intersection (see Figure 3.4-1). The data for the intersection of Route 9 and the Commercial Gate reflect 10 vehicles per hour for an 8-hour work day (Austin, Tsutsumi & Associates 2006).

Based on the volume data depicted on Figure 4.4-2 for the intersection of Arc Light Boulevard and Highway 1 and Route 9 and the LOS definitions in Subchapter 3.4.6, it is estimated that the LOS for the intersection would be LOS C or better during the peak hours of traffic. The baseline condition for the intersection is LOS B. At LOS C most experienced drivers are comfortable, roads remain safely below but efficiently near capacity, and posted speed is maintained. The 2006 traffic study found that a traffic signal is not warranted for the intersection of the Commercial Gate and Route 9 and the intersection would operate at LOS B or better.

4.4.3 No Action Alternative

Under the No Action Alternative, the ISR/Strike capability would not be established at Andersen AFB. Construction and demolition activities associated with individually programmed facility actions and O&M activities would continue to occur. Although the number of assigned personnel could undergo the minor fluctuations resulting from routine Air Force personnel actions, the number of Air Force personnel at the Base would remain at the September 2004 levels (*i.e*., approximately 5,900 personnel).

4.4.3.1 Water Supply

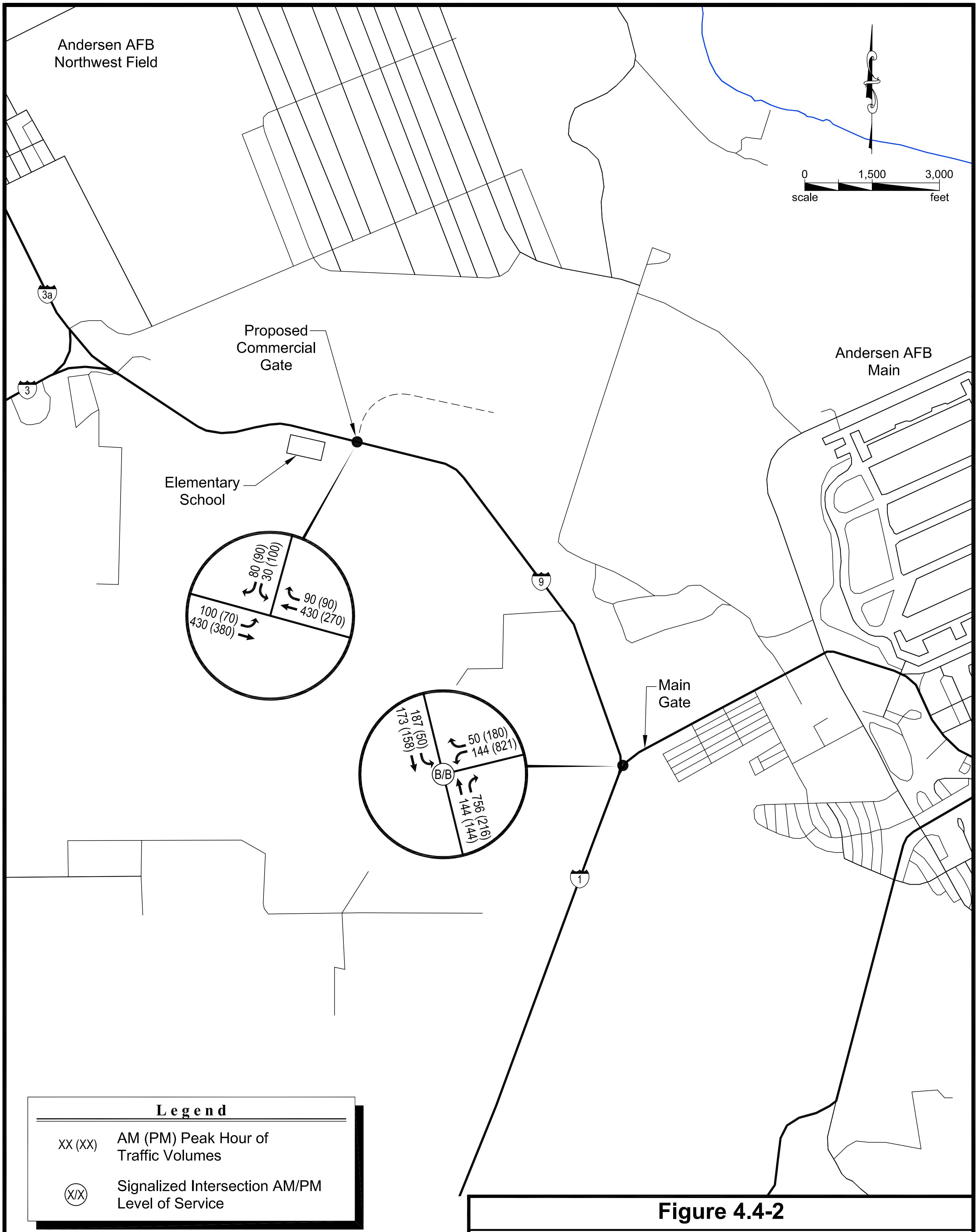
Under the No Action Alternative, water consumption by personnel would continue at 0.59 mgd, which is approximately 13 percent of the system capacity of 4.5 mgd.

4.4.3.2 Wastewater Treatment

Under the No Action Alternative, the Base would continue to generate approximately 0.22 mgd of wastewater that would be treated at the GWA WWTP. The WWTP would continue to operate at 79 percent of the plant design capacity.

As discussed in Subchapter 3.4.2, Andersen AFB has experienced two overflow conditions in the wastewater collection system due to typhoons. GPA-funded overflow studies and other infrastructure improvements to the WWTP, pump station, and upgrades to sanitary sewers in the Northern District WWTP system would eliminate surcharges and increase system reliability. Planned improvements and repairs, including completion of the ocean outfall, should bring the WWTP back into compliance with the USEPA. Base personnel would continue to monitor waste water flow rates on a daily basis at the base's final lift station.

Andersen AFB has no concentration limitations on its wastewater discharge that is sent to the GWA WWTP. However, the GWA plant does have an NPDES permit for specific constituents. If the NPDES permit for the GWA plant is revised, it is likely that GWA would impose contaminant concentration limits on the Base.



AM Peak Hour:
6:30-7:30 AM

PM Peak Hour:
3:30-4:30 AM

Source: Austin, Tsutsumi & Associates 2006

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Figure 4.4-2

Estimated Traffic Volumes
Alternative B

Andersen AFB, Guam

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4.4.3.3 Energy and Communication

Energy

Andersen AFB would continue to be serviced by the GPA and the Base would continue to consume electricity at the rate of 20 MW (Ostil 2006a), which equates to 3.6 percent of the GPA generation capacity. The electrical distribution system shortcomings identified in Subchapter 3.4.3 would continue.

Communications

Under the No Action Alternative, the existing Base communications system would continue to meet the immediate needs of the Base even as it implements the CITS which began in June 2004. The CITS is upgrading some network infrastructure both underground and inside buildings at the Base. These improvements would increase both capacity and reliability.

4.4.3.4 Storm Water Management

Under the No Action Alternative, storm water management and runoff would continue as described for the current conditions. Over 100 dry wells are installed to assist in storm water migration into the aquifer. The total disposal capacity of the wells is approximately 548 mgd. The base would continue to monitor 12 of the wells twice a year to ensure that water entering the wells meets drinking water standards. Upgrades to stormwater systems would be required for on-going military construction (MILCON) construction projects. New facilities that have washracks would have oil/water separator systems. Discussions of required pre-treatment of stormwater and stricter discharge limitations in Subchapter 4.4.1.3 apply.

4.4.3.5 Solid Waste Management

Under the No Action Alternative, it is estimated the landfill would reach 100 percent capacity by December 2007. A study is currently being conducted to investigate the possibility of vertically extending the current landfill for use beyond 2009. The study is scheduled for completion in January 2007. Thus, Andersen AFB plans to use the expanded on-Base landfill until 2009 or later if the current study supports expansion, and then use a permitted landfill. Although it is not known at this time which landfill would be used, there are two possible options: (1) the proposed GovGuam landfill after it becomes available in 2009-2010; and (2) the Navy landfill. Planning for the GovGuam landfill has not progressed to the point where the capacities or life span is known. Therefore, quantitative analysis of the impact of the No Action Alternative on the landfill cannot be accomplished. MSW disposal would continue at the current rate of 23.1 tpd. All green waste would continue to be segregated and collected for mulching, chipping, and composting or burned in small piles on site after obtaining a burning permit from the local fire department. Additionally, Andersen AFB would continue its aggressive pollution prevention program to divert solid waste.

4.4.3.6 Transportation System

The volume of traffic at the intersection of Arc Light Boulevard and Highway 1 and Route 9 and along Route 9 west of the Main Gate would remain at baseline levels. The intersection of

Arc Light Boulevard and Highway 1 and Route 9 at the Main Gate would continue to operate at LOS B during both the morning and afternoon peak hours of traffic.

4.4.4 Mitigation

There are no water, wastewater, energy, communication, solid waste management, and transportation system impacts from either Alternative A or Alternative B that require mitigation.

4.4.5 Cumulative Impacts

Alternative A

The same criteria used to calculate Alternative A infrastructures and utilities were used to determine cumulative impacts. As indicated in Subchapter 2.4, numerous other projects would be accomplished during the same time period as Alternative A. The methods identified and used to estimate Alternative A infrastructure requirements were used for the cumulative conditions. The following data and assumptions apply.

- An additional 1,248 personnel would live and work at Andersen AFB under the other actions, including 788 dependents, and 460 permanent military personnel (145 unaccompanied and 315 accompanied personnel). Thus, when combined with the 3,000 additional personnel associated with Alternative A, the Base population would increase by 4,248 persons.
- A total of about 2.3 million ft^2 of space would be constructed for repairing and repaving existing taxiways, ramps, and parking areas on Andersen AFB. Thus, when combined with the 3.08 million ft^2 increase from Alternative A, the total amount of roadways and parking areas would increase by 5.38 million ft^2.
- A total of about 3.0 million ft^2 of building space and other structures would be constructed and 2.5 million ft^2 of space would be demolished on the main Base portion of Andersen AFB under the other actions. Thus, when combined with the 1,918,089 ft^2 increase from Alternative A at Andersen AFB, the total building space would increase by 3,084,508 ft^2 (1,166,419 ft^2 from the other action and 1,918,089 ft^2 from Alternative A).

Water Supply

Table 4.4-6 presents the cumulative water use for Alternative A. As indicated in the table, water consumption would be 83 percent greater than the No Action Alternative consumption. The 1.081 mgd of water consumption would equate to 24 percent of the new water supply system. The discussion and analysis for water conservation measures, fire demand, water quality, and water storage in Alternative A apply.

Table 4.4-6 Alternative A Cumulative Water Supply Analysis

Line	Condition	Volume	Value
1	Additional personnel	4,248	personnel
2	Per capita consumption	100	gallons per person per day
3	Consumption for cumulative additional Alternative A personnel	424,800	gallons per day
4	Consumption for cumulative additional Alternative A personnel (line 3)	0.425	mgd
5	ISR/Strike aircraft washing/rinsing consumption	0.002	mgd
6	Northwest Field consumption	0.064	mgd
7	Baseline personnel consumption (*i.e.*, excluding water associated with system loss)	0.590	mgd
8	Cumulative Alternative A water consumption (lines 4+5+6+7)	1.081	mgd
9	Cumulative Alternative A consumption compared to No Action Alternative (line 8/line 7)	+83	%
10	System capacity	4.5	mgd
11	Cumulative Alternative A consumption as % of system capacity (line 8/line 10)	24	%

Note: Northwest Field water consumption from Brown and Caldwell 2005.

Wastewater Treatment

Table 4.4-7 presents the cumulative wastewater generation for Alternative A. As indicated in the table, wastewater generation would be 109 percent greater than the No Action Alternative generation. The total wastewater discharge at the WWTP when combining the Base's wastewater and the existing flow would be 9.96 mgd, or about 83 percent of the plant design capacity. The service contract, surface water discharge, wastewater system evaluation, wastewater disposal upgrades, MOU, Section 301(h) of the Clean Water Act, wastewater pre-treatment, and wastewater flow monitoring discussion for Alternative A apply.

Other action projects (see Table 2.4-1) would replace the 20-inch force main and repair the lift stations that have caused sewage back ups and overflows discussed in Subchapter 3.4.2. Automatic overflow detection devices should be installed at the pump stations to notify utilities personnel of impending sewage overflow conditions. All wastewater system upgrades and repairs would comply with Guam EPA wastewater regulations.

Table 4.4-7 Alternative A Cumulative Wastewater Analysis

Line	Condition	Volume	Value
1	Additional personnel	4,248	personnel
2	Per capita generation	35	gallons per person per day
3	Cumulative generation for additional Alternative A personnel	148,680	gallons per day
4	Cumulative generation for additional Alternative A personnel (line 3)	0.149	mgd
5	ISR/Strike aircraft washing/rinsing generation	0.002	mgd
6	Cumulative additional industrial generation	0.060	mgd
7	Northwest Field generation	0.028	mgd
8	Baseline generation	0.220	mgd
9	Cumulative Alternative A generation (lines 4+5+6+7+8)	0.459	mgd
10	Cumulative Alternative A generation compared to No Action Alternative (line 9/line 8)	+109	%
11	Average daily WWTP flow	9.5	mgd
12	Projected WWTP flow (lines 9+line 11)	9.96	%
13	WWTP design capacity	12.0	mgd
14	Alternative A cumulative generation as % of WWTP design capacity (line 12/line 13)	83	%

Note: *Design of the wash racks and clear water rinse facility indicate wastewater from the facilities would be discharged to the wastewater collection system. Therefore, the volume of water that would be used at the facilities (see Table 4.4-71) would be discharged to the wastewater collection system. Northwest Field wastewater generation from Brown and Caldwell 2005.*

Energy

Building space would increase by 3,084,508 ft^2 as a result of Alternative A and the other actions. Based on the baseline consumption of 0.0027 kWH per square foot per day and the increase in space, electricity consumption would increase by 8,328 kWH per day. This would equate to an approximate 44.0 percent increase when compared to the average daily No Action Alternative electrical consumption of 18,913 kWH per day and 1.5 percent of the GPA generation capacity. The Andersen AFB electricity use resulting from Alternative A, the other actions, and the existing condition would be 27,241 kWH, which equates to 4.9 percent of the GPA generation capacity. The GPA's power plant 100 percent generation capacity reserve (USAF 2004c) would accommodate the increase in electrical consumption. Repair of the Base distribution as described in Subchapter 3.3 and installation of another 20 MW substation as planned for the ISR/Strike capability would ensure that additional generation could be distributed on the Base. Where practicable, facilities would be constructed in an energy-efficient and sustainable manner as discussed in Subchapter 2.2.1.1.

Communications

According to a systems assessment conducted in June 2004, there are no significant problems or capacity issues with the current Base communications system. To accomplish missions in the future and accommodate mission growth, the Base should continue to implement communications system expansions and improvements (USAF 2004c).

Storm Water Management

An additional 2,867,359 ft^2 of impervious cover would be constructed at the main Base under the other actions, while 4,733,634 ft^2 of additional cover would be constructed under Alternative A. Thus, an additional 7,600,993 ft^2, or 174.5 acres, would be added at Andersen AFB. The additional impervious cover would equate to a 20 percent increase when compared to the No Action Alternative condition of 875 acres of impervious cover at Andersen main. Therefore, the amount of storm water runoff could increase accordingly. The stormwater system upgrade, pre-treatment, UIC stormwater controls, and EPP discussion and analysis for Alternative A apply.

Solid Waste Management

There would be an additional 4,248 personnel working and residing on Base as a result of the other actions. Thus, approximately 10,620 additional pounds per day (5.3 tpd) of solid waste would be generated above the No Action Alternative by mission and residential activities when considering the increase in personnel and the baseline generation rate of 2.5 lbs per person per day. Combining the 5.3 tpd with the baseline of 7.4 tpd, results in 12.7 tpd of solid waste (3,966 tpy) being disposed in a landfill 312 days per year. The increase in disposal equates to 72 percent above the No Action Alternative rates.

Under other actions, a total of 2,980,899 ft^2 would be constructed, 2,519,467 ft^2 would be demolished, and 2,291,282 ft^2 of new pavements would be constructed from other actions. Based on these data and the assumptions listed in Subchapter 4.4.3.5, it is estimated that 123,003 tons of construction and demolition debris would be generated by the other actions. Thus, cumulatively, a total of 150,703 tons of solid waste would be generated (27,700 tons from Alternative A, 123,003 tons from the other actions).

It is estimated the landfill would reach 100 percent capacity by December 2007, regardless of Alternative A and other action activities. A study is currently being conducted to investigate the possibility of vertically extending the current landfill for use beyond 2009. The study is scheduled for completion in January 2007. Thus, Andersen AFB plans to use the expanded on-Base landfill until 2009 or later if the current study supports expansion, and then use a permitted landfill. Although it is not known at this time which landfill would be used, there are three possible options: (1) the proposed GovGuam landfill after it becomes available in 2009-2010; (2) the on-Base landfill that would be constructed as an ISR/Strike project; and (3) the Navy landfill. Planning for the GovGuam and ISR/Strike landfills has not progressed to the point where the capacities or life spans are known. Therefore, quantitative analysis of the impact of the ISR/Strike project on the landfill cannot be accomplished. The landfill permitting and environmental controls discussion for Alternative A applies.

As with Alternative A, the contractor would recycle materials to the maximum extent possible, thereby reducing the amount of construction and demolition debris disposed in the landfill. Therefore, the discussion and analyses for Alternative A apply. Likewise, the green waste and pollution prevention and recycling discussion for Alternative A applies.

As indicated in Table 2.4-1, one of the other action projects would construct a WTE plant at Andersen AFB. Construction and operation of the facility would reduce the amount of material that would be landfilled. The WTE discussion for Alternative A applies. It is not possible to determine at this time how much MSW could be diverted to the WTE plant because planning for the plant has not been initiated.

Transportation

Facilities construction and activities under other actions are very similar to Alternative A and could occur in areas near the ISR/Strike projects. The discussion and analysis for on-Base traffic at and around construction sites for Alternative A apply.

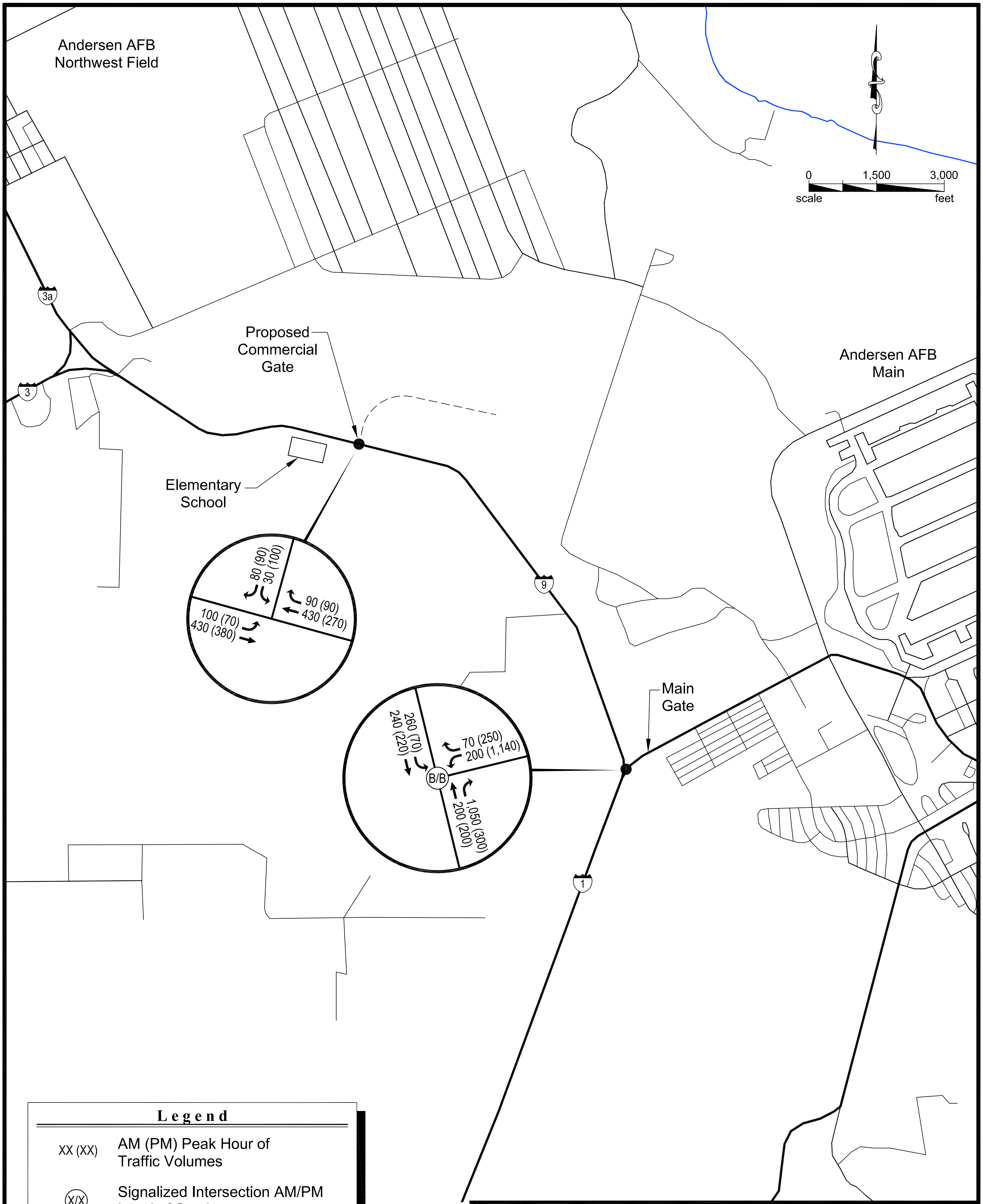
The traffic study completed for the Commercial Gate project estimated that vehicle volumes would double (Austin, Tsutsumi & Associates 2006) when considering the ISR/Strike Alternative A and other projects. Figure 4.4-3 presents the estimated traffic volumes at the intersections of Arc Light Boulevard and Highway 1 and Route 9 and the Commercial Gate for the morning (6:30-7:30 a.m.) and afternoon (3:30-4:30 p.m.) peak hours of traffic for Alternative A and the other actions. Data for the intersection of Route 9 and the Commercial Gate reflect 10 vehicles per hour for an 8-hour work day (Austin, Tsutsumi & Associates 2006).

Based on the volume data depicted on Figure 4.4-3 for the intersection of Arc Light Boulevard and Highway 1 and Route 9 and the LOS definitions in Subchapter 3.4.6, it is estimated that the LOS for the intersection would be LOS C or better during the peak hours of traffic. The baseline condition for the intersection is LOS B. At LOS C most experienced drivers are comfortable, roads remain safely below but efficiently near capacity, and posted speed is maintained. The 2006 traffic study found that a traffic signal is not warranted for the intersection of the Commercial Gate and Route 9 and the intersection would operate at LOS B or better.

Alternative B

The same criteria used to calculate Alternative B infrastructures and utilities were used to determine cumulative impacts. As indicated in Subchapter 2.4, numerous other projects would be accomplished during the same time period as Alternative B. The methods identified and used to estimate Alternative B infrastructure requirements were used for the cumulative conditions. The following data and assumptions apply:

- An additional 1,248 personnel would live and work at Andersen AFB under the other actions, including 788 dependents, and 460 permanent military personnel (145 unaccompanied and 315 accompanied personnel). Thus, when combined with the 1,850 additional personnel associated with Alternative B, the Base population would increase by 3,098 persons.
- A total of about 2.3 million ft^2 of space would be constructed for repairing and repaving existing taxiways, ramps, and parking areas on Andersen AFB main airfield. Thus, when combined with the 3.08 million ft^2 increase from Alternative B, the total amount of roadways and parking areas would increase by 5.38 million ft^2.



Legend

XX (XX) AM (PM) Peak Hour of Traffic Volumes

(X/X) Signalized Intersection AM/PM Level of Service

AM Peak Hour:
6:30-7:30 AM

PM Peak Hour:
3:30-4:30 AM

Source: Austin, Tsutsumi & Associates 2006

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Figure 4.4-3

Estimated Traffic Volumes
Alternative A Cumulative

Andersen AFB, Guam

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A total of about 3.0 million ft^2 of building space and other structures would be constructed and 2.5 million ft^2 of space would be demolished on the main Base portion of Andersen AFB under the other actions. Thus, when combined with the 1,452,940 ft^2 increase from Alternative B at Andersen AFB, the total building space would increase by 2,619,359 ft^2 (1,166,419 ft^2 from the other actions and 1,452,940 ft^2 from Alternative B).

Water Supply

Table 4.4-8 presents the cumulative water use for Alternative B. As indicated in the table, water consumption would be 64 percent greater than the No Action Alternative consumption. The 0.97 mgd of water consumption would equate to 21 percent of the new water supply system. The discussion and analysis for water conservation measures, fire demand, water quality, and water storage in Alternative A apply.

Table 4.4-8 Alternative B Cumulative Water Supply Analysis

Line	Condition	Volume	Value
1	Additional personnel	3,098	personnel
2	Per capita consumption	100	gallons per person per day
3	Consumption for cumulative additional Alternative B personnel	309,800	gallons per day
4	Consumption for cumulative additional Alternative B personnel (line 3)	0.310	mgd
5	ISR/Strike aircraft washing/rinsing consumption	0.002	mgd
6	Northwest Field consumption	0.064	mgd
7	Baseline personnel consumption (*i.e.*, excluding water associated with system loss)	0.590	mgd
8	Cumulative Alternative B water consumption (lines 4+5+6+7)	0.966	mgd
9	Cumulative Alternative B consumption compared to No Action Alternative (line 8/line 7)	+64	%
10	System capacity	4.5	mgd
11	Cumulative Alternative B consumption as % of system capacity (line 8/line 10)	21	%

Note: Northwest Field water consumption from Brown and Caldwell 2005.

Wastewater Treatment

Table 4.4-9 presents the cumulative wastewater generation for Alternative B. As indicated in the table, wastewater generation would be 96 percent greater than the No Action Alternative generation. The total wastewater discharge at the WWTP when combining the Base's wastewater and the existing flow would be 9.916 mgd, or about 83 percent of the plant design capacity. The service contract, surface water discharge, wastewater system evaluation, wastewater disposal upgrades, MOU, Section 301(h) of the Clean Water Act, wastewater pre-treatment, and wastewater flow monitoring discussion for Alternative A apply. The wastewater treatment collection system upgrades discussion from the Alternative A cumulative impact discussion also applies.

Table 4.4-9 Alternative B Cumulative Wastewater Analysis

Line	Condition	Volume	Value
1	Additional personnel	3,098	personnel
2	Per capita generation	35	gallons per person per day
3	Cumulative generation for additional Alternative B personnel	108,430	gallons per day
4	Cumulative generation for additional Alternative B personnel (line 3)	0.108	mgd
5	ISR/Strike aircraft washing/rinsing generation	0.002	mgd
6	Cumulative additional industrial generation	0.058	mgd
7	Northwest Field generation	0.028	mgd
8	Baseline generation	0.220	mgd
9	Cumulative Alternative B generation (lines 4+5+6+7+8)	0.416	mgd
10	Cumulative Alternative B generation compared to No Action Alternative (line 9/line 8)	+96	%
11	Average daily WWTP flow	9.5	mgd
12	Projected WWTP flow (line 9+line 11)	9.916	%
13	WWTP design capacity	12.0	mgd
14	Alternative B cumulative generation as % of WWTP design capacity (line 12/line 13)	83	%

Note: Design of the wash racks and clear water rinse facility indicate wastewater from the facilities would be discharged to the wastewater collection system. Therefore, the volume of water that would be used at the facilities (see Table 4.4-9) would be discharged to the wastewater collection system. Northwest Field wastewater generation from Brown and Caldwell 2005.

Energy

Building space would increase by 2,619,359 ft^2 as a result of Alternative B and the other actions. Based on the baseline consumption of 0.0027 kWH per square foot per day and the increase in space, electricity consumption would increase by 7,072 kWH per day. This would equate to an approximate 37 percent increase when compared to the average daily No Action Alternative electrical consumption of 18,913 kWH per day and 1.3 percent of the GPA generation capacity. The Andersen AFB electricity use resulting from Alternative B, the other actions, and the existing condition would be 25,985 kWH, which equates to 4.7 percent of the GPA generation capacity. The GPA's power plant 100 percent generation capacity reserve (USAF 2004c) would accommodate the increase in electrical consumption. Repair of the Base distribution as described in Subchapter 3.3 and installation of another 20 MW substation as planned for the ISR/Strike capability would ensure the additional generation could be distributed on the Base. Where practicable, facilities would be constructed in an energy-efficient and sustainable manner as discussed in Subchapter 2.2.1.1.

Communications

The discussion for Alternative A cumulative impact analysis applies to Alternative B.

Storm Water Management

Additional impervious cover of 2,867,359 ft^2 would be constructed at the main Base under the other actions, while 4,268,485 ft^2 of additional cover would be constructed under Alternative B. Thus, an additional 7,135,844 ft^2, or 163.8 acres, would be added at Andersen

AFB. The additional impervious cover would equate to a 18.7 percent increase when compared to the No Action Alternative condition of 875 acres of impervious cover at Andersen AFB main base. Therefore, the amount of storm water runoff could increase accordingly. The stormwater system upgrade, pre-treatment, UIC stormwater controls, and EPP discussion and analysis for Alternative A apply.

Solid Waste Management

There would be an additional 3,098 personnel working and residing on Base as a result of the other actions. Thus, approximately 7,745 additional pounds per day (3.9 tpd) of solid waste would be generated above the No Action Alternative by mission and residential activities when considering the increase in personnel and the baseline generation rate of 2.5 pounds per person per day. Combining the 3.9 tpd with the baseline of 7.4 tpd, results in 11.3 tpd of solid waste (3,526 tpy) being disposed in a landfill 312 days per year. The increase in disposal equates to 53 percent above the No Action Alternative rates.

Under other actions, a total of 2,980,899 ft^2 would be constructed, 2,519,467 ft^2 would be demolished, and 2,291,282 ft^2 of new pavement would be constructed. Based on these data and the assumptions listed in Subchapter 4.4.3.5, it is estimated that 123,003 tons of construction and demolition debris would be generated by the other actions. Thus, cumulatively, a total of 146,803 tons of solid waste would be generated (26,800 tons from Alternative B, 123,003 tons from the other actions).

It is estimated the landfill would reach 100 percent capacity by December 2007, regardless of Alternative B and other action activities. A study is currently being conducted to investigate the possibility of vertically extending the current landfill for use beyond 2009. The study is scheduled for completion in January 2007. Thus, Andersen AFB plans to use the expanded on-Base landfill until 2009 or later if the current study supports expansion, and then use a permitted landfill. Although it is not known at this time which landfill would be used, there are three possible options: (1) the proposed GovGuam landfill after it becomes available in 2009-2010; (2) the on-Base landfill that would be constructed as an ISR/Strike project; and (3) the Navy landfill. Planning for the GovGuam and ISR/Strike landfills has not progressed to the point where the capacities or life spans are known. Therefore, quantitative analysis of the impact of the ISR/Strike project on the landfill cannot be accomplished. The landfill permitting and environmental controls discussion for Alternative A applies. Likewise, the WTE plant discussion for the Alternative A cumulative impacts also applies.

As with Alternative A, the contractor would recycle materials to the maximum extent possible, thereby reducing the amount of construction and demolition debris disposed in the landfill. Therefore, the discussion for Alternative A cumulative impact analysis applies to Alternative B. Likewise, the green waste and pollution prevention and recycling discussion for Alternative A also applies.

Transportation

Other actions facilities construction and activities are very similar to Alternative B and could occur in areas near the ISR/Strike projects. The discussion and analysis for on-Base traffic at and around construction sites for Alternative A applies.

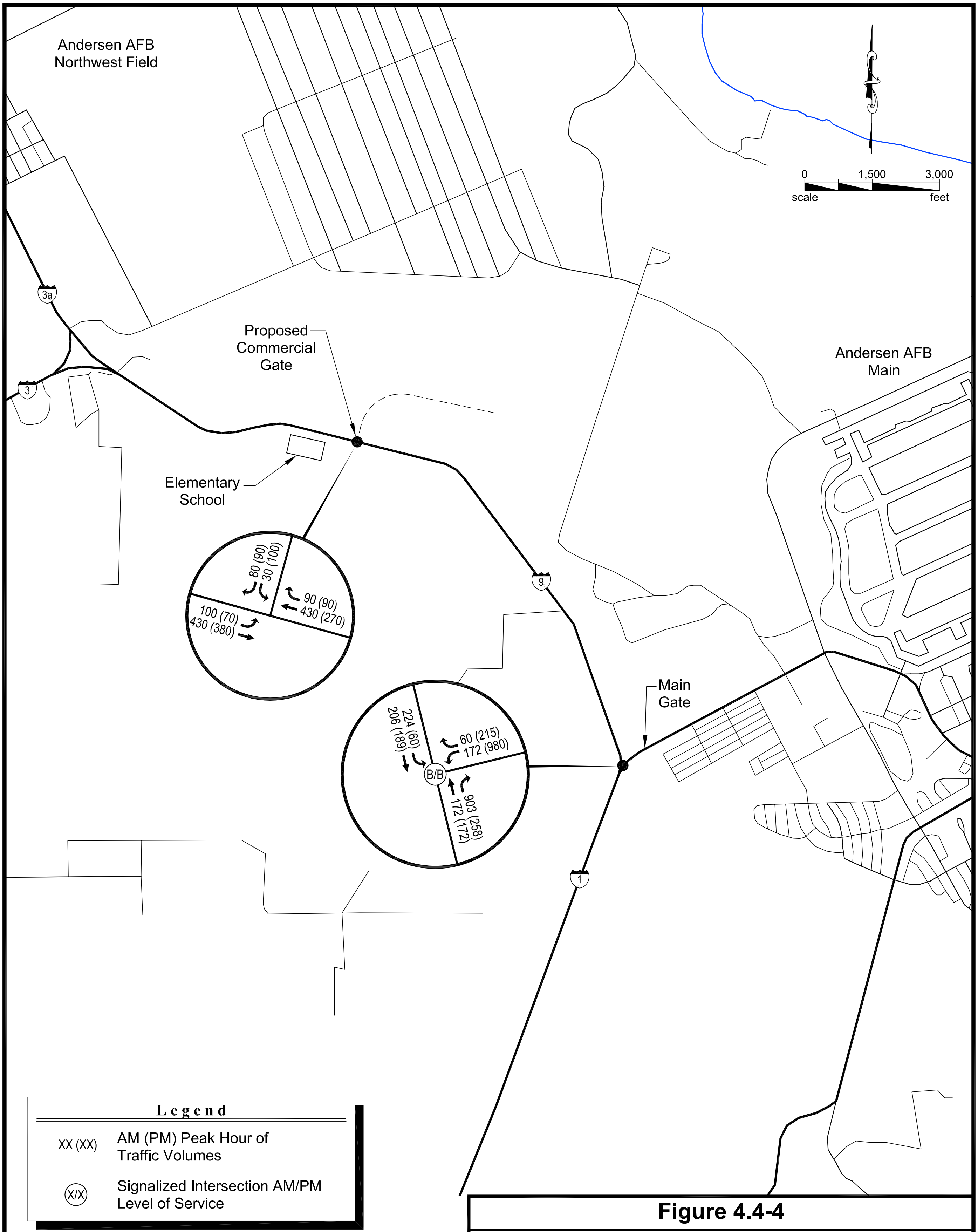
The traffic study completed for the Commercial Gate project estimated that vehicle volumes would double (Austin, Tsutsumi & Associates 2006) when considering the ISR/Strike Alternative B and other projects. Figure 4.4-4 presents the estimated traffic volumes at the intersections of Arc Light Boulevard and Highway 1 and Route 9 and the Commercial Gate for the morning (6:30-7:30 a.m.) and afternoon (3:30-4:30 p.m.) peak hours of traffic for Alternative B and the other actions. The estimated levels of traffic are prorated on the assumption that the doubling of traffic applies to the condition that would result from the combination of the ISR/Strike project and the other actions identified in Subchapter 2.4. Adding the 3,098 additional persons associated with Alternative B and the other actions to the current base population would equate to 86 percent of the doubled condition estimated by Austin, Tsutsumi & Associates 2006. Therefore, the traffic estimates for the Arc Light Boulevard intersection with Highway 1 and Route 9 on Figure 4.4-4 reflect 86 percent of the doubled baseline data for the intersection (see Figure 3.4-1). Data for the intersection of Route 9 and the Commercial Gate reflect 10 vehicles per hour for an 8-hour work day (Austin, Tsutsumi & Associates 2006).

Based on the volume data depicted on Figure 4.4-4 for the intersection of Arc Light Boulevard and Highway 1 and Route 9 and the LOS definitions in Subchapter 3.4.6, it is estimated that the LOS for the intersection would be LOS C or better during the peak hours of traffic. The baseline condition for the intersection is LOS B. The ability to pass or change lanes is not always assured at LOS C. At LOS C most experienced drivers are comfortable, roads remain safely below but efficiently near capacity, and posted speed is maintained. The 2006 traffic study found that a traffic signal is not warranted for the intersection of the Commercial Gate and Route 9 and the intersection would operate at LOS B or better.

4.5 BIOLOGICAL RESOURCES

Biological resources analyses used the following evaluation criteria to assess the impacts of the alternatives:

- The extent, if any, that the action would diminish suitable habitat for a plant or animal species;
- The extent, if any, that the action would diminish population sizes or distribution of regionally important plant or animal species;
- The extent, if any, that the action would be likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species;
- The extent, if any, that the action would permanently lessen physical and ecological habitat qualities that listed species depend upon, and which partly determines the species' prospects for conservation and recovery; or
- The extent, if any, that the action would be inconsistent with the goals of the Andersen AFB INRMP.



AM Peak Hour:
6:30-7:30 AM

PM Peak Hour:
3:30-4:30 AM

Source: Austin, Tsutsumi & Associates 2006

743955 AG-EIS-VOL-ALTB.DWG

Figure 4.4-4

Estimated Traffic Volumes
Alternative B Cumulative

Andersen AFB, Guam

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4.5.1 Alternative A

Construction activities associated with Alternative A would involve land clearing, some of which supports elements of suitable habitat for listed species. Ungulate exclosure fencing is proposed to fence 200 hectares (494 acres) near Ritidian Point. A Wildlife Management Specialist would conduct and manage depredation hunts within ungulate exclosure fencing units.

Because the proposed activities would involve clearing and grading, a Guam EPA permit and EPP would be required. Prior to the commencement of earthmoving activities, local government clearances from the Department of Agriculture, Department of Parks and Recreation, and the GSHPO would also need to be obtained.

4.5.1.1 Vegetation

Under Alternative A, approximately 74 hectares (183 acres) would be subject to clearing activities associated with construction. This area accounts for 1.7 percent of the Refuge Overlay and the Ritidian Unit of the GNWR. The most intact forested areas subject to clearing activities were classified as *Neisosperma-Macaranga* forest, amounting to 1.4 hectares (3.5 acres), which is less than 0.1 percent of the Refuge Overlay and the Ritidian Unit of the GNWR. Within this forest type, primary limestone forest characteristics exist; however, lacking a typical overstory of primary limestone forest and regeneration of upper canopy species, this forest type is considered a secondary growth limestone forest. All vegetation communities within the project areas contain native species. The number of hectares removed from each vegetation community type is shown in Table 4.5-1.

All other facility modifications and new construction for Alternative A would take place in developed areas on Base maintained as urban landscape. Therefore, there would be no additional impact to any forested areas or native vegetation from Alternative A.

4.5.1.2 Wildlife

Introduced Terrestrial Species

The clearing of approximately 74 hectares (183 acres) of habitat would displace BTSs and other predators, increasing numbers in adjacent habitat areas. Based on the inspection procedures outlined in Subchapter 3.5.2.1, there would be a low potential for transporting the BTS to offsite locations due to Alternative A. Conservation measures, as part of Alternative A, would reduce numbers of BTS populations at Pati Point. Removal of exotic predators supports recovery actions for listed species outlined in various USFWS recovery plans.

The Base would use the Armed Forces Pest Management Board Technical Guide No. 37 *Guidelines for Reducing Feral/Stray Cat Populations on Military Installations in the United States*. Additionally, the base's family housing occupancy guide is provided to each family as it moves into an on-base military family housing unit. Rules for controlling family pets include: pets must be kept on a leash; and pets left outside must be in a fenced yard or on a leash and directly attended by the owner. Failure to comply with the pet control rules can result in revocation of pet privileges.

Table 4.5-1 Vegetation Community Types and Clearing Activities

Vegetation Community Type	**Woody Species Observed Within Plots**	**Woody Sapling Species Observed Within Plots**	**Total Area Subject to Clearing (hectares)**	**Total Area Cleared as Percentage of Refuge Overlay and Ritidian Unit[1] (hectares)**
Aglaia – Guamia Forest	Aglaia mariannensis Guamia mariannae Cycas circinalis Ficus prolixa Hibiscus tiliaceus Eugenia thompsonii Morinda citrifolia Neisosperma oppositifolia Maytenus thompsonii Mammea odorata Tabernaemontana rotensis	Aglaia mariannensis Caesalpinia major Guamia mariannae Hibiscus tiliaceus Ixora coccinea Neisosperma oppositifolia Pandanus tectorius Triphasia trifolia	20.5	0.5
Guamia Forest	Guamia mariannae Aglaia mariannensis Hibiscus tiliaceus Cycas circinalis Neisosperma oppositifolia Psychotria mariana	Aglaia mariannensis Guamia mariannae Hibiscus tiliaceus Neisosperma oppositifolia Pandanus tectorius Triphasia trifolia	17.6	0.4
Herbaceous Scrub	Morinda citrifolia Pandanus tectorius Hibiscus tiliaceus Triphasia trifolia	Morinda citrifolia Pandanus tectorius Hibiscus tiliaceus Triphasia trifolia	16.4	0.4
Neisosperma – Macaranga Forest	Guamia mariannae Macaranga thompsonii Neisosperma oppositifolia Aglaia mariannensis Hibiscus tiliaceus Eugenia thompsonii Cycas circinalis Ficus prolixa Premna obtusifolia Morinda citrifolia Intsia bijuga Psychotria mariana Maytenus thompsonii Mammea odorata Pandanus tectorius	Aglaia mariannensis Flagellaria indica. Eugenia thompsonii Guamia mariannae Hibiscus tiliaceus Leucaena leucocephala Macaranga thompsonii Neisosperma oppositifolia Pandanus fragrans Pandanus tectorius Premna obtusifolia Tabernaemontana rotensis Triphasia trifolia	1.4	< 0.1

Table 4.5-1 Vegetation Community Types and Clearing Activities (*continued*)

Vegetation Community Type	Woody Species Observed Within Plots	Woody Sapling Species Observed Within Plots	Total Area Subject to Clearing (hectares)	Total Area Cleared as Percentage of Refuge Overlay and Ritidian Unit[1] (hectares)
Hibiscus – Leucaena Shrub	Hibiscus tiliaceus Leucaena leucocephala Pandanus tectorius Aglaia mariannensis Cycas circinalis	Aglaia mariannensis Guamia mariannae Hibiscus tiliaceus Leucaena leucocephala Morinda citrifolia Pandanus tectorius Triphasia trifolia	7.2	0.2
Guamia – Premna Forest	Guamia mariannae Hibiscus tiliaceus Aglaia mariannensis Premna obtusifolia Neisosperma oppositifolia Cycas circinalis Ficus prolixa Macaranga thompsonii Maytenus thompsonii Eugenia thompsonii Pandanus tectorius Triphasia trifolia	Aglaia mariannensis Cycas circinalis Eugenia thompsonii Guamia mariannae Hibiscus tiliaceus Leucaena leucocephala Pandanus tectorius Premna obtusifolia Tabernaemontana rotensis Triphasia trifolia	9.0	0.2
Vitex – Remnant *Elaeocarpus* Forest	Guamia mariannae Vitex parviflora Cycas circinalis Neisosperma oppositifolia Premna obtusifolia Pandanus tectorius	Aglaia mariannensis Elaeocarpus joga Guamia mariannae Neisosperma oppositifolia Pandanus tectorius Triphasia trifolia Vitex parviflora	1.8	< 0.1
TOTAL			**73.9**	**1.7**

*Total area cleared as a percentage is calculated as: The total area subject to clearing divided by the total refuge overlay and the Ritidian Unit. The Refuge overlay and the Ritidian Unit is 4,480. For example, in the Aglaia-Guamia forest, (20.5 / 4,480) * 100 = 0.5 %.*

Introduced Game Species

Bow hunting for pigs and deer is currently allowed in the area proposed for the ASA facility, and the annual average harvest in this area is quite low. It is expected that once this facility is operational, recreational hunting would no longer be allowed due to safety and security considerations. Although vegetation clearing would remove 74 hectares (183 acres) of habitat, approximately 144 hectares (356 acres) of habitat would be excluded from hunting. Estimations of deer density within project areas are 1.22 deer per hectare (or 0.49 deer per acre) (Parsons 2006), which suggests displacement of 175 deer onto adjacent land. With an estimated feral pig density of 0.21 pigs per hectare (or 0.08 pig per acre), the suggested number of 30 pigs would be displaced. Displacement of ungulates onto adjacent lands would increase browse pressure and further limit forest regeneration. Conservation measures as part of Alternative A address the displacement of ungulates into adjacent forested habitats. The strategy of ungulate impact reduction would be managed by a Wildlife Management Specialist through a comprehensive ungulate management plan. The conservation measures include depredation hunts, ungulate exclosure fencing, and facilitation of research specific to ungulate management.

Ungulate impact reduction supports specific recovery actions for listed species described in various USFWS recovery plans.

4.5.1.3 Threatened and Endangered Species

Table 4.5-2 shows the presence/absence of suitable habitat and the presence/absence of species based on literature review, recent field surveys, and conversations with local environmental personnel covering all federally and locally listed T&E species on Guam and within the ASA and Commercial Gate project areas. Table 4.5-3 lists woody species of value subject to clearing activities. The effects are summarized from the Establishment and Operation of an ISR/Strike Capability Biological Assessment (Parsons 2006), submitted to the USFWS in March 2006, as well as the Biological Opinion (USFWS 2006) associated with the ISR/Strike project. The analysis included in this subchapter considers direct and indirect effects of facility operation and construction, as well as effects of aircraft operations. Direct effects include habitat loss in areas cleared for construction of the proposed facilities. Indirect effects associated with facilities and construction include the reduced use of habitat adjacent to proposed facilities due to auditory and visual disturbance associated with their construction, operation, and maintenance. Table 4.5-4 lists the estimated habitat loss for listed species associated with the ISR/Strike project. Conservation measures to limit effects on listed species are outlined in Subchapter 2.2.1.2. There are three plant species, one mammal, three birds, three tree snails, and one insect that may have some elements of suitable habitat within the ASA and Commercial Gate project areas. Effects determination for each T&E and sensitive species was based on the following definitions (USFWS 1998):

Draft EIS Comment: The assessment of project impacts on Mariana fruit bat habitat does not include an assessment of indirect habitat loss due to human disturbance activities. Forested areas adjacent to the proposed aircraft staging area will be exposed to human activity that may limit the potential of these forests to support the long-term conservation of the Mariana fruit bat. We recommend that these indirect impacts and associated acreage also be included in the assessment on potential habitat loss for this species.

Response: The FEIS was improved and modified as suggested by replacing the data in Table 4.5-4 related to direct and indirect habitat loss with the indirect and direct habitat loss from the USFWS Biological Opinion. Additionally, text in the DEIS that related to Table 4.5-4 was revised in the FEIS to agree with the updated data in the table. The October 3, 2006 USFWS Biological Opinion states that implementation of the ISR/Strike project "…is not likely to jeopardize the continued existence of the Mariana fruit bat, Mariana crow, Guam Micronesian kingfisher, Guam rail, and other off-site species listed under the ESA."

- "No effect" – The T&E and sensitive species were not present within the ASA or Commercial Gate project areas, or the proposed action would have no effect on the available habitat of T&E and sensitive species.
- "May affect" –The proposed action may pose effects (any) on T&E species or designated critical habitat.
- "May affect – is not likely to adversely affect" – T&E and sensitive species habitat or T&E and sensitive individuals could potentially be present within ASA or Commercial Gate project areas, and the proposed action would have beneficial, insignificant, or discountable effects.
- "May affect – is likely to adversely affect" – T&E and sensitive species habitat or T&E and sensitive individuals could potentially be present within ASA or Commercial Gate project areas, and adverse effects cannot be avoided.

Herritiera longipetiolata. A grove of *H. longipetiolata* would not be affected by construction or operations at the ASA or the Commercial Gate project areas because it is some distance away from the two projects. Conservation measures to reduce the potential effects associated with any Base activities include increasing awareness of environmental concerns, which includes identification of the tree, should more be located in the future. Ungulate exclosures near Ritidian Point, coupled with the proposed ungulate management actions and proposed vegetation studies would support recovery of this species.

Tabernaemontana rotensis. A number of *T. rotensis* individuals occur within the footprint of land clearing. Inventory for *T. rotensis* continues, and the plant appears to be more abundantly distributed than previously thought (Marler 2006). Conservation measures to reduce the effects associated with any Base activities include increasing awareness of environmental concerns, which includes identification of the plant and transplanting seeds and saplings outside the project footprint. Browse pressure does not seem to be a major threat to this species; therefore, outplantings may occur in areas outside of ungulate exclosures. Additional vegetation studies, as part of the proposed action, may identify additional mature trees and sapling concentrations.

Serianthes nelsonii. The six remaining *Serianthes* individuals on Guam would not be affected by construction or operations at the ASA or the Commercial Gate project areas, because they are some distance away from the two projects. Conservation measures to reduce the potential effects associated with any Base activities include increasing awareness of environmental concerns, including identification of the tree, should more be located in the future. Ungulate exclosures near Ritidian Point, coupled with the proposed ungulate management actions and proposed vegetation studies would support recovery actions outlined in the USFWS Recovery Plan for *Serianthes nelsonii* (USFWS 1994).

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Table 4.5-2 Presence / Absence of Suitable Habitat and Species within Project Areas

English Common Name	Scientific Name	USFWS Listed/Guam listed[1]	Required Habitat	Presence / Absence of Habitat	Presence / Absence of Species
VEGETATION					
Hayun lagu	*Serianthes nelsonii*	E / E	Limestone derived soils; on or near steep hillsides	Present	Not Present
Tree fern	*Cyathea lunulata*	-- / E	Hills of southern Guam, along drainage slopes	Not Present	Not Present
Ufa halomtano	*Heritiera longipetiolata*	-- / E	Crevices of rough limestone, especially on cliffs	Present	Not Present
--	*Tabernaemontana rotensis*	-- / S	Limestone forests along cliff line; edge species that now grows along roadsides and disturbed areas	Present	Present
BIRDS					
Guam rail	*Rallus owstoni*	E / E	Savannas in southern Guam; scrubby secondary growth in northern Guam. Extirpated from Guam; in captive breeding program on mainland U.S. and Guam.	Present	Not Present
Common moorhen	*Gallinula chloropus guami*	E /E	Occurs only in wetlands	Not Present	Not Present
Vanikoro swiftlet (Island swiftlet)	*Aerodramus vanikorensis bartschi*	E / E	Occurs only in caves at south end of Guam	No nesting habitat present Foraging habitat present	Not Present
Micronesian kingfisher	*Halcyon cinnamomina cinnamomina*	E / E	Native primary growth limestone forest and secondary growth forest to some extent; shrubby habitat of northern Guam. Extirpated from Guam; in captive breeding program on mainland U.S. and Guam.	Present	Not Present
Mariana crow	*Corvus kubaryi*	E / E	Mature, native forest, late successional secondary forest. Captive breeding programs are in operation on Guam and Rota.	Present	Present
Nightingale reed-warbler	*Acrocephalus luscinia*	E /E	Unique to wetlands.	Not Present	Not Present
Micronesian starling	*Aplonis opaca guami*	-- / E	No longer known from native forest, but may be present in secondary growth forests	Present	Not Present
Micronesian honeyeater	*Myzomela rubrata*	-- / E	Uncommon, native resident on Guam; likely extinct	Present	Not Present
MAMMALS					
Mariana fruit bat	*Pteropus mariannus mariannus*	T / E	Colony east of Pati Point, forages in primary and secondary forest	Present	Present

Table 4.5-2 Presence / Absence of Suitable Habitat and Species within Project Areas (*continued*)

English Common Name	Scientific Name	USFWS Listed/Guam listed[1]	Required Habitat	Presence / Absence of Habitat	Presence / Absence of Species
REPTILES					
Green sea turtle	*Chelonia mydas*	T / T	Native resident, rare	Not Present	Not Present
Hawksbill sea turtle	*Eretomochelys imbricata*	E / E	Native resident, rare	Not Present	Not Present
Leatherback sea turtle	*Dermochelys coriacea*	E / --	Accidental visitor to Guam	Not Present	Not Present
Loggerhead sea turtle	*Caretta caretta*	T / --	Accidental visitor to Guam	Not Present	Not Present
Oceanic gecko	*Gehyra oceanica*	-- / E	Habitat requirements poorly described, but may use forests from coastal areas to mountainous areas. Most suitable habitat has been eliminated	Present	Not Likely Present
Micronesian gecko	*Perocinis ateles*	-- / E	Habitat requirements poorly described, but may use forests from coastal areas to mountainous areas. Most suitable habitat has been eliminated	Present	Not Likely Present
Pacific slender-toed skink	*Nactus pelagicus*	-- / E	Habitat requirements poorly described, but may use forests from coastal areas to mountainous areas. Most suitable habitat has been eliminated	Present	Not Likely Present
Snake-eyed skink	*Cryptoblepharus poecilopleurus*	-- / E	Habitat requirements poorly described, but may use forests from coastal areas to mountainous areas. Most suitable habitat has been eliminated	Present	Not Likely Present
Tide-pool skink	*Emoia atrocasteta*	-- / E	Habitat requirements poorly described, but may use forests from coastal areas to mountainous areas. Most suitable habitat has been eliminated	Present	Not Likely Present
Azure-tailed skink	*Emoia cyanura*	-- / E	Habitat requirements poorly described, but may use forests from coastal areas to mountainous areas. Most suitable habitat has been eliminated	Present	Not Likely Present
Slevin's skink	*Emoia slevini*	-- / E	Habitat requirements poorly described, but may use forests from coastal areas to mountainous areas. Most suitable habitat has been eliminated	Present	Not Likely Present
Moth skink	*Lipinia noctua*	-- / E	Habitat requirements poorly described, but may use forests from coastal areas to mountainous areas. Most suitable habitat has been eliminated	Present	Not Likely Present

Table 4.5-2 Presence / Absence of Suitable Habitat and Species within Project Areas (*continued*)

English Common Name	Scientific Name	USFWS Listed/Guam listed[1]	Required Habitat	Presence / Absence of Habitat	Presence / Absence of Species
MOLLUSKS					
-	*Allepithema tuberculata*	-- / T		Not Present	Not Present
Mt. Alifan tree snail	*Partula salifana*	-- / E	Closed canopy mesic forest with relatively undisturbed understory	Present	Not Likely Present
Mariana Islands tree snail	*Partula gibba*	-- / E	Closed canopy mesic forest with relatively undisturbed understory	Present	Not Likely Present
Pacific tree snail	*Partula radiolata*	-- / T	Closed canopy mesic forest with relatively undisturbed understory	Present	Not Likely Present
Mariana Islands fragile tree snail	*Samoana fragilis*	-- / E	Closed canopy mesic forest with relatively undisturbed understory	Present	Not Likely Present
INSECTS					
Mariana eight-spot butterfly	*Hypolimnus oculata var. mariannensis*	-- / E	Karst areas with associative indicator plants (*Procris pedunculata*, and *Elatostema calcareum)*	Present	Not Likely Present

[1] *Listing status: -- = Not listed; E = Endangered; T = Threatened; S = locally sensitive species.*

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Table 4.5-3 Woody Species of Value to Listed Species in Project Areas

Woody Species of Value to Listed Species	**Occurrence in Areas Proposed for Clearing**	
	ISR/Strike	**Commercial Gate**
Aglaia mariannensis [1,2,3]	X	X
Carica papaya [2]		X
Elaeocarpus joga [1,2,3]		X
Eugenia reinwardtiana [1]	X	
Eugenia thompsonii [1]	X	
Ficus prolixa [1,2,3]	X	
Guamia mariannae [1,3]	X	X
Guettarda speciosa [2]	X	
Hibiscus tiliaceus [1]	X	X
Intsia bijuga [1,3]	X	
Leucaena leucocephala [1]	X	X
Macaranga thompsonii [1,2]	X	
Mammea odorata [1,2]	X	
Maytenus thompsonii [2]	X	
Neisosperma oppositifolia [1,2,3]	X	X
Pandanus tectorius [1,2,3]	X	X
Pisonia grandis [1,2,3]	X	
Premna obtusifolia [1,3]	X	X
Tristiropsis obtusangula [1]	X	X
Vitex parviflora [1,2]	X	X

1 *Foraging or nesting habitat for Mariana crow*
2 *Foraging or roosting habitat for Mariana fruit bat*
3 *Nesting habitat for Micronesian kingfisher*

Table 4.5-4 Habitat Subject to Direct and Indirect Effects for Listed Species

Species	Habitat Type	Direct Loss[1] (Hectares / Acres)	Indirect Loss[2] (Hectares / Acres)	Total Loss (Hectares / Acres)
Mariana Fruit Bat	Foraging	57.5 / 142.1	80 / 197	138 / 340
	Roosting	57.5 / 142.1	128 / 317	186 / 460
Mariana Crow	Foraging	57.5 / 142.1	147 / 363	201 / 506
	Nesting	57.5 / 142.1	147 / 363	201 / 506
Micronesian Kingfisher	Foraging	74 / 183	135 / 334	193 / 477
	Nesting	57.5 / 142.1	101 / 249	159 / 392
Guam Rail	Foraging and Nesting	23 / 57	- / -	23 / 57

1 Direct loss of habitat areas are obtained from associative vegetation communities listed in Table 4.5-1.

2 Indirect loss of habitat areas is obtained from USFWS Biological Opinion (2006). Indirect loss was not calculated for the Guam rail due to lack of information on potential impacts of human disturbance on habitat use.

Animal Species

Mariana fruit bat. No Mariana fruit bats were observed in the ASA or Commercial Gate project areas during the January 2006 survey (Parsons 2006); however, recent telemetry data (Janeke 2006) indicate that clearing of vegetation would occur in a known foraging area for a single Mariana fruit bat female. Figure 3.5-1 and Figure 3.5-2 show the primary habitat that would be disturbed in the ASA project area and the Commercial Gate project area, respectively. Figure 3.5-3 shows locations of recent observations of Mariana fruit bats.

Construction activities would remove secondary growth limestone forest associative trees such as *N. oppositifolia* and *Pandanus* shrubs used by the Mariana fruit bat for foraging (Wiles 1986). Construction would remove approximately 74 hectares (183 acres) of vegetated land, of which, 57.5 hectares (142.1 acres) consist of potential forested and shrub habitat. This removed habitat is 1.3 percent of the GNWR Ritidian Unit and refuge overlay units. The most suitable habitat of these 57.5 hectares (142.1 acres) includes two areas of intact secondary forest overlying karst substrates totaling 1.4 hectares (3.5 acres) in the ASA project area. This relatively higher quality habitat lacks a sufficient emergent canopy layer to be considered primary limestone forest; however, the species composition and canopy structure suggest a higher foraging and roosting potential for the Mariana fruit bat. The 1.4 hectares (3.5 acres) of higher quality habitat of the 57.5 hectares (142.1 acres) of potential habitat represent 0.1 percent of the total refuge overlay and the Ritidian Unit. The removal of 57.5 hectares of habitat may adversely affect the Mariana fruit bat because of the removal of a known foraging territory. Mariana fruit bats primarily forage at night; therefore, daytime construction activities and the use of shielded lights at proposed facilities would not be expected to have severe impacts on foraging behavior. Therefore, Indirect effects that limit habitat availability include operation of the ASA facility (aircraft entering and leaving the facility, vehicles, and personnel working in the area) (USFWS 2006). As shown in Table 4.5-4, 80 hectares (197 acres) of foraging habitat and 128 hectares (317 acres) of roosting habitat would be lost due to indirect effects. Table 4.5-3 lists woody species of value to the Mariana fruit bat subject to clearing activities. Due to the relatively small amount of habitat removed in relation to available habitat (refuge overlay and Ritidian Unit), and suitable conservation measures to offset effects, any adverse effects would not represent an adverse modification to habitat or jeopardize the species.

Aircraft overflights would occur over areas that contain suitable habitat for roosting and foraging. Although there is suitable vegetation in the ASA and Commercial Gate project areas vegetation community types, the Mariana fruit bat appears to prefer foraging habitat where there are more large fruit trees available, such as the *Neisosperma – Macaranga* forest, which contains suitable canopy. Figure 4.5-1 shows noise exposure contours from aircraft operations and aircraft flight track locations. Biological resources analysis points (points A, B, C) were established north of the airfield for noise analysis. The points were selected based on locations of the Mariana fruit bat colony at Pati Point and known foraging sites identified by radio tracks of individual bats in a previous study. Table 4.5-5 lists the combined airfield operation events for all aircraft operating on the aircraft flight tracks within a 2,000-foot radius of various analysis points.

Draft EIS Comment: Though habituation of fruit bats to noise is perceived as most likely to occur, the Draft EIS cites a study of megachiropteran (**p. 4-62**). There may be differences in tolerances to noise levels between the species, and also, Mariana fruit bats are known to fly from the island of Rota to Guam, providing a source for the Guam population. It is unknown if bats would stay in the area with the increase in noise due to aircraft.

Response: Implementation of the adaptive management conservation measure described in Subchapter 2.2.1.2 would close the data gap identified in the comment. The October 3, 2006 USFWS Biological Opinion states that implementation of the ISR/Strike project "…is not likely to jeopardize the continued existence of the Mariana fruit bat, Mariana crow, Guam Micronesian kingfisher, Guam rail, and other off-site species listed under the ESA."

Table 4.5-5 Airfield Operation Events on the Runway and at Points North of the Andersen AFB Airfield

Operations Condition	Point A			Point B			Point C		
	day	dark	total	day	dark	total	day	dark	total
Current Condition	1.8193	0.2087	2.0280	0.0734	0,0000	0.0734	87.1760	21.7940	108.9700
Alternative A	51.0438	2.8714	53.9152	43.5888	2.2903	45.8791	122.0600	23.6300	145.6900
Net Change due to Alternative	+49.2245	+2.6627	+51.8872	+43.5154	+2.2903	+45.8057	+34.8840	+1.8360	+36.7200
Current Condition	88.6380	22.0267	110.7007	0.1534	0.0200	0.1734	0.0000	0.0000	0.0000
Alternative A	144.0056	25.1047	169.1103	9.3842	0.5313	9.9155	34.8840	1.8360	36.7200
Net Change due to Alternative	+55.3677	+3.0419	+58.4096	+9.2308	+0.5113	+9.7421	+34.8840	+1.8360	+36.7200

Note: Data reflect operations on the aircraft flight tracks within a 2,000-foot radius of Pati Point.

Maximum noise levels at Pati Point would not exceed those of the current conditions; however, the frequency of aircraft overflights would increase to an estimated three times per hour, based on additional flight tracks and aircraft operations. Under current conditions, Morton (1996) suggests that bats at the Pati Point colony have become relatively habituated to daytime aircraft noise and continue to roost there. It is unknown if Mariana fruit bats would become habituated to more frequent noise, but recent observations indicate they have become habituated to aircraft noise (Janeke 2005). Studies of habituation in other animal species have not observed any level of tolerance that has eventually become unacceptable to the animals when the type of disturbance has remained constant.

Hearing sensitivity in a related megachiropteran fruit bat, *Rousettus aegyptiacus*, spans from about 2.25 kHz to 64 kHz at a 60 dB sound pressure intensity (Koay, *et al*. 1998). From a behavioral auditory threshold study of *Rousettus aegyptiacus,* their greatest sensitivity is in the range of 8-10 kHz (Suthers and Summers 1980), much higher than the frequency spectrum of aircraft. Interestingly, the study found no behavioral response to sounds below 1 kHz, which indicates that their sensitivity or even ability to hear below that level is low to nonexistent. Much of the acoustic energy of aircraft noise is below 2 kHz.

Habituation of bats to increased overflight noise is expected (Janeke 2005), especially since aircraft overflights would be incrementally increased over a multi-year period. The degree of habituation, however, is not represented in the current literature. Conservation measures involve an Adaptive Management Strategy, which is commonly used when data gaps exist, to continually address noise effects as overflights increase. Conservation measures also allow for modification of overflight patterns to reduce effects of increased aircraft. Modifications would be based on proposed studies of the Mariana fruit bat, as described in Subchapter 2.2.1.2.

Noise events associated with aircraft overflights may affect the Mariana fruit bat. Conservation measures could reduce these effects by applying an Adaptive Management Strategy to modify ground tracks based on monitoring studies. Additional conservation measures include the protection and management of 200 hectares (494 acres) of suitable habitat near Ritidian Point, reducing BTS populations at the Pati Point colony, and adopting an Adaptive Management Strategy that uses scientific research to effect operational changes to overflight routes. Further, these conservation measures directly support recovery actions outlined in the USFWS Mariana Fruit Bat Recovery Plan by addressing the need for habitat restoration and control of BTSs at the Pati Point colony.

Mariana crow. The Mariana crow does not currently nest in the ASA or Commercial Gate project areas. The primary habitat that would be removed in the ASA and Commercial Gate project areas is shown in Figures 3.5-1 and 3.5-2, respectively. Figure 3.5-3 shows the locations of recent observations of the Mariana crow.

Despite the lack of Mariana crows within project areas, construction activities would remove secondary limestone forest associative trees such as *N. oppositifolia* and *G. mariannae* used by the Mariana crow for foraging and/or nesting. Construction activities may lead to forest fragmentation, which may affect the Mariana crow (Andren 1992; Fancy, *et al.* 1999; Plentovich, *et al*. 2005). Although some small suitable habitat patches may be available after construction activities cease, Mariana crows may not use these patches extensively. Table 4.5-3 lists woody species of value to the Mariana crow subject to clearing activities.

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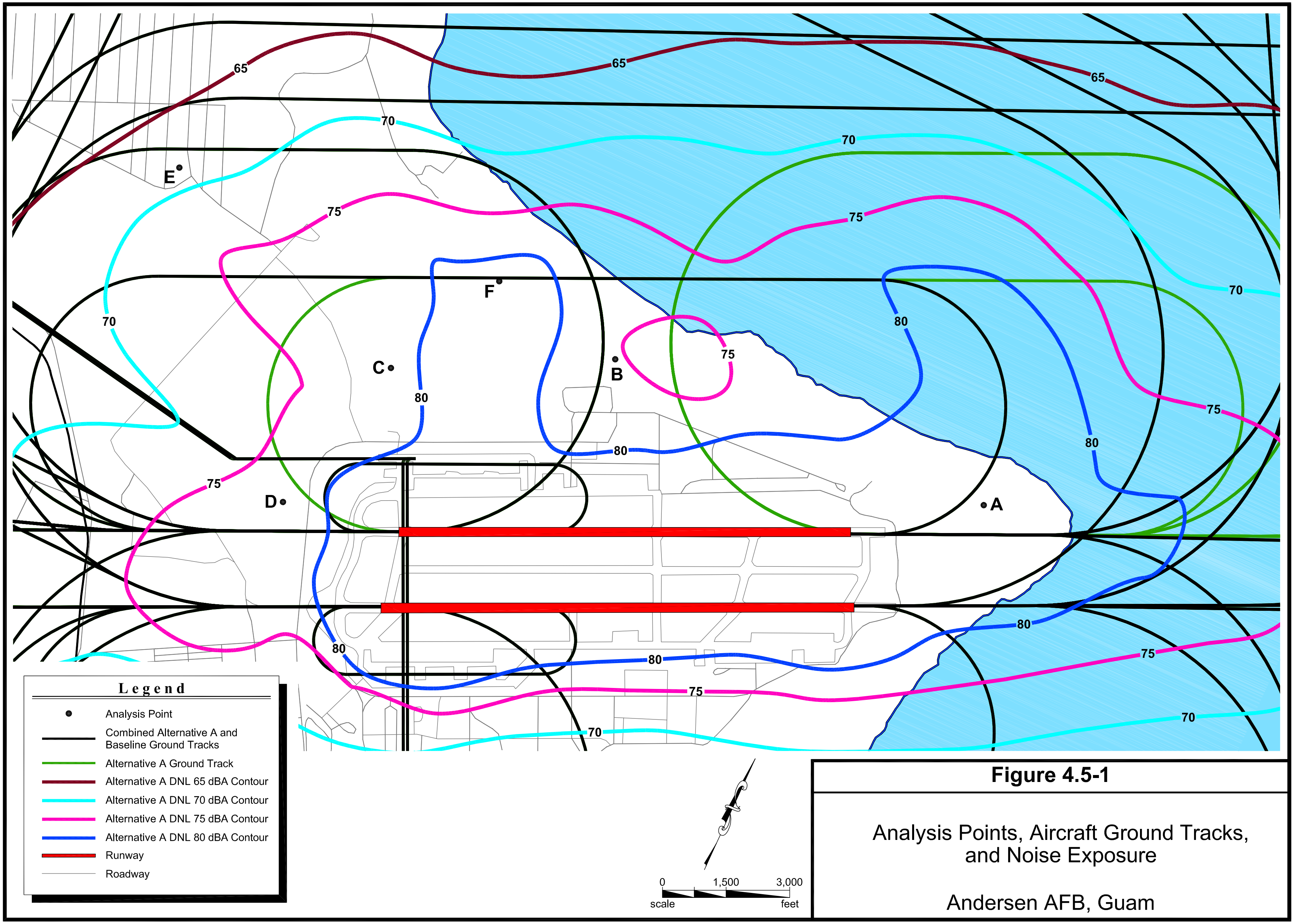

Figure 4.5-1

Analysis Points, Aircraft Ground Tracks, and Noise Exposure

Andersen AFB, Guam

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Construction activities would remove 57.5 hectares (142.1 acres) of potential habitat in forested and shrub areas that contain associative trees of the Mariana crow. This amount of removed habitat amounts to 1.3 percent of the Ritidian Unit and the refuge overlay. The most suitable habitat of these 57.5 hectares (includes two areas of intact secondary forest overlying karst substrates totaling 1.4 hectares (3.5 acres) in the ASA project area. This relatively higher quality habitat lacks a sufficient emergent canopy layer to be considered primary limestone forest; however, the species composition and canopy structure suggest a higher attractiveness for the Mariana crow. The 1.4 hectares of higher quality habitat inside the 57.5 hectares (1,42.1 acres) of potential habitat subject to removal represents 0.1 percent of the Ritidian Unit total refuge overlay. In addition to the 57.5 hectares of foraging and nesting habitat subject to direct effects of facilities and construction, 147 hectares (363 acres) of foraging and nesting habitat would be subject to indirect loss associated with the ISR/Strike project. Based on the relatively small amount of habitat removed and the lack of utilization within or adjacent to the project areas, direct and indirect effects of the ISR/Strike project would not adversely affect current populations or future recovery of the Mariana crow.

Operational activities include aircraft overflight. Crows are sensitive to human disturbances, and may be particularly sensitive to noise generated from aircraft (Morton 1996). Aircraft overflights would occur over areas that contain suitable habitat for nesting and foraging. Figure 4.5-1 shows the noise exposure contours from ISR/Strike aircraft operations. Morton (1996) demonstrated that Mariana crows react negatively to aircraft overflight noise and other human disturbances in some cases, but not always. Noise disturbance of the Mariana crow can cause distress in the birds, cause them to flush from the nest and disrupt nest building, incubation, and nest attendance at least temporarily. However, if the Mariana crow nests are abandoned due to disturbance or predation, the pairs generally attempt to re-nest (Morton 1996). In addition, crows may respond to visual stimuli as well as noise stimuli (*e.g.*, aircraft outlines, pedestrians). Other studies demonstrate that birds are likely to hear loud noises (*e.g.*, sonic booms), and stop the activity in which they are engaged (Higgins 1974), but a *Corvus* species study showed the birds rapidly returned to normal activities after the noise event (Davis 1967).

There is some indication that Mariana crows can be tolerant of disturbances, much like related species of crows throughout the world. The fact that Morton (1996) observed some pairs renesting after nest disturbances may indicate their tenacity. This tolerance can lead to habituation of disturbances that are not threatening to the individuals. Habituation is a process many species of animals undergo to cope with or tolerate environmental stimuli inconsequential to their livelihood or well-being. Animals like those discussed in the Morton (1996) study responded to visual and acoustic stimuli potentially harmful to them. Typically, this is because of their innate predator-prey response mechanism, which causes an increase in alertness or flushing or fleeing from the impending threat. There are many studies showing that recurring events without consequence cause animals to eventually ignore those stimuli. Busnel (1978) observed that many species are able to habituate to noise disturbance. Andersen, *et al.* (1989) concluded that Red-tailed hawks could have habituated to aircraft noise. Becker (2002) suspected roosting Bald eagles were habituated to disturbances when exposed to a large industrial construction project. Delaney, *et al.* (1999) found that endangered Mexican spotted owls become habituated to disturbances like chainsaw noise and helicopter noise. Observations of Mariana crows and Mariana fruit bats by Morton (1996) during aircraft flyover events demonstrated there were reactions in some cases where some observed individuals responded to the noise or visual stimuli and others did not. This could be due to the experience level of the animals, where resident crows or bats were habituated to the aircraft events, and non-resident or young were not accustomed to the intrusions.

Aircraft altitudes in areas where Mariana crows have established nests in the past (Morton 1996) would be 300 meters (984 feet) AGL and greater. Noise modeling was accomplished to determine the maximum sound level at two of the 10 analysis points (*i.e.*, Pati Point and Tarague Channel) selected for noise analysis (see Subchapter 4.1) and four biological resources analysis points in the area north and northwest of the airfield where there is suitable habitat for Mariana crow nesting activities. Sound levels from noise modeling were compared to information from the Morton (1996) study to determine the potential for effect.

Based on noise modeling, the maximum sound level produced by any of the ISR/Strike aircraft would be 108 dBA by B-1 aircraft at Pati Point, and 87 dBA by F-22 aircraft at Tarague Channel. The maximum sound level at any of the four other points in the area north and northwest of the airfield would be 109 dBA from F-22 aircraft.

Noise modeling indicated that the maximum sound levels (L_{max}) produced under the proposed action (*i.e.*, 108 dBA by the B-1 aircraft at Pati Point) would be 2 dBA less than the maximum noise from the Morton (1996) study (*i.e.*, 110 dBA). Additionally, the maximum proposed action sound level at any of the four other points north and northwest of the airfield where the Mariana crow is known to occur would be 109 dBA, which is 1 dBA less than the Morton (1996) study. Noise from aircraft overflights did not cause nest abandonment for at least one pair of Mariana crows when aircraft were restricted to altitudes greater than 300 meters (984 feet) AGL (Morton 1996). Based on the similarities of the maximum noise levels and AGL when comparing the Morton (1996) study and the proposed action, Mariana crow reaction to noise would be expected to be similar or less than that found in the Morton study; that is, some crows might flush from the nest, while others show no negative effects. Additionally, there is a possibility that Mariana crows habituate to aircraft noise since there is no negative reinforcement to cause nest abandonment.

Noise from aircraft overflights are expected to affect Mariana crow behavior. Conservation measures would reduce these effects by applying an Adaptive Management Strategy to modify ground tracks based on monitoring studies. Further, conservation measures would designate approximately 200 hectares (494 acres) of forested land, some of which is currently utilized by the Mariana crow, as a conservation land use category. Management actions for these 200 hectares (494 acres) include ungulate exclosure fencing, ungulate depredation hunts, and forage plot establishment.

Micronesian kingfisher. The Micronesian kingfisher has been extirpated from the wild and persists in captive breeding populations. Survey data from 1981 indicate that Micronesian kingfishers were present in the northern portion of Andersen AFB, but not at Andersen main. Construction would remove 57.5 hectares (142.1 acres) of secondary growth forest and shrubby areas that are potential foraging and nesting habitat for the Micronesian kingfisher. The area represents 1.3 percent of the refuge overlay and the Ritidian Unit. Of the 57.5 hectares (142.1 acres) of potential habitat for the Micronesian kingfisher, 1.4 hectares (3.5 acres) have been identified as more suitable habitat, which amounts to 0.1 percent of the refuge overlay and the Ritidian Unit. Table 4.5-3 lists woody species of value to the Micronesian kingfisher subject to clearing activities. In addition to the 57.5 hectares of foraging habitat and 74 hectares (183 acres) of nesting habitat subject to direct effects of facilities and construction, 135 hectares (334 acres) of foraging habitat and 101 hectares (249 acres) of nesting habitat would be subject to indirect loss associated with the ISR/Strike project. Based on the relatively small amount of habitat removed and the lack of utilization within or adjacent to the project areas, direct and indirect effects of the ISR/Strike project would not adversely affect current populations or future recovery of the Micronesian kingfisher.

The small amount of habitat loss from the proposed action would have no impact on plans to reintroduce the Micronesian kingfisher into MSA 1. Habitat for this species within MSA 1 would not be disturbed by construction. The DNL 65 dBA noise contour from aircraft operations would extend into the southernmost portion of MSA 1. Maximum sound pressures from aircraft overflight in southern MSA 1 is 97 dBA.

Guam rail. Guam rails have been extirpated in the wild and persist as captive breeding populations. As a ground nesting species, the Guam rail is particularly susceptible to predation by the BTS and egg predation by feral pigs and feral cats (GovGuam DAWR 1999; 2000b).

Construction in the ASA and Commercial Gate project areas would remove 23 hectares (57.5 acres) of suitable habitat. This amount of vegetation represents 1 percent of the refuge overlay and the Ritidian Unit. Because of the relatively small amount of habitat subject to clearing, and due to the lack of a wild population, construction activities would not adversely affect recovery efforts of the Guam rail. Further, areas previously targeted for re-introductions would not be subject to noise increases sufficient to adversely affect recovery efforts of the Guam rail.

Mariana Islands Tree Snail, Pacific Tree Snail, Mariana Islands Fragile Tree Snail. Suitable habitat for all three species includes mesic, relatively closed-canopy forest, where ground disturbance has been minimal or absent. Although degraded, some habitat is present in the ASA project area. No snails were observed during the field surveys (Parsons 2006). The presence of invasive snail predators reduces the potential success for this species (Hopper and Smith 1992; Wiles, *et al.* 1995; GovGuam DAWR 2005). Construction would remove 1.4 hectares (3.5 acres) of suitable habitat. This represents less than 0.1 percent of the refuge overlay and the Ritidian Unit. Removal of snail habitat for these snails is small enough to not adversely affect current populations. Further, aircraft overflights are expected to have no effect on the snail species recovery or current populations.

Mariana Eight-spot Butterfly. No butterflies or associative plants were observed in the ASA or Commercial Gate project areas during the January 2006 survey. Although degraded due to ungulate browse pressure, there is a small amount of potential karst habitat present in the ASA project area. Construction would remove 1.4 hectares (3.5 acres) of potentially suitable habitat. This represents less than 0.1 percent of the refuge overlay and the Ritidian Unit. This relatively small amount of habitat subject to removal would not adversely affect the Mariana eight-spot butterfly. In addition, aircraft overflights are not expected to adversely affect this species of butterfly.

Offsite Effects for T&E Species

Base population could increase by about 3,000 persons when considering additional military personnel and dependents. These individuals would travel to and from Guam by commercial air carrier flights that use Guam International Airport. The majority of the household goods belonging to permanently assigned personnel would be transported as cargo in ships. Thus, there could be an additional approximate 220 household good shipments each year. The additional containers for the household goods would require USDA inspection for the BTS. The USDA would use the updated BTS inspection procedures to attain 100 percent inspection of outgoing ships and cargo. Rotational personnel would bring only personal effects, and those articles could be accommodated as baggage on the aircraft on which the individuals travel. Because 100 percent inspection of all outbound cargo from Andersen AFB would occur, the proposed action would not adversely affect offsite T&E species.

Summary of Effects Determination on T&E Species

The effects determinations for species relevant to this EIS are listed in Table 4.5-6.

Table 4.5-6 Effects Determination

Species	Potential Effects of Construction	Potential Effects of Operations
Heritiera longipetiolata	No effect	No effect
Serianthes nelsonii	No effect	No effect
Tabernaemontana rotensis	May affect	May affect
Mariana fruit bat	May adversely affect	May adversely affect
Mariana crow	May affect	May affect
Micronesian kingfisher	May affect	May affect
Guam rail	May affect	May affect
Mariana Islands tree snail	May affect	No effect
Pacific tree snail	May affect	No effect
Mariana Islands fragile tree snail	May affect	No effect
Mariana eight-spot butterfly	May affect	No effect

With the exception of the Mariana fruit bat, the proposed action may affect, but not adversely affect, populations of existing species as well as recovery of species populations. Although the project footprint has been altered to limit impacts to intact secondary limestone forest (see Subsection 2.2.1.2), the clearing of vegetation would impact one known Mariana fruit bat foraging area. This clearing of habitat would represent an adverse effect; however, the clearing would not jeopardize the continued existence of the species, nor would the clearance adversely modify the overall habitat. The effects determination for the proposed action is based on the following assumptions:

- Existing conditions for listed species within habitat areas of the overlay refuge continue to degrade. Excessive ungulate pressure prevents recruitment of emergent canopy species within forested areas, while BTS predation limits recovery of listed species.

- The size of the areas subject to clearing are relatively small in comparison to available habitat. Vegetation clearing would remove less than 74 hectares, which represent approximately 1.6 percent of the combined area of the GNWR Ritidian Unit and refuge overlay units. This small amount of clearing would not adversely affect listed species.
- Noise from aircraft overflights would affect Mariana fruit bat and Mariana crow recovery efforts, as well as current populations. Based on current literature and field observations, habituation to an incremental increase of overflights is expected. Further, adverse effects that do become apparent due to aircraft operations would initiate modifications to aircraft ground tracks and profiles over sensitive areas, through an Adaptive Management Strategy. This Adaptive Management Strategy involves a multi-year monitoring program of noise effects using up-to-date standards for acoustical studies on sensitive species, and could affect operational changes.
- Implementation of the conservation measures described in Subchapter 2.2.1.2 would reverse the continued degradation of approximately 200 hectares (494 acres) of important habitat, and therefore, contribute to the recovery of listed species. In addition, conservation measures address issues associated with exotic predator interdiction and control. Many of the conservation measures correspond directly to management needs identified as critical recovery actions in USFWS recovery plans for listed species. Further, the conservation measures would effectively manage areas of higher quality habitat for listed species. Therefore, the species may utilize the better-quality habitat that would be effectively enhanced by the conservation measures, rather than the relatively lower quality habitat currently present at Andersen main.

Natural Resources Planning

Under Alternative A, project goals described in the Andersen AFB INRMP (2002) would be supported by conservation measures included in the proposed action. Conservation measures call for the designation of 200 hectares (494 acres) of ungulate exclosure fencing units as a conservation classification. Further, conservation measures as part of Alternative A would support recovery actions outlined in various USFWS recovery plans for listed species.

4.5.1.4 Summary of Biological Opinion

Formal Section 7 consultation was concluded with the USFWS issuance of the BO in response to the BA. The BO, which was issued after the Draft EIS public comment period, concluded that the ISR/Strike project is not likely to jeopardize the continued existence of the Mariana fruit bat, Mariana crow, Micronesian kingfisher, Guam rail, and other off-site species listed under the ESA. The determination by USFWS is based on the following factors summarized from the BO (see Appendix E):

- No jeopardy determinations for listed species are based on conservation measures described in Subchapter 2.2.1.2 of the Final EIS;
- An Adaptive Management Strategy will develop and implement additional avoidance, minimization, and offset measures, based on the best available science subject to USFWS approval;

- The proposed action is not anticipated to compromise recovery efforts of listed species; and
- The Air Force has agreed to implement measures that avoid, minimize, and/or offset potential impacts associated with the proposed action, included in Subchapter 4.5.4 of the Final EIS.

The USFWS issued with the BO an Incidental Take Statement for the Mariana fruit bat. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Harm is further defined by the USFWS to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing essential behavior patterns. Harass is defined by the USFWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns. No take of Mariana crows, Micronesian kingfishers, or Guam rails will occur from the ISR/Strike project, and the level of anticipated take for the Mariana fruit bat is not likely to jeopardize the continued existence of the Mariana fruit bat. The Incidental Take Statement anticipates the following forms of incidental take:

- The take of one Mariana fruit bat foraging territory in the form of harm, as a result of clearing and construction of the ASA project area; and
- The take of two Mariana fruit bat colonies and 21 Mariana fruit bats on Guam and 36 Mariana fruit bats from Rota will occur in the form of harassment and death as a result of aircraft disturbance associated with overflights and subsequent illegal poaching activities.

The Incidental Take Permit includes non-discretionary reasonable and prudent measures that are necessary and appropriate to minimize the impacts of incidental take of the Mariana fruit bat. Summaries of these measures are included as mitigation in Subchapter 4.5.4.

4.5.2 Alternative B

Except for the family housing units and family housing management facilities that would not be constructed under Alternative B, the facilities construction and activities are identical to Alternative A. Therefore, the discussion and analysis for Alternative A apply to Alternative B.

4.5.3 No Action Alternative

Under the No Action Alternative, the ISR/Strike capability would not be established. No land clearing would occur northwest of the runways at Andersen main, and there would be no reduction in land identified as the overlay refuge. Public hunting would not be curtailed on this same land.

Vegetation and Wildlife

Although no vegetation clearing would occur, the degradation of northern limestone forest on Andersen AFB would continue. The uncleared land would continue to be judged as low quality, modified forest with little to no prospects for gradual improvement by seral succession because of the overriding cascading effects of prior land use. Plant and animal species resources, which include T&E species, would not change from baseline conditions. Continued encroachment of invasive herbaceous species would be expected.

Hunting levels would remain constant and consistent with the Base hunting procedures currently in effect. Deer and pig populations would remain at current levels. BTS interdiction would remain at current levels with a low probability of transporting the BTS offsite.

Threatened and Endangered Species

The habitat on Andersen AFB main would remain marginal for supporting endangered species. Continued foraging, however, in the ASA would be expected. No conservation measures would be implemented that directly support recovery actions of listed species outlined in USFWS recovery plans. The No Action Alternative has low potential for enhancing recovery or repopulation of these species.

Natural Resources Planning

The conservation measures that support projects in the INRMP would not be implemented, and no land use designations would change.

4.5.4 Mitigation

Mitigation, as defined by the CEQ (40 CFR Part 1508.20), includes the following concepts:

- Avoiding the impact altogether by not taking a certain action or parts of an action.
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- Compensating for the impact by providing substitute resources or environments.

“Compensating” and “minimizing” are common to both the Section 7 consultation process and the CEQ guidance for accomplishing environmental impact analysis under NEPA. Conservation measures were identified during the scoping and Section 7 consultation processes, and were included in the proposed action in Subchapter 2.2.1.2. Implementation of the conservation measures would minimize and compensate for potential effects of the ISR/Strike project on the species under review. These conservation measures are described in Subchapter 2.2.1.2. The Air Force has agreed to non-discretionary terms and conditions associated with the Incidental Take Statement from the BO (see Appendix E) and Subchapter 4.5.1.4.

4.5.5 Cumulative Impacts

Cumulative impacts would result from the additive effects of removing forested areas, fragmenting the habitat, disturbances due to aircraft operations, or impacts to food sources. For the purposes of this EIS, the following proposed and ongoing projects are considered for cumulative effects:

- The Aircraft Staging Area associated with the ISR/Strike project (Alternative A);
- The Commercial Gate associated with implementation of the ISR/Strike capability (Alternative A);
- Beddown of Training and Support Initiatives at Northwest Field; and
- MSA 1 project area.

Some vegetation that may provide suitable trees for the recovery and protection of listed species would be removed within each of these areas (see Table 4-5.7). The total vegetation removed from all projects combined would be approximately 122.7 hectares (303.2 acres), which is 2.7 percent of available refuge land. Table 4.5-8 lists each project area with proposed areas for clearing. Removal of this amount of vegetation would not be expected to jeopardize the recovery and continued existence of listed species. Further, conservation measures, as integral parts of the proposed actions, are designed to enhance habitat by addressing conservation issues in northern limestone forests of Guam. These issues include ungulate control to facilitate forest regeneration through depredation and exclosure fencing, BTS control and interdiction, and continued field research. The conservation measures support recovery actions of various USFWS recovery plans for listed species.

Draft EIS Comment: We view the loss of 122 hectares as impacting the recovery and preservation of Guam's native wildlife, especially the federally endangered Mariana crow, Micronesian kingfisher, and threatened Mariana fruit bat.

Response: The conservation measures stated in Subchapter 2.2.1.2 of the FEIS were tailored to correspond to the USFWS recovery plans for the Mariana crow, Micronesian kingfisher, and Mariana fruit bat. The October 3, 2006 USFWS Biological Opinion states that implementation of the ISR/Strike project "…is not likely to jeopardize the continued existence of the Mariana fruit bat, Mariana crow, Guam Micronesian kingfisher, Guam rail, and other off-site species listed under the ESA."

Cumulative Impacts Concerning Off-Site Effects on T&E Species

Potential adverse effects to offsite ecosystems include transport of BTSs from Andersen AFB in association with the off-island transport of people and cargo from ISR/Strike and Northwest Field activities. Assigned personnel and their dependents would rotate every 2 to 3 years. This represents approximately 410 families as well as their household goods requiring transport from the island to other locations. These individuals would likely depart via commercial aircraft from the Guam International Airport. There would be an increase of outgoing household goods through the Andersen AFB air freight terminal. Small portions of personnel goods would be shipped via air freight, most likely on military aircraft. Thus, there could be a requirement for the USDA WS to annually inspect as many as many as 410 additional containers that could be shipped via air freight from Andersen AFB. These additional shipments would be sent as air freight on routine cargo movement flights from Andersen AFB, and there should be no requirement for additional aircraft to transport the household goods. However, the additional containers for the household goods would require USDA WS inspection for the BTS. An estimated 194 rotational aircraft and contract aircraft carrying rotational personnel would depart Andersen AFB annually to return to their home station. These aircraft would move in groups. While this action represents less than one aircraft per day over a year, group movement would require a surge in USDA WS inspection capacity on

Draft EIS Comment: The cumulative impacts of these projects and future actions will negatively impact the Overlay Refuge and the species dependent upon it.

Response: As discussed in Subchapter 4.5.5, implementation of the conservation measures in Subchapter 2.2.1.2 for the ISR/Strike action and in Subchapter 2.4.2.2 (Northwest Field action) would minimize the potential for negative impact to the Overlay Refuge and the species dependent on it.

the days rotational aircraft depart. The Air Force would ensure a 100 percent BTS inspection program for aircraft and goods departing the Andersen AFB terminal. There would be no potential adverse effects to offsite T&E species.

Table 4.5-7 Woody Species of Value to Listed Species in Project Areas

Woody Species of Value to Listed Species	Occurrence in Proposed Areas for Clearing			
	ISR/Strike	Commercial Access Gate	Northwest Field	MSA1
Aglaia mariannensis [1,2,3]	X	X	X	X
Artocarpus mariannensis [1,2]				X
Carica papaya [2]		X		
Cocos nucifera [1,2,3]			X	
Elaeocarpus joga [1,2,3]		X		X
Eugenia reinwardtiana [1]	X			X
Eugenia thompsonii [1]	X		X	X
Ficus Prolixa [1,2,3]	X			X
Guamia mariannae [1,3]	X	X	X	X
Guettarda speciosa [2]	X			X
Hibiscus tiliaceus [1]	X	X	X	X
Intsia bijuga [1,3]	X	X		X
Leucaena leucocephala [1]	X	X	X	X
Macaranga thompsonii [1,2]	X			X
Mammea odorata [1,2]	X			X
Maytenus thompsonii [2]	X			
Neisosperma oppositifolia [1,2,3]	X	X	X	X
Pandanus tectorius [1,2,3]	X	X	X	X
Pisonia grandis [1,2,3]	X			
Premna obtusifolia [1,3]	X	X	X	X
Tristiropsis obtusangula [1]	X	X		X
Vitex parviflora [1,2]	X	X	X	X

1 Foraging or nesting habitat for Mariana crow
2 Foraging or roosting habitat for Mariana fruit bat
3 Nesting habitat for Micronesian kingfisher

Table 4.5-8 Proposed Clearing in Project Areas

Project Area Name	Area of Proposed Clearing (Hectares)	Total Area Cleared as Percentage of Refuge Overlay and Ritidian Unit[1]
ISR/Strike (ASA project area)	66.4	1.48
ISR/Strike (Commercial Gate)	7.5	0.17
Northwest Field Proposed Project Area	47.7	1.06
MSA 1 (Phase I)[2]	1.1	0.02
TOTAL	**122.7**	**2.73**

1 *Total area cleared as a percentage is calculated as: The total area subject to clearing divided by the total refuge overlay and Ritidian Unit. The Refuge overlay and Ritidian Unit is 4,480 hectares (11,070 acres). For example, in ISR/Strike ASA Project Area, (66.4 / 4,480) * 100 = 1.48%.*

2 *The planning process for Phase II of the MSA 1 project is very preliminary, and foreseeable implementation of Phase II may not require additional clearing of vegetation in MSA 1.*

Cumulative Impacts to Mariana Crows and Mariana Fruit Bats

Construction and training activities associated with the proposed action, Base-wide actions would not be expected to adversely affect Area 50 or the proposed HMU, both of which may present some potential habitat for the Mariana crow, and potential habitat for the re-introduction of the Micronesian kingfisher and the Guam rail. In addition, Base-wide activities would not expected to adversely affect the ungulate exclosure areas where there are likely to be suitable habitat for Mariana crows, Micronesian kingfishers, and Mariana fruit bats. The ISR/Strike projects include aircraft operations and construction activities near potential nesting sites of the Mariana crow, as well as foraging areas of the Mariana fruit bat. Construction associated with the ASA would impact a known female Mariana fruit bat foraging area. Therefore, clearing for the ASA project would represent an adverse effect. As discussed in Subsection 4.5.1.3, this forest removal would not jeopardize the continued existence of the Mariana fruit bat or adversely modify overall habitat. Noise from ISR/Strike aircraft would be comparable to the noise from aircraft currently operating at Andersen AFB. Therefore, the cumulative impacts of noise on the behavior of the Mariana crow and the Mariana fruit bat would not be expected to change from the current condition.

Cumulative Impacts of Habitat Fragmentation

Construction activities throughout the Base would remove suitable vegetation for listed species. This would have the effect of increasing habitat fragmentation. Habitat fragmentation is the process of converting contiguous vegetation and other resources required by a species into smaller patches or fragments. This process may make some portions of the fragmented area unavailable to the species. For example, some forest species will not cross large open spaces, or will not utilize areas that are near an "edge" of a habitat patch. As the suitable habitat patches become smaller, they will generally support fewer resources required by a particular species, and will overall support fewer species. The Mariana fruit bats are very mobile, and have been known to travel between Rota and Guam, and therefore, would likely travel across disturbed or cleared vegetation patches. Mariana crows are sensitive to human disturbance, but it is not known if they would travel across large open spaces. Nest site fidelity has been observed on both Guam and Rota when pairs have experienced nest success. A lack of nest fidelity may result from previous unsuccessful nesting attempts. Although some habitat would be removed, the proposed conservation measures within intact forested areas would provide suitable habitat that is protected from ungulate browse pressure, and this habitat around the perimeter of Andersen main and Northwest Field would provide a "corridor" for movement of Mariana crows and Mariana fruit bats to available nesting and foraging areas. Ungulate exclosures as part of the proposed action at Northwest Field and other actions associated with the ISR/Strike capability amount to 200 hectares (494 acres). These exclosure areas are adjacent to the GNWR Ritidian Unit. Management activities within these exclosure units include enhancing foraging habitat for Mariana fruit bats and Mariana crows through outplanting of appropriate species, as well as enacting an ungulate depredation program with eradication of ungulates as a goal.

Construction activities and the associated fragmentation may also affect invasive species. Both deer and pigs are likely to move away from direct human activity (*e.g.,* construction), but may move back to an area shortly after activities cease, to look for new browse areas. Deer and pigs would also transport seeds of invasive plant species. Therefore, after construction, there could be an increase in the number of invasive plants that become established. Because deer and pigs are below the carrying capacity, their numbers may also increase. The full time Wildlife Management Specialist would need to address the areas of construction shortly after activities cease to determine if ungulate population sizes are increasing.

Cumulative Impacts of Conservation Measures

Conservation measures for other actions are described in detail in Subchapter 2.4.2.2. Figure 4.5-2 shows conservation measures on Andersen AFB. The cumulative impacts of conservation measures would be beneficial to the biological resources of northern Guam. Some 336 hectares (830 acres) are proposed for active natural resource management activities, shown in Table 4.5-9. Coupled with ungulate control programs within exclosure areas, the continued degradation of forested areas would be halted. In addition, 10 foraging plots, totaling 2.5 hectares (6.1 acres) within ungulate exclosure areas, are included as conservation measures for the proposed action and other actions. BTS control at Pati Point would directly address the alarming lack of Mariana fruit bat pups at the Pati Point colony by removing a primary predator. Conservation measures have been designed to enhance recovery efforts of listed species and species habitat.

Draft EIS Comment: The Air Force [should] adequately mitigate for the loss of native limestone forest. We recommend that the areas proposed for clearing during the second phase of the MSA Igloo project and areas subject to disturbance associated with training in the Northwest Field and ISR/Strike project (e.g., forest adjacent to the proposed aircraft staging area under the proposed ISR/Strike project) be assessed in the cumulative impacts and appropriately mitigated.active land management practices on 336 hectares.

Response: The planning process for Phase II of the MSA project is very preliminary and is not yet to the point where details are adequate or needed for inclusion in the cumulative impacts analysis of the ISR/Strike EIS. Additionally, as stated in Subchapter 4.5.5, the amount of vegetation subject to clearing is 122.7 hectares. However, conservation measures as part of the ISR/Strike action and other actions would initiate active land management practices on 336 hectares..

Table 4.5-9 Cumulative Impacts of Ungulate Removal

Exclosure Area	Area (Hectares)	Management Guidelines
Ungulate exclosure area near Ritidian Point Ritidian East Unit	110 / 272	Ungulate fencing, removal through depredation hunting
Ungulate exclosure area near Ritidian Point Ritidian West Unit	90 / 222	Ungulate fencing, removal through depredation hunting
Ungulate exclosure area east of FTX	54 / 133	Ungulate fencing, removal through depredation hunting
Existing Area 50	22 / 54	Ungulate fencing, removal through depredation hunting. Exotic predator control (BTS, cat, dog, rat) Suitable exotic predator control fencing
Habitat Management Unit	60 / 148	Ungulate fencing, removal through depredation hunting. Exotic predator control (BTS, cat, dog, rat) Suitable exotic predator control fencing
TOTAL	**336 / 830**	

4.6 GROUNDWATER RESOURCES

In considering the impacts to groundwater resources, the following evaluation criteria were examined:

- The extent, if any, that the action would impact the groundwater levels, and
- The extent, if any, that the action would cause contamination of groundwater.

4.6.1 Alternative A

Alternative A would increase the Base's population by approximately 3,000 personnel, and aircraft washing activities would increase when compared to the No Action Alternative. The per person water consumption for the additional personnel is projected to be the same as the baseline condition. As a result of Alternative A, average daily water consumption would increase by 0.302 mgd from 0.59 mgd to 0.892 mgd when compared to the No Action Alternative. Assuming the most environmentally extreme condition that water distribution system loss would continue at the baseline rate of 1.91 mgd, the water withdrawal from the aquifer for Alternative A would be 2.802 mgd (1.91+0.892=2.802 mgd), which equates to 6.52 percent of the total 43 mgd of water withdrawn from the aquifer, an increase of 0.71 percent.

The potential for groundwater contamination from Andersen AFB activities would continue be from storm water run-off. However, the potential for storm water contamination and, potentially groundwater, would be minimized through the use of the procedures in the Base's SWPPP. The Base would continue to monitor 12 of the UIC wells twice a year during and after construction is complete to ensure that water entering the wells meets drinking water standards. Base personnel would continue to monitor all construction activity and require an EPP that identifies the actions necessary to reduce or preclude surface contamination from entering the UIC wells.

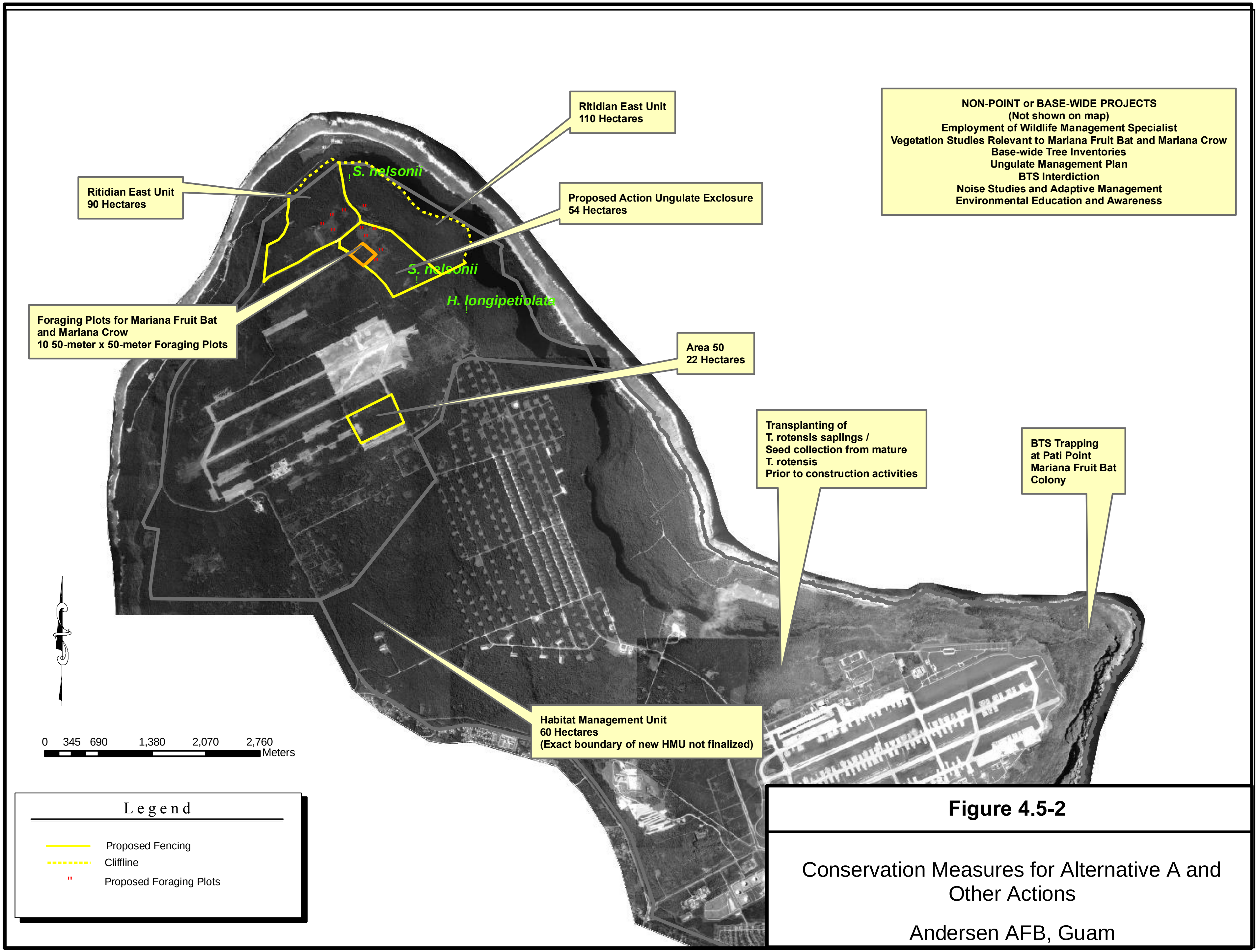

Figure 4.5-2

Conservation Measures for Alternative A and Other Actions

Andersen AFB, Guam

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4.6.2 Alternative B

Alternative B would increase the Base's population by approximately 1,850 personnel, and aircraft washing activities would increase when compared to the No Action Alternative. When using the factors used for Alternative A analysis, water withdrawal from the aquifer for Alternative B would be 2.687 mgd (1.91+0.777=2.687 mgd), which equates to 6.25 percent of the total 43 mgd of water withdrawn from the aquifer, an increase of 0.44 percent above the No Action Alternative. The erosion control techniques and injection well monitoring discussion to minimize groundwater contamination for Alternative A apply for Alternative B.

4.6.3 No Action Alternative

Under the No Action Alternative, the ISR/Strike capability would not be established at Andersen AFB. The types and level of activities and the number of personnel would remain at baseline conditions. The types and level of activities and the number of personnel (*i.e.*, about 5,900) would remain at baseline conditions. Therefore, water withdrawal from the aquifer for Base activities would remain at approximately 2.5 mgd, which is about 5.81 percent of the daily water withdrawal from the aquifer. The erosion control techniques discussion to minimize ground water contamination for Alternative A apply.

4.6.4 Mitigation

There are no groundwater impacts from either Alternative A or Alternative B that require mitigation.

4.6.5 Cumulative Impacts

Alternative A

Approximately 4,248 additional personnel would be at Andersen AFB under Alternative A and the other actions when compared to the No Action Alternative. When using the factors used for Alternative A analysis, water withdrawal from the aquifer by Andersen AFB would be 2.991 mgd (1.91+1.081=2.991 mgd), which equates to 6.96 percent of the total 43 mgd of water withdrawn from the aquifer, an increase of 1.15 percent above the No Action Alternative. The erosion control techniques and injection well monitoring discussion to minimize groundwater contamination for Alternative A apply.

Alternative B

Approximately 3,098 additional personnel would be at Andersen AFB under Alternative B and the other actions when compared to the No Action Alternative. When using the factors used for Alternative B cumulative analysis, water withdrawal from the aquifer by Andersen AFB would be 2.876 mgd (1.91+0.966=2.876 mgd), which equates to 6.69 percent of the total 43 mgd of water withdrawn from the aquifer, an increase of 0.88 percent above the No Action Alternative. The erosion control techniques discussion to minimize groundwater contamination for Alternative A applies.

4.7 EARTH RESOURCES

The following evaluation criteria were used to assess impacts on earth resources:

- The extent, if any, that the action would have the potential to disrupt geologic features and the locations of facilities in relation to potential geological hazards; and
- The extent, if any, that the action would have on the potential to increase erosion caused by disturbance of the ground surface during training activities and construction and demolition of facilities.

4.7.1 Alternative A

4.7.1.1 Geology and Topography

Proper construction techniques would be used to ensure structural stability of new facilities due to the potential for seismic activity on and in the vicinity of Guam. Ground disturbance associated with construction activity would occur in areas previously disturbed by construction, and no topographic features would be affected.

4.7.1.2 Soil

Soil would be disturbed and vegetation would be removed during construction activities. Major cut and fill efforts would not be necessary for the construction activities. The areas in which facilities would be constructed are relatively flat. Use of the erosion control techniques listed in Subchapter 4.4.2 would minimize the potential for erosion contamination from Alternative A activities.

Clearing and grading activities would require obtaining Guam EPA permits and an Environmental Protection Plan. Stormwater best management practices and erosion control measures would be implemented for construction and post-construction phases. Local government clearances from the Department of Agriculture, Department of Parks and Recreation, and the Historic Preservation Office would be obtained prior to the commencement of earthmoving activities.

4.7.2 Alternative B

Except for the family housing units and family housing management facilities that would not be constructed under Alternative B, the facilities construction and activities are identical to Alternative A. Therefore, the geology, topography, and soil discussion and analysis for Alternative A apply.

4.7.3 No Action Alternative

Under the No Action Alternative, the ISR/Strike capability would not be established at Andersen AFB. The types and level of activities at the Base would remain at baseline conditions. Continued use of the erosion control measures identified in the Base's SWPPP would minimize erosion.

4.7.4 Mitigation

There are no earth resources impacts from either Alternative A or Alternative B that require mitigation.

4.7.5 Cumulative Impacts

The types of construction activities associated with other actions would be almost identical to those for Alternative A. Therefore, the discussion and analysis for Alternative A applies to the cumulative impact analyses, and no cumulative earth resource impacts would occur.

4.8 HAZARDOUS MATERIALS AND WASTE

The following evaluation criteria were used to assess the alternatives with regard to hazardous materials and waste:

- The extent, if any, that the action would require materials that could not be accommodated by existing guidance;
- The extent, if any, that the action would cause waste generation that could not be accommodated by current Andersen AFB waste management capacities; and
- The extent, if any, that the action would interfere with the Andersen AFB IRP.

4.8.1 Alternative A

4.8.1.1 Hazardous Materials

Products containing hazardous materials would be procured and used during the proposed construction and demolition projects. Contractors could use products containing hazardous materials for equipment operation (*e.g.*, hydraulic fluid) during construction activities. Contractors would be required to use and store hazardous materials in accordance with Base procedures. The contractor would be responsible for the storage, treatment, disposal, and transportation off-Guam of any hazardous material that has an expired shelf-life, is out of date, unopened, and/or unused. Overages of hazardous material would not become the burden of the 36th Wing, Andersen AFB, or the DoD.

The aircraft construction materials (*i.e.*, both metal and composite materials), aircraft systems (*i.e.*, hydraulic, electrical, *etc*.), and operations (*i.e.*, mission type) would be the same for the ISR/Strike aircraft and the baseline aircraft. Therefore, it is not likely that any new hazardous materials would be needed to maintain and operate the ISR/Strike aircraft when compared to the baseline. However, it is likely that the procurement of hazardous materials would increase due to the additional 70 aircraft that would operate from Andersen AFB. The existing hazardous materials handling processes and procedures should accommodate the activities associated with ISR/Strike aircraft operation and maintenance. However, the hazardous materials handling processes and procedures would be updated should a hazardous material be required for the ISR/Strike operations that was not previously used. Hazardous materials to be used for maintenance at Andersen AFB facilities would be coordinated and approved by the Hazardous Materials Pharmacy.

4.8.1.2 Hazardous Waste

Under Alternative A, hazardous waste would be generated during construction and demolition activities. Construction contractors would manage hazardous waste in accordance with Base, local, and federal guidance, and would be responsible for storage, treatment, disposal, and the off-Guam transportation of any hazardous waste. Hazardous waste would not become the burden of the 36th Wing, Andersen AFB, or the DoD. Additionally, construction contractors would obtain their own USEPA generator identification number. It is expected the quantity of waste would be negligible and limited to equipment maintenance products. Any hazardous waste generated would be handled in accordance with federal and local laws and regulations, including Resource Conservation and Recovery Act (RCRA) requirements, for waste management and USDOT requirements for waste transport, and would be coordinated with the Andersen AFB Environmental Flight.

In the event of a spill of any amount or type of hazardous material or waste (petroleum products included), the construction contractor would take immediate action to contain and clean up the spill in accordance with the Base's Spill Prevention, Control, and Countermeasures Plan. The contractor would accomplish required documentation procedures and notify the Andersen AFB Fire Department and the Base Environmental Flight for reporting to regulatory agencies. Contractor spill cleanup personnel would be trained and certified to perform spill cleanup. The contractor would be responsible for proper characterization and disposal of any spilled waste and cleanup materials. All waste and associated cleanup material would be removed from the project site and transported and/or stored in accordance with regulations until final disposal. Fueling and lubrication of equipment would be conducted in a manner that affords maximum protection against spills. Secondary containment is required for transformers, tank trucks, and containers with a capacity of 55 gallons or more.

Should construction projects occur near known IRP sites, the construction contractor would be responsible for impacted soil. Should impacted soil be removed from the construction site, the construction contractor would be responsible for sampling and characterization of the soil prior to disposal to determine the proper disposal and transportation management methods. Soil that meets hazardous criteria must be managed in accordance with applicable federal requirements, including proper disposal, treatment (if necessary), and transportation. The safe and proper handling of the impacted soil should be coordinated with the Base Environmental Flight and Bioenvironmental Engineering to prepare a work plan and health and safety plan in the event contamination is encountered during excavation activities.

Hazardous waste generated by ISR/Strike aircraft O&M activities would be similar in nature with the baseline condition waste streams from existing activities at Andersen AFB. The primary waste-producing processes would continue to include aircraft parts cleaning, fluid changes for routine aircraft and vehicle maintenance, aircraft corrosion control, facility, and infrastructure maintenance. Any hazardous waste generated would be handled in accordance with federal, state, and local laws and regulations, including RCRA requirements for waste management and USDOT requirements for waste transport. It is possible that hazardous wastes could be sent off-island disposal so as to minimize any impacts and the waste could not be accommodated on-island.

The aircraft construction materials (*i.e.*, both metal and composite materials), aircraft systems (*i.e.*, hydraulic, electrical, *etc*.), and operations (*i.e.*, mission type) would be the same for the ISR/Strike aircraft and the baseline aircraft. Therefore, it is not likely that any new hazardous waste streams would occur from the maintenance and operation of ISR/Strike aircraft when compared to the baseline. The existing hazardous waste management processes and procedures should accommodate the waste generated under Alternative A. Andersen AFB personnel estimate hazardous waste generation could increase from the current 12,000 pounds per year to about 22,000 pounds per year with the addition of ISR/Strike aircraft. The Base would increase the 90-day waste storage capacity to accommodate the additional hazardous waste. Andersen AFB would revise its existing *Hazardous Waste Management Plan* to incorporate activities of the ISR/Strike capability.

4.8.1.3 Installation Restoration Program

Construction under Alternative A would occur in and around land which currently comprises an IRP site, former AOCs requiring no further action, SWMUs, and other possibly contaminated areas. Under Alternative A, numerous structures would be constructed and roadways, taxiways, and parking areas would either be constructed or repaved. Trenching and construction activities under the No Action Alternative may take place in or around sites that have soil contaminated with sanitary trash, waste chemicals, metals debris, pesticides, construction debris, semi-volatile organic compounds, UXO, asphaltic waste, dioxins, polychlorinated biphenyls, and fuel-related constituents.

A review of Figure C-1 in Appendix C, which shows the locations of the IRP sites, former AOCs requiring no further action, SWMUs, and other sites, and Figure 2.2-4, which shows the proposed locations of the construction projects, reveals that many of the IRP sites are near some of the proposed construction projects. These construction projects would not be impacted by the IRP sites, former AOCs requiring no further action, SWMUs, or other sites because most of them are storage areas within a defined space and would not be impacted by the individual construction activities of these projects.

There is a possibility of construction personnel coming into contact with contaminants of concern and UXO. The Base Explosives Ordnance Disposal (EOD) has the responsibility for the proper handling and disposal of UXO discovered during current and future investigations and at construction sites. The contractors would be advised to stop work and contact the Base EOD and other appropriate Air Force project personnel if UXO is encountered or if there was any suspicion of a hazardous condition during construction activities. The construction contractor would coordinate with the Base Environmental Flight and Bioenvironmental Engineering prior to handling and disposing any IRP-related material at a MILCON site, including a site that is built on top of a known IRP or military munitions response site that has not been completed under the remedial action process. MILCON projects must not hinder access to current IRP sites, IRP sites with Land Use Controls, former AOCs requiring no further action, other contaminated areas, monitoring wells, and remedial systems for sampling and operation and maintenance activities.

Facilities design and construction would be coordinated with the Base Environmental Flight and Bioenvironmental Engineering to ensure that MILCON would avoid interference with ongoing investigations, remediation work, and land use controls, and would not worsen the condition or impair the ability to remediate any site. Before construction activities begin, the contractor would be required to coordinate with the Base Environmental Flight and Bioenvironmental Engineering to prepare a work plan and health and safety plan in the event contamination is encountered during excavation activities. The work plan and health and safety plan would address measures for using field instruments capable of detecting contaminants at harmful levels. Soil gas associated with contamination could enter the building at levels that could present a long-term health risk. For this reason, buildings to be constructed over any contaminated land would be designed to include a subterranean vapor barrier, closed barrier seams, and a passive vent system.

4.8.1.4 Stored Fuel

Petroleum products that would be used under Alternative A are identical in nature to those used by the current aircraft activities at Andersen AFB. Fueling and equipment lubrication activities would be conducted in a manner that affords maximum protection against spills. Based on average sortie duration rates and average jet fuel consumption per flying hour for each of the ISR/Strike aircraft, it is estimated that an additional 21,157,806 gallons per year would be dispensed for Alternative A aircraft operations. Jet fuel consumption could increase from the approximate 2,200,000 gallons of fuel dispensed under the No Action Alternative to 23,357,806 gallons annually, or 63,995 gpd. Assuming the storage tanks are full each day (*i.e.*, 66,000,000 gallons), the average daily jet fuel consumption would equate to about 0.1 percent of the Base's fuel storage capacity. The increase in fuel consumption could require additional deliveries. Fuel would continue to be managed using the existing procedures.

4.8.2 Alternative B

Except for the construction projects that would not be constructed under Alternative B (see Subchapter 2.2.2) and the slight reduction in KC-135 flying time (*i.e.*, the time associated with fewer closed pattern operations), the types and levels of activities that would occur under Alternative B would be the same as Alternative A. Therefore, the discussion and analysis for hazardous material, hazardous waste, IRP, and stored fuel for Alternative A apply to Alternative B.

4.8.3 No Action Alternative

Under the No Action Alternative, the ISR/Strike capability would not be established at Andersen AFB. The activities and operations that occur under the existing, baseline condition would continue at the Base. Construction and demolition activities associated with individually programmed facility actions and O&M activities would continue to occur. The number of Air Force active duty and civilian personnel, as well as contractor personnel at the Base, would remain at the September 2004 levels (*i.e.*, approximately 5,900 personnel).

4.8.3.1 Hazardous Material

Under the No Action Alternative, hazardous material would continue to be managed by the Base's Hazardous Materials Pharmacy. Contractors and Base personnel working on routine MILCON projects would follow the Base's Hazardous Materials Management program established by AFI 32-7086. The construction and demolition activities for the No Action Alternative would be similar to the Alternative A activities. Therefore, the discussion and analysis for Alternative A apply.

4.8.3.2 Hazardous Waste

Under the No Action Alternative, hazardous waste would continue to be generated during routine Base activities. The hazardous waste management, spill containment and clean up, and contaminated soil procedures mentioned for Alternative A apply to the No Action Alternative.

Hazardous waste from recurring aircraft and vehicle maintenance activities would continue to be handled in accordance with existing Base management plans.

4.8.3.3 Installation Restoration Program

Under the No Action Alternative, MILCON may occur in and around land currently comprising an IRP site, former AOCs requiring no further action, SWMUs, and other possibly contaminated areas. Remedial investigations and clean-up efforts would continue under the Base's IRP. Trenching and construction activities under the No Action Alternative may take place in or around sites that have soil contaminated with sanitary trash, waste chemicals, metals debris, pesticides, construction debris, semi-volatile organic compounds, UXO, asphaltic waste, dioxins, polychlorinated biphenyls, and fuel-related constituents. The discussion and analysis for Alternative A apply due to the similarities of the construction projects of the No Action Alternative.

4.8.3.4 Stored Fuel

The primarily used petroleum product would continue to be jet fuel. The Base would continue to have storage capacity of 66,000,000 gallons and dispense about 2.2 million gallons of jet fuel annually, which equates to 65,000 gallons daily and 0.01 percent of the storage capacity.

4.8.4 Mitigation

There are no hazardous material, hazardous waste, IRP, or stored fuel impacts from either Alternative A or Alternative B that require mitigation.

4.8.5 Cumulative Impacts

The construction contractor for other action projects would be required to comply with the regulatory requirements identified for the Andersen AFB No Action Alternative and Alternative A. Some of the other actions would be adjacent to an Alternative A or Alternative B project site. Use of the requirements identified for the No Action Alternative and Alternative A would minimize the potential for cumulative impacts. When completed, activities at the other facilities would be managed in accordance with applicable environmental plans and policies. No cumulative hazardous material, hazardous waste, IRP, or stored fuel impacts would occur if either Alternative A or Alternative B would be implemented.

4.9 CULTURAL RESOURCES

The effects of an action on cultural resources would be considered significant if activities and undertakings would directly or indirectly effect cultural resources. The nature and potential significance of cultural resources in the APE were identified by considering the following definition. Historic resources, under 36 CFR Part 800, are defined as "…any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP." For the purposes of these regulations, this term includes artifacts, records, and remains related to and located within such properties. The term "eligible for inclusion in the National Register" includes both properties formally determined as such by the Secretary of the Interior and all other properties that meet NRHP listing criteria. Therefore, sites not yet evaluated are considered potentially eligible for inclusion in the NRHP and, as such, are afforded the same regulatory consideration as nominated properties.

The Air Force is required to comply with federal historic preservation statutes and regulations that apply to cultural resource management. These requirements include: compliance with Sections 106 and 110 of the NHPA; compliance with the Archaeological Resources Protection Act, Standards for Archaeology, History and Architecture (36 CFR 61.9); and the Secretary of the Interior's Guidelines for Archaeological Documentation (48 CFR 44720).

The Air Force is required to protect cultural resources listed or eligible for listing on the NRHP. Federal agencies are required under Section 106 of the NHPA of 1966, as amended, to exercise stewardship over historic resources under its ownership, encourage preservation of such properties controlled by others, and consider the effects of its actions on such properties. Under Section 110(s)(2) of the NHPA and as directed by a Presidential EO promulgated in March 2003, federal agencies are required to locate, inventory, and nominate the NRHP eligible properties under their control as part of a comprehensive effort in cultural resource management (Andersen AFB 2003c).

The criteria of effects from Section 106 of the NHPA are used to evaluate the potential for adverse effects on cultural resources. Any action that could change in any way the characteristics that qualify the property for inclusion in the NRHP, for better or for worse, is considered to have an "effect." If the action could diminish the integrity of such characteristics, it is considered to have an "adverse effect." Effects may occur at the same time and place as the undertaking or at a later time and distance from the location of the undertaking. For example, construction of a new roadway may cause or accelerate changes in land use or traffic patterns in other areas; these changes are potential effects of the action and are referred to as indirect effects.

Criteria of Effect. Section 800.9(a) of the NHPA states that an undertaking has an effect on a historic resource when the undertaking may alter characteristics of the property that may qualify the property for inclusion in the NRHP. For the purpose of determining effect, alteration to features of a property's location, setting, or use may be relevant depending on the property's significant characteristics and should be considered.

Criteria of Adverse Effect. Section 800.9(b) of the NHPA states that an undertaking is considered to have an adverse effect when the effect on a historic resource may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic resources include, but are not limited to:

- Physical destruction, damage, or alteration of all or part of the property;
- Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for inclusion on the NRHP;
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or which alter its setting;
- Neglect of the property resulting in its deterioration or destruction; and
- Transfer, lease, or sale of the property.

Exceptions to the criteria of adverse effects are considered when:

- The research value of a property can be substantially preserved through research conducted with applicable professional standards and guidelines;
- When the undertaking is limited to rehabilitation of buildings and structures conducted in a manner that preserves historical and architectural values through conformance with the Secretary of the Interior's standards for rehabilitation; and
- When the undertaking is limited to the transfer, lease, or sale of a historic resource and adequate restrictions or conditions are included to ensure preservation of significant historic features.

4.9.1 Alternative A

Alternative A would result in construction activities in areas that have not been surveyed for archaeological resources. Six of the construction projects associated with the proposed actions related to establishment of the ISR/Strike capability would be located in areas not previously surveyed: 190 family housing units, the Tactical Missile Maintenance Facility, Conventional Missile Maintenance Facility, Armament Systems Shop (Building 51104), new Commercial Gate, and expansion of the landfill. Any construction projects within CRMA IV would occur in an area that has not been subject to archaeological survey. Alternative A could result in a greater potential for impacts for undiscovered cultural resources than the No Action Alternative.

While Alternative A would not result in any effects to historic buildings listed on the NRHP, there are construction projects that would occur within the boundaries of historic site 66-07-1064 (North Field). The North Field historic site has been recommended as eligible for listing on the NRHP, and comprises the airfield complex within the main Base. Construction projects that would be located within the historic North Field complex are:

- Clean Water Rinse Facility;
- Mooring and Grounding Points;
- Repair of Taxiway Bravo, Taxiway Foxtrot, and Taxiway Charlie;
- Repair of the South Runway;
- Repair of Taxiway D; and
- Arm/Disarm Pads/End of Runway Shelter.

Because the historic North Field is eligible for listing on the NRHP, construction activities within this area would be subject to stipulations to be developed during the Section 106 consultation process that has been initiated (see Appendix D). It has been recommended that NRHP nomination forms prepared in 1975 for this property be completed and submitted by the Air Force (Andersen AFB 2003a). Figure 3.9-2 shows the historic North Field.

Facilities to be constructed in the Andersen main base would primarily be within existing development, an area heavily impacted by past Air Force construction and buildup. This area is within CRMA III. This CRMA is unlikely to contain surface or subsurface cultural resources deposits. As recommended in the ICRMP, cultural resource management should continue interpretation and commemorative programs.

Construction in open space areas would be required for the Tactical Missile Maintenance Facility, Conventional Missile Maintenance Facility, Sports Field Complex, Commercial Gate, expansion of the landfill, and military family housing warehouse. Because the final siting of new buildings has not been determined or may be subject to change, and because new facilities may be constructed in unsurveyed areas within any of the three CRMAs, the potential for encountering cultural resources is considered to be generally high. Two of the three CRMAs have not been systematically surveyed for archaeological resources, and the potential for unearthing of artifact scatter from pre- and post-Contact periods exists. Any disturbance or loss of cultural resources would be considered an adverse effect.

Alternative A would include building alteration projects; however, demolition of existing buildings is not planned at this time. Alternative A would not affect any of the seven buildings previously evaluated and recommended for the NRHP.

Construction within historic North Field, and within any of the areas not previously surveyed, may result in an adverse effect upon historic resources and/or archaeological sites. The loss of historic structures on Andersen AFB would be an adverse effect because this undertaking would result in the permanent removal of characteristics of a historic resource that may qualify for inclusion on the NRHP. Loss of historic resources would be irreplaceable. Loss of archeological material could result loss of information important in prehistory or history. In addition, reasonably foreseeable effects of the undertaking may occur later in time or farther removed by distance.

Two of the three CRMAs in the proposed ISR/Strike project area were previously recommended for archaeological inventory, ethnographic survey, and Section 106 review if a planned project would affect archaeological properties. Pursuant to Section 106 consultation with the GSHPO in October 2005, it was determined that in addition to known cultural resources, an unknown number of potential cultural resources could be adversely effected by planned construction activities in the area north of the airfield where the ASA is proposed.

Cultural resource inventories were conducted in the proposed APE (*i.e.* ASA) between May and August 2006. This effort located 34 previously unrecorded prehistoric sties and four previously undocumented historic foundations. The prehistoric sites are primarily scatters of Latte Period ceramic sherds and lack vertical stratification or habitation features. The historic resources appear to represent MILCON activities spanning roughly the years 1945-1955. An Executive Summary for Cultural Resources Inventory was submitted to the GSHPO on September 6, 2006. Based on review of the Executive Summary, the GSHPO responded in an October 3, 2006 letter (see Appendix D) that “further archaeological investigation on prehistoric sites at ISR/Strike will not provide any new information about the project area, but such an investigation will only be redundant to what we already know about the project.” This letter from the GSHPO concluded Section 106 consultation.

Should historic resources or archaeological resources be discovered during project activities, work in the immediate area would be suspended and the Andersen AFB Environmental Flight would consult the GSHPO. Subsequent actions would follow guidance provided in 36 CFR 800 and other relevant laws, regulations, and standard operating procedures outlined in the ICRMP.

4.9.2 Alternative B

Except for the family housing units and family housing management facilities that would not be constructed under Alternative B, the alternative facilities construction and activities are identical to Alternative A. Therefore, the discussion and analysis for Alternative A apply to Alternative B.

4.9.3 No Action Alternative

Under the No Action Alternative, the ISR/Strike capability would not be established at Andersen AFB. There would be no construction associated with the ISR/Strike project on Andersen AFB. The activities that occur under the baseline conditions would continue. Cultural resources on Andersen AFB would continue to be managed in accordance with procedures defined in the ICRMP. Therefore, the No Action Alternative would have no adverse effect on cultural resources.

4.9.4 Mitigation

As described in Subchapters 1.2.5 and 4.9.1, the Air Force accomplished Section 106 consultation with the GSHPO. No mitigation was identified as a result of the process.

4.9.5 Cumulative Impacts

The ISR/Strike project is one of a number of other planned projects involving construction on Andersen AFB. The potential for cumulative impacts from the ISR/Strike and other actions is minimal based on the distance between project sites, especially for the Northwest Field project. Additionally, the Air Force accomplished the Section 106 process for the Northwest Field project. The potential for cumulative impacts between the ISR/Strike projects and other projects would be prevented or minimized through implementation of the procedures identified in the Andersen AFB ICRMP. When combining the other actions with implementation of the ISR/Strike project through the consultation process, no cumulative adverse effects on significant cultural resources, including visual resources, would occur.

4.10 SOCIOECONOMIC RESOURCES

The DoD standard (O&M) and construction models of the USACE Economic Impact Forecast System (EIFS) were used to forecast impacts of Alternative A. The standard model estimates the impacts of ongoing mission and operations as well as assessment of changes in operations. The construction model predicts the economic impacts of the expenditures and employment from construction activities. Using a technique termed the rational threshold value (RTV), EIFS estimates are compared to historic trends for each economic indicator (business volume [using non-farm income], personal income, employment, and population) to determine impacts. The RTV model analyzes annual changes since 1969, and establishes analysis criteria based on historic deviations in the value of these four socioeconomic indicators. The EIFS calculates both positive and negative RTVs. This assessment assumes impacts would occur within the area surrounding the Base. The evaluation criteria using the socioeconomic analysis include:

- The extent, if any, that the existing housing, education, and economic sectors would accommodate the population, housing, education, and economic changes resulting from the action; and
- The extent, if any, that the economic and social effects would cause an adverse impact to the human environment. The human environment is defined by the CEQ 1508.14 as impacts on the natural and physical environment (air, water, and ecosystems).

4.10.1 Alternative A

4.10.1.1 Population

Under Alternative A, there would be an overall increase of 3,000 personnel and dependents. It is assumed that all military personnel and dependents would reside on Andersen AFB, while the few civilian contracting personnel would reside off-Base. Under Alternative A the on-Base full-time equivalent population would increase by approximately 51 percent when compared to the No Action Alternative.

The off-Base population would temporarily increase for the duration of the construction activities. The increase would result from U.S. skilled workers who would temporarily relocate to Guam to augment the relatively small number of construction workers available on Guam. Approximately 80 percent of the required construction workers would be from elsewhere in the U.S.; which translates to 1,800 or more temporary U.S. workers.

The increase in required construction workload may require deliberate efforts to increase the supply of skilled construction workers available on Guam, depending on available funding and the pace and intensity of authorized construction projects.

Currently, federal law prohibits the use of alien labor present on Guam under temporary, non-immigrant worker visas (so-called “H-2” workers) to be employed on federal construction contracts or base services contracts awarded under Office of Management and Budget Circular A-76 outsourcing and privatization procedures. Use of non-immigrant alien labor for military construction projects on Guam would require either a change in current law or use of limited waiver provisions available in the current law.

4.10.1.2 Housing

Construction of 190 family housing units in conjunction with use of the 250 vacant on-Base family housing units would accommodate the need for 450 additional family housing units generated by Alternative A. New dormitory spaces would also be constructed to accommodate the additional demand for unaccompanied military personnel. The dormitory construction and family housing renovation and construction projects would occur on a phased schedule that mirrors the increases in the number of personnel.

Housing to accommodate temporary skilled U.S. workers would be required during the 16-year construction period. This housing would be located outside the Base. Three types of housing, identified and discussed in the following paragraphs, are likely to be utilized to accommodate these workers. It is likely that a combination of two or more of these types would be used to provide the increased need in housing. Use of these three types of housing occurred during the high level of construction activity in the early 1990s.

The current vacant traditional housing supply on Guam consists of a mixture of single-family homes, apartments, townhouses, duplexes, triplexes and condominiums. The April 2005 Guam Multiple Listing Service listed approximately 250 housing units for sale and 240 units for rent. Most temporary workers would rent rather than purchase housing during their temporary residency on Guam. Although the current supply of vacant lower-priced rental units is less than the potential demand, some of the housing units listed for sale would be moved into the rental market by the current or new owners, as occurred during the early 1990s. The demand by temporary U.S. workers for rental housing would provide incentive for landlords to renovate and cleanup many unused dwellings. The impact on the existing infrastructure that would occur from occupation of these housing units generally has been previously addressed during permitting of these housing units.

Underutilized guest type lodging (*i.e*., hotels, motels, vacation apartments, and condominiums) would be another potential source of housing. This type of lodging may include: existing hotels willing to rent at rates appropriate for long term occupancy; hotels that would convert all or in part to long term rental operation (such as the Tumon Horizon did in the early 1990s); and vacant hotels requiring repair/renovation prior to occupancy. It is unknown how many such units could be provided. The impact on existing infrastructure was addressed during permitting and design of these types of units.

Another alternative is construction of new and/or renovation of existing temporary housing facilities dedicated to use by the temporary skilled workers. Historically, establishment and operation of such housing has been undertaken by the construction contracting companies, and has been used by nonimmigrant alien workers, sometimes referred to as H-2 workers. These workers are prohibited by Federal law from working on military construction projects on Guam.

One or more of these temporary housing types may be required to house workers not otherwise accommodated by the previous two types of housing. Use of existing temporary housing facilities would be advantageous because the infrastructure (*i.e*., roads, wastewater, and water) would be in place. However, these systems may require significant renovation and upgrade to be used by temporary U.S. workers. New temporary housing facilities would require evaluation for siting, infrastructure, access, availability of non-work transportation. This type of housing could include prefabricated structures that could be shipped in “knock-down” condition. (Fully constructed or pre-constructed housing [“mobile homes”] would not likely be a viable option due to size of and cost of shipping.)

Many of the existing temporary housing facilities are in the northern municipalities of Yigo and Dededo and relatively close to Andersen AFB. Yigo and Dededo may be a preferred location for temporary housing that may be constructed or imported (“knock-down” structures) because of their proximity to the Base and the established infrastructure.

The use of temporary housing facilities for skilled U.S. workers would require detailed evaluation of required capacity, schedule of the requirements, options of the above and other possible housing types, and impact on existing infrastructure. These and other issues would be the responsibility of construction contractor(s), and would have to be identified and evaluated on accurate information at such time as these types of housing would be required.

Another alternative that has been utilized in other locations would house workers in waterborne vessels. This alternative would have to be fully evaluated by the construction contracting company(s).

4.10.1.3 Education

Under Alternative A, there would be an increase in school enrollment due to the increase in the number of military personnel and dependents. The majority of this enrollment increase would occur in the DoDEA schools on Andersen AFB. This enrollment increase would approximate 525-550 new students, including an estimated 100-110 high school students when compared to the No Action Alternative.

The current enrollment of the DoDEA Andersen Elementary/Middle Schools is 1,300 students, with an enrollment capacity of 1,522 students. The majority of this current excess capacity is at Andersen Elementary, while Andersen Middle School is near capacity. The addition of as many as 440 elementary/middle school students to the existing enrollment would expand the student population to about 1,740 students, exceeding the capacity by about 218 students. The current enrollment of the DoDEA Guam High School is 435 students, with an enrollment capacity of 450 students. The addition of as many as 110 high school students to the existing enrollment would expand the student population to about 545 students, exceeding the capacity by about 95 students.

One of the ISR/Strike projects would construct a DoDEA high school, which would accommodate additional high school students. Vacated space in the existing high school could be used to accommodate the additional elementary/middle school students. Should additional space be needed, portable buildings similar to those used by public school districts could be used to alleviate overcrowding.

Enhanced government workforce training programs, private sector apprenticeship training programs, migration of skilled workers from the mainland United States or Hawaii, and migration of workers from the nearby freely associated Micronesian nations may be necessary to meet possible additional labor requirements.

4.10.1.4 Economy

Direct and indirect short-term beneficial economic impacts to the Guam economy would be realized during the construction associated with Alternative A. Employment generated by construction activities would result in wages paid, increases in business sales volume, and increased demand for local and regional services, materials, and supplies In addition, there would be direct and indirect long-term beneficial economic impacts due to the expanded operations associated with Alternative A that would not occur under the No Action Alternative.

The EIFS model provides a systematic method for evaluating the short-term and long-term regional socioeconomic effects of government actions, particularly military actions. The primary EIFS model inputs for construction impacts are the estimated construction cost (capital costs) for project implementation, and annual average income for construction workers. In addition, the extent of the use of skilled U.S. workers from elsewhere in the U.S. is included as a model input. The estimated construction cost for the projects is pro-rated over the 16-year construction period to estimate annual economic impacts. The economic Region of Influence is considered to be the Island of Guam. The calculated multiplier for Guam is 2.2374.

Long-term beneficial economic benefits of Alternative A would be realized as a result of the increase of approximately 1,050 full-time equivalent military and civilian employees during operations. The primary inputs for the EIFS operations model are an increase in estimated annual operating expenditures; estimated increase of full-time equivalent military and civilian employees; and, annual average incomes of $28,000 and $40,000, respectively, for the new military and civilian employees.

The EIFS model uses employment and income multipliers developed with a comprehensive regional/local database combined with economic export base techniques to estimate the regional economic impacts of changes in employment generated and expenditures directly and indirectly resulting from project construction. The EIFS model evaluates the economic impacts of regional change in sales (business) volume, employment and personal income. Since the EIFS model does not include a database for Guam, a database was constructed to assess annual impacts. This database consists of time series data on employment, income, and business sales receipts. The 2002 Economic Census of Guam and the Guam Economic Report, Wage and Salary Earnings (2003), were the main sources of information for developing this database.

As indicated in Table 4.10-1, direct annual regional economic impacts would occur as a result of operations under Alternative A. There would be an increase of 1,262 employees in the government, retail trade, services, and industrial sectors, which would increase the regional economy by $23.1 million in business volume (sales) and result in $33.5 million in direct personal income when compared to the No Action Alternative. Employment and income of the 1,050 full-time equivalent military personnel are included in the direct employment and direct income. The direct income represents the earnings of employees in the government, retail, wholesale and service establishments that would be initially or directly affected by the net gain of military and civilian employees. The increase in business volume reflects increases in the sales of goods, services, and supplies to the military and civilian personnel, and other employment directly associated with project operations.

Table 4.10-1 shows the indirect annual regional impacts on secondary sales, employment, and income generated by the employment and business activity directly associated with the expanded operations. The direct increase in sales and employment generates increases in secondary sales of $28.6 million; the gain of an additional 262 jobs indirectly in the retail trade, services and industry sectors; and a gain of an additional $5.0 million in indirect income when compared to the No Action Alternative. Income is indirectly impacted as a result of the increase in sales and employment resulting from the initial economic impacts.

Table 4.10-1 shows the direct annual regional economic impacts of project construction over this 16-year period under Alternative A. These direct construction impacts would include increases of $339.6 million in business volume (sales); the addition of 2,752 jobs in the construction, retail trade, services and industrial sectors; and include increases of $84.8 million in direct personal income when compared to the No Action Alternative. Direct employment includes those workers who would accomplish the construction activities associated with Alternative A. Personal income represents the earnings of employees in the construction, retail, wholesale, and service establishments who would be initially or directly affected by the construction activity. The increase in business volume includes the sales of goods, services, and supplies associated with project construction activity.

Table 4.10-1 shows that the indirect economic impacts during the 16-year construction period include secondary sales of $67.8 million and an additional 621 jobs indirectly in the retail trade, services, and industry sectors. This results in an additional $12 million in indirect income above the No Action Alternative. Income is indirectly impacted as a result of the indirect increase in sales and employment resulting from the initial economic impacts.

Table 4.10-1 Annual Alternative A Economic Impacts

	Direct Impacts	Indirect Impacts	Total
Annual Operations Impacts			
Sales (Business) Volume	$23,122,947	$28,613,476	$51,736,423
Income	$33,500,653	$ 5,074,350	$38,575,003
Employment	1,262	262	1,524
Annual Construction Impacts[1]			
Sales (Business) Volume	$ 339,648,917	$67,864,394	$ 407,513,311
Income	$ 84,790,884	$12,035,158	$ 96,826,042
Employment	2,752	621	3,373

[1]Annual impacts only during the 16-year construction period.
Source: EIFS.

The EIFS model also includes an RTV profile used in conjunction with the forecast models to assess the significance of impacts of an activity for a specific geographic area. For each variable (sales volume, employment, income, and population), the current time-series data available from the U.S. Department of Commerce (USDOC) Bureau of Economic Analysis (USDOC 2000; 2001) are calculated along with the annual change, deviation from the average annual change, and the percent deviation for each of these variables, which then defines a threshold for significant annual regional economic impacts for a variable. Within the EIFS model, the RTV is calculated for each of these variables when assessing the regional economic impacts of a specific project. If the RTV for a particular variable associated with the impacts of a specific project exceeds the maximum annual historic deviation for that variable, then the economic impacts would be considered significant. If the RTV for a variable is less than the maximum annual historic deviation for that variable, then the regional economic impacts would not be considered significant. With respect to the EIFS model assessment of the economic impacts of construction under Alternative A, the RTVs for annual sales volume and income exceed the respective regional RTVs. In respect to the additional annual operations, the RTVs for each of the three variables (sales volume, income, and employment) were found to be significantly less than the regional RTVs. Thus, project construction would result in significant annual economic impacts on Guam during the construction period, while the expanded operations under Alternative A would not result in significant annual economic impacts on Guam.

The Guam economy would also realize additional economic benefits from the receipt of income taxes on wages received by the construction workers and new permanent based population. The citizens and residents of Guam, including military personnel, pay federal income taxes to the Guam Treasury rather than the U.S. Treasury. The U.S. Congress created the Territorial Government of Guam as a separate taxing jurisdiction by enactment in 1950 of the Organic Act of Guam. Section 31 of the Act provides that the income tax laws in force in the United States shall be the income tax laws of Guam, substituting Guam for the United States where necessary and omitting any inapplicable or incompatible provisions. The U.S. Internal Revenue Code with such changes constitutes the Guam Territorial Income Tax Law. Assuming a 15 percent effective tax bracket, the Guam Treasury could receive between $2-3 million annually from the additional new military and civilian personnel at Andersen AFB when compared to the No Action Alternative.

Other potential income for the Guam Treasury would be realized from the Gross Receipts Tax levied on businesses. This tax, which is 4 percent, is included in the sales price of consumer goods and services, and is paid by the business establishment. Additional tax revenues from gasoline, alcoholic beverage, and tobacco taxes could also be realized when compared to the No Action Alternative. Since there is no sales tax on consumer goods in Guam, no additional revenue would be realized from this source.

4.10.2 Alternative B

4.10.2.1 Population

Under Alternative B, there would be an overall increase of 1,850 personnel and dependents. It is assumed that all military personnel and dependents would reside on Andersen AFB, while the few civilian contracting personnel would reside off-Base. Under Alternative B the on-Base population full-time equivalent population would increase by approximately 31 percent when compared to the No Action Alternative.

The off-Base population would temporarily increase for the duration of the construction activities. The increase would result from U.S. skilled workers who would temporarily relocate to Guam to augment the relatively small number of construction workers available on Guam. Approximately 80 percent of the required construction workers would be from elsewhere in the U.S.; which translates to 1,600 or more temporary U.S. workers.

4.10.2.2 Housing

Use of the 250 vacant on-Base family housing units would accommodate the need for the 100 additional family housing units generated by Alternative B. New dormitory spaces would be constructed to accommodate the additional demand for unaccompanied military personnel. The off-Base housing discussion for skilled workers from elsewhere in the U.S. in Alternative A applies.

4.10.2.3 Education

Under Alternative B, there would be an increase in school enrollment due to the increase in the number of military personnel and dependents. The majority of this enrollment increase would occur in the DoDEA schools on Andersen AFB. This enrollment increase would approximate 80-90 new students, including an estimated 15-20 high school students when compared to the No Action Alternative.

The current enrollment of the DoDEA Andersen Elementary/Middle Schools is 1,300 students, with an enrollment capacity of 1,522 students. The majority of this current excess capacity is at Andersen Elementary, while Andersen Middle School is near capacity. The addition of as many as 70 elementary/middle school students to the existing enrollment would expand the student population to about 1,370 students, leaving an excess capacity of about 152 students. The current enrollment of the DoDEA Guam High School is 435 students, with an enrollment capacity of 450 students. The addition of as many as 20 high school students to the existing enrollment would expand the student population to about 455 students, exceeding the capacity by about five students. One of the ISR/Strike projects would construct a DoDEA high school, which would accommodate the additional high school students.

4.10.2.4 Economy

Direct and indirect short-term beneficial economic impacts to the Guam economy would be realized during the construction associated with Alternative B. Employment generated by construction activities would result in wages paid, increases in business sales volume, and increased demand for local and regional services, materials, and supplies. In addition, there would be direct and indirect long-term beneficial economic impacts due to the expanded operations associated with this alternative. The EIFS model was also used to measure or project the economic impacts of Alternative B.

As indicated in Table 4.10-2, direct annual regional economic impacts would occur as a result of operations under Alternative B. There would be an increase of 752 employees in the government, retail trade, services and industrial sectors, which would increase the regional economy by $13.8 million in business volume (sales) and result in $19.9 million in direct personal income when compared to the No Action Alternative. Employment and income of the 647 full-time equivalent military personnel are included in the direct employment and direct income. The direct income represents the earnings of employees in the government, retail, wholesale and service establishments that would be initially or directly affected by the net gain of military and civilian employees. The increase in business volume reflects increases in the sales of goods, services, and supplies to the military and civilian personnel, and other employment directly associated with project operations.

Table 4.10-2 Annual Alternative B Economic Impacts

	Direct Impacts	Indirect Impacts	Total
Annual Operations Impacts			
Sales (Business) Volume	$ 13,858,394	$ 17,149,061	$31,007,454
Income	$ 19,957,665	$ 3,041,236	$22,998,902
Employment	752	157	909
Annual Construction Impacts[1]			
Sales (Business) Volume	$ 304,856,984	$60,912,705	$365,769,690
Income	$ 76,121,017	$10,802,337	$ 86,923,354
Employment	2,471	558	3,028

[1] *Annual impacts only during the 16-year construction period.*

Source: EIFS.

Table 4.10-2 shows the indirect annual regional impacts on secondary sales, employment, and income generated by the employment and business activity directly associated with the expanded operations. The direct increase in sales and employment generates increases in secondary sales of $17.1 million; the gain of an additional 157 jobs indirectly in the retail trade, services and industry sectors; and, a gain of an additional $3.0 million in indirect income when compared to the No Action Alternative. Income is indirectly impacted as a result of the increase in sales and employment resulting from the initial economic impacts.

Table 4.10-2 shows the direct annual regional economic impacts of project construction over this 16-year period under Alternative B. These direct construction impacts would include increases of $304.8 million in business volume (sales); the addition of 2,471 jobs in the construction, retail trade, services and industrial sectors; and include increases of $76.1 million in direct personal income when compared to the No Action Alternative. Direct employment includes those workers who would accomplish the construction activities associated with Alternative B. Personal income represents the earnings of employees in the construction, retail, wholesale, and service establishments who would be initially or directly affected by the construction activity. The increase in business volume includes the sales of goods, services, and supplies associated with project construction activity.

Table 4.10-2 shows that the indirect economic impacts of project construction include secondary sales of $60.9 million and an additional 558 jobs indirectly in the retail trade, services, and industry sectors. This results in an additional $10.8 million in indirect income above the No Action Alternative. Income is indirectly impacted as a result of the indirect increase in sales and employment resulting from the initial economic impacts.

Long-term beneficial economic benefits under Alternative B would be realized as a result of the increase of approximately 647 full-time equivalent military, and civilian employees during operations. The primary inputs for the EIFS operations model under Alternative B include the increase in estimated annual operating expenditures; estimated increase of full-time equivalent military and civilian employees (620); and, annual average incomes of $28,000 and $40,000, respectively, for the new military and civilian employees.

With respect to the EIFS model assessment of the economic impacts of construction under Alternative B, the RTV for annual sales volume exceeds the respective regional RTV. With respect to the additional annual operations, the RTVs for each of the three variables (sales volume, income, and employment) were found to be significantly less than the regional RTVs. Thus, project construction would result in significant annual economic impacts to business sales on Guam during the construction period, while the expanded operations under Alternative B would not result in significant annual economic impacts on Guam.

Guam’s economy would also realize additional economic benefits from the receipt of income taxes on wages received by the construction workers and new permanent based population. The citizens and residents of Guam, including military personnel, pay federal income taxes to the Guam Treasury rather than the U.S. Treasury. Assuming a 15 percent effective tax bracket, the Guam Treasury could receive between $.3.5 million annually from the additional new military and civilian personnel at Andersen AFB when compared to the No Action Alternative.

Other potential income for the Guam Treasury would be realized from the Gross Receipts Tax levied on businesses. This tax, which is 4 percent, is included in the sales price of consumer goods and services, and is paid by the business establishment. Additional tax revenues from gasoline, alcoholic beverage, and tobacco taxes could also be realized when compared to the No Action Alternative. Since there is no sales tax on consumer goods in Guam, no additional revenue would be realized from this source.

4.10.3 No Action Alternative

Under the No Action Alternative, the ISR/Strike capability would not be established at Andersen AFB. Thus, activities and operations that occur under the baseline would continue and there would be no change to the Base population of approximately 5,900 persons. There would be no need for additional housing. Enrollment in the DoDEA and Guam Public School System schools would remain at baseline levels. The current Guam labor force, employment, unemployment, and economic conditions would continue. Andersen AFB would continue to be a major contributor to the Island's economy through direct military and civilian employment, subsequent creation of indirect employment, and the purchase of goods and supplies from local businesses.

4.10.3.1 Mitigation

There are no impacts to socioeconomic resources that require mitigation.

4.10.4 Cumulative Impacts

4.10.4.1 Alternative A

Population

There would be short-term and long-term increases in population because of Alternative A and the other actions. The other actions in this assessment include 80 additional personnel associated with two other identified units, and construction of the munitions igloos. Short-term population increases would result from the required construction labor, the majority of which would consist of skilled U.S. workers from elsewhere in the U.S. A total labor supply of approximately 2,600 workers is estimated for the combined Alternative A, Northwest Field initiatives, and other actions, of which 80 percent may have to consist of skilled U.S. workers from elsewhere in the U.S. due to the local shortage of skilled workers. Thus, local housing would need to be provided for approximately 2,080 workers.

There is a potential increase of 4,248 in the population, all of which would be located on-Base. This population increase would represent an approximate 72 percent increase over the No Action Alternative on-Base permanent population of approximately 5,900.

Housing

Additional on-Base family housing units and dormitory spaces would be required to accommodate personnel for Alternative A and the other actions. There would be a shortfall of 470 family housing units when applying the current on-Base inventory of 250 vacant on-Base military family housing units plus the 190 units (440 total units) that would be constructed under Alternative A to the demand for an additional cumulative 910 units (450 units for Alternative A and 460 units for the other actions). As mentioned in Subchapter 3.10.2, there was an inventory of 484 off-Base houses and condominiums listed for sale and the houses and condominiums available for lease in Guam in April 2005. Nearly all the inventory of 484 off-Base units would be needed for the requirement of 470 units assuming the inventory is typical for Guam.

New dormitory spaces would also be constructed to accommodate the additional housing demand for unaccompanied military personnel. One of the dormitories would be constructed to house transitory students at Northwest Field.

The off-Base housing discussion for skilled workers from elsewhere in the U.S. in Subchapter 4.10.1.2 applies.

Education

There could be a 70-75 percent increase in the on-Base DoDEA school enrollment as a result of new military personnel associated with Alternative A, Northwest Field initiatives, and other actions. Because incoming military personnel would reside on-Base, the majority of school enrollment increase would occur in the DoDEA schools on Andersen AFB. The projected enrollment increase would be approximately 900-950 new students, including approximately 175-185 high school students, when compared to the No Action Alternative.

The current enrollment of the DoDEA Andersen Elementary/Middle Schools is 1,300 students, with an enrollment capacity of 1,522 students. The majority of this current excess capacity is at Andersen Elementary, while Andersen Middle School is near capacity. The addition of as many as 765 elementary/middle school students to the existing enrollment would expand the student population to about 2,065 students, exceeding the capacity by about 543 students. The current enrollment of the DoDEA Guam High School is 435 students, with an enrollment capacity of 450 students. The addition of as many as 185 high school students to the existing enrollment would expand the student population to about 620 students, exceeding the capacity by about 170 students.

One of the ISR/Strike projects would construct a DoDEA high school, which would accommodate the additional high school students. Vacated space in the existing high school should be able to accommodate the additional elementary/middle school students. Should additional space be needed, portable buildings similar to those used by public school districts could be used to alleviate overcrowding.

Economy

Table 4.10-3 shows the annual cumulative economic impacts of the additional long-term construction activities associated with Alternative A, Northwest Field initiatives, and the other actions. These impacts are in addition to the current economic impacts to Andersen AFB. Total annual direct cumulative impacts include an increase of $678 million in direct business sales; $167 million increase in direct income; and an increase of 3,196 in direct employment when compared to the No Action Alternative. Total annual indirect cumulative impacts include an increase of $135 million in indirect business sales; $24 million increase in indirect income; and an increase of 723 in indirect employment when compared to the No Action Alternative. None of the RTVs for sales volume, income, or employment would be equaled or exceeded under the cumulative impacts of Alternative A, Northwest Field initiatives, and the other actions.

Therefore, the annual cumulative economic impacts of the additional operations under Alternative A and other actions would not to be considered significant.

Table 4.10-3 Annual Alternative A Cumulative Economic Impacts: Construction

	Direct Impacts	Indirect Impacts	Total
Sales (Business Volume)			
Alternative A	$339,648,917	$67,864,394	$407,513,311
Northwest Field initiatives	$236,760,996	$46,349,868	$283,110,864
Other Actions[2]	$101,687,892	$20,317,998	$122,005,890
Cumulative Impact	$678,097,805	$134,532,260	$812,630,065
Income			
Alternative A	$84,790,884	$12,035,158	$96,826,042
Northwest Field initiatives	$56,685,816	$ 8,219,742	$64,905,558
Other Actions[2]	$25,390,872	$ 3,603,222	$28,994,094
Cumulative Impact	$166,867,572	$23,858,122	$190,725,694
Employment			
Alternative A	2,752	621	3,373
Northwest Field initiatives	307	71	378
Other Actions[2]	137	31	168
Cumulative Impact	3,196	723	3,919

Source: Economic Impact Forecast System.

Total annual cumulative potential federal income taxes received by the Guam Treasury as a result of the additional permanently stationed military personnel could range between $4-$5 million above the No Action Alternative. This amount represents the potential total federal income taxes on wages paid to the new military and civilian personnel associated with the Andersen AFB ISR/Strike Alternative A and other actions. Additional GovGuam revenues would be generated by the Gross Receipts Tax, and gasoline, alcohol, tobacco, and other taxes.

Table 4.10-4 shows the annual cumulative economic impacts of the additional long-term operations associated with Alternative A, Northwest Field initiatives, and the other actions. These impacts are in addition to the current economic impacts to Andersen AFB experienced under the No Action Alternative. Total annual direct cumulative impacts include an increase of $34.5 million in direct business sales; $48.6 million increase in direct income; and an increase of 1,811 in direct employment when compared to the No Action Alternative. Total annual indirect cumulative impacts include an increase of $42.7 million in indirect business sales; $7.6 million increase in indirect income; and an increase of 391 in indirect employment when compared to the No Action Alternative. None of the RTVs for sales volume, income, or employment would be equaled or exceeded under the cumulative impacts of Alternative A, Northwest Field initiatives, and other actions. Therefore, the annual cumulative economic impacts of the additional operations under Alternative A, Northwest Field initiatives, and other actions to business volume, income, and employment in Guam would not to be considered significant.

Table 4.10-4 Annual Alternative A Cumulative Economic Impacts: Operations

	Direct Impacts	Indirect Impacts	Total
Sales (Business Volume)			
Alternative A	$23,122,947	$28,613,476	$51,736,423
Northwest Field initiatives	$ 9,415,183	$11,650,813	$21,065,996
Other Actions	$ 1,977,188	$ 2,446,670	$ 4,423,858
Cumulative Impact	$34,515,318	$42,710,959	$77,226,277
Income			
Alternative A	$33,500,653	$ 5,074,350	$ 38,575,003
Northwest Field initiatives	$12,445,701	$ 2,066,170	$ 14,511,871
Other Actions	$ 2,613,597	$ 433,395	$ 3,047,492
Cumulative Impact	$48,559,951	$ 7,575,915	$56,134,366
Employment			
Alternative A	1,262	262	1,524
Northwest Field initiatives	458	107	565
Other Actions	91	22	113
Cumulative Impact	1,811	391	2,202

Source: Economic Impact Forecast System.

Total annual cumulative potential federal income taxes received by the Guam Treasury as a result of the additional permanently stationed military personnel could range between $5-$6 million above the No Action Alternative. This amount represents the potential total federal income taxes on wages paid to the new military and civilian personnel. Additional federal income tax revenues would be received from other directly and indirectly related employment associated with Alternative A, Northwest Field initiatives, and other actions. Additional GovGuam revenues would be generated by the Gross Receipts Tax, and gasoline, alcohol, tobacco, and other taxes.

Other cumulative indirect economic impacts would occur as a result of both the short-term and long-term direct impacts. The population resulting from the construction and subsequent operations of Alternative A and the other actions would create additional demand for consumer goods and services. This new demand could foster new commercial development in the form of retail goods and service outlets. This new development would, in turn, require additional investment in the associated public infrastructure, and would enhance the property tax revenue base of Guam.

4.10.4.2 Alternative B

Population

There would be short-term and long-term increases in population because of Alternative B and the other actions. The other actions in this assessment include only an additional 80 personnel associated with two other units, and construction of the munitions igloos. Short-term population increases would result from the required construction labor, the majority of which would consist of skilled U.S. workers from elsewhere in the U.S. A total labor supply of approximately 2,350 workers is estimated for the combined Alternative B, Northwest Field initiatives, and other actions, of which 80 percent may have to consist of skilled U.S. workers from elsewhere in the U.S. due to the local shortage of skilled workers. Thus, local housing would have to be provided for approximately 1,880 workers.

There is a potential increase of 3,098 in the population, all of which would be located on-Base. This population increase would represent an approximate 53 percent increase over the No Action Alternative on-Base permanent population of approximately 5,900.

Housing

Additional on-Base family housing units and dormitory spaces would be required to accommodate personnel for Alternative B and the other actions. There would be a shortfall of 310 family housing units when applying the current on-Base inventory of 250 vacant on-Base military family housing units to the demand for an additional cumulative 560 units (100 units for Alternative B and 460 units for the other actions). As mentioned in Subchapter 3.10.2, there was an inventory of 484 off-Base houses and condominiums listed for sale and the houses and condominiums available for lease in Guam in April 2005. The need for 310 units could be accommodated by the inventory of 484 off-Base units assuming the inventory is typical for Guam.

The discussion of dormitory space and housing for skilled workers from elsewhere in the U.S. for Alternative A applies to Alternative B.

Education

There could be an approximate 30-35 percent increase in the on-Base DoDEA school enrollment as a result of the new military personnel associated with Alternative B and the other actions. Because incoming military personnel would reside on Base, the majority of school enrollment increase would occur in the DoDEA schools on Andersen AFB. The projected enrollment increase could be approximately 450-475 new students, including approximately 90-95 high school students, when compared to the No Action Alternative.

The current enrollment of the DoDEA Andersen Elementary/Middle Schools is 1,300 students, with an enrollment capacity of 1,522 students. The majority of this current excess capacity is at Andersen Elementary, while Andersen Middle School is near capacity. The addition of as many as 380 elementary/middle school students to the existing enrollment would expand the student population to about 1,680 students, exceeding the capacity by about 158 students. The current enrollment of the DoDEA Guam High School is 435 students, with an enrollment capacity of 450 students. The addition of as many as 95 high school students to the existing enrollment would expand the student population to about 530 students, exceeding the capacity by about 80 students.

One of the ISR/Strike projects would construct a DoDEA high school, which would accommodate the additional high school students. Vacated space in the existing high school could be used to accommodate the additional elementary/middle school students. Should additional space be needed, portable buildings similar to those used by public school districts could be used to alleviate overcrowding.

Economy

Under Alternative B and the other actions, short-term and long-term cumulative economic impacts would occur. The annual impacts on employment, income, and sales volume indicated in Table 4.10-5 for the construction associated with Alternative B and other actions are each multiplied by six (length of construction period) to determine the total impacts for each economic variable. The annual impacts of the construction activity associated with the other actions are also each multiplied by six and added to Alternative B totals to estimate the overall total cumulative impact for each economic variable over the 16-year construction period.

Table 4.10-5 shows the annual cumulative economic impacts of the construction projects associated with Alternative B, Northwest Field initiatives, and the other actions. The majority of these economic impacts would be associated with Alternative B. Total cumulative impacts, inclusive of both direct and indirect impacts, include an increase of $771 million in business sales; $181 million increase in income; and an increase of 3,574 in employment when compared to the No Action Alternative. These values represent the total cumulative impact during the 16-year construction period. The RTVs for sales volume and income are exceeded under the cumulative impacts of Alternative B, Northwest Field initiatives, and the other actions. Thus, the annual cumulative economic impacts of project construction on the sales volume and income of Guam would be considered significant. In addition, the maximum annual RTV for the increase in employment is almost equaled by the annual cumulative employment generated by the combined construction projects of Alternative B, Northwest Field initiatives, and the other actions.

Table 4.10-5 Annual Alternative B Cumulative Economic Impacts: Construction

	Direct Impacts	Indirect Impacts	Total
Sales (Business Volume)			
Alternative B	$ 304,856,984	$60,912,705	$365,769,690
Northwest Field initiatives	$ 236,760,996	$ 46,349,868	$ 283,110,864
Other Actions[2]	$ 101,687,892	$ 20,317,998	$ 122,005,890
Cumulative Impact	$643,305,872	$127,580,571	$770,886,444
Income			
Alternative B	$ 76,121,017	$10,802,337	$ 86,923,354
Northwest Field initiatives	$ 56,685,816	$ 8,219,742	$ 64,905,558
Other Actions[2]	$ 25,390,872	$ 3,603,222	$ 28,994,094
Cumulative Impact	$158,197,705	$22,628,301	$180,823,006
Employment[1]			
Alternative B	2,471	558	3,028
Northwest Field initiatives	307	71	378
Other Actions[2]	137	31	168
Cumulative Impact	2,915	660	3,574

[1] *Annual employment for a period of 16 years.*
[2] *Includes munitions igloos only.*
Source: Economic Impact Forecast System.

Total cumulative potential federal income taxes received by the Guam Treasury during this 16-year construction period would approximate $80-$90 million above the No Action Alternative, or between $13-$15 million annually. This amount represents the potential total federal income taxes on wages paid to the construction workers during the 16-year construction period in addition to income earned by other direct and indirect employment. Additional Government of Guam revenues would be generated by the Gross Receipts Tax, gasoline, alcohol, and tobacco taxes.

Table 4.10-6 shows the annual cumulative economic impacts of the additional long-term operations associated with Alternative B, Northwest Field initiatives, and other actions. These impacts are in addition to the current economic impacts to Andersen AFB. Total annual direct cumulative impacts include an increase of $25.3 million in direct business sales; $35.0 million increase in direct income; and an increase of 1,301 in direct employment when compared to the No Action Alternative. Total annual indirect cumulative impacts include an increase of $31.2 million in indirect business sales; $5.5 million increase in indirect income; and an increase of 286 in indirect employment when compared to the No Action Alternative. None of the RTVs for business sales, income and employment would be equaled or exceeded under the cumulative impacts of Alternative B and the other actions. Therefore, the annual cumulative economic impacts of Alternative B, Northwest Field initiatives, and other actions would not be considered significant.

Table 4.10-6 Annual Alternative B Cumulative Economic Impacts: Operations

	Direct Impacts	Indirect Impacts	Total
Sales (Business Volume)			
Alternative B	$13,858,394	$17,149,061	$ 31,007,454
Northwest Field initiatives	$ 9,415,183	$11,650,813	$ 21,065,996
Other Actions	$ 1,977,188	$ 2,446,670	$ 4,423,858
Cumulative Impact	$25,250,765	$31,246,544	$ 56,497.308
Income			
Alternative B	$ 19,957,665	$ 3,041,236	$22,998,902
Northwest Field initiatives	$12,445,701	$ 2,066,170	$ 14,511,871
Other Actions	$ 2,613,597	$ 433,895	$ 3,047,492
Cumulative Impact	$35,016,963	$ 5,541,301	$ 40,558,265
Employment			
Alternative B	752	157	909
Northwest Field initiatives	458	107	565
Other Actions	91	22	113
Cumulative Impact	1,301	286	1,587

Source: Economic Impact Forecast System.

Total annual cumulative potential federal income taxes received by the Guam Treasury as a result of the additional permanently stationed military and civilian personnel could range between $2-$3 million above the No Action Alternative. This amount represents the potential total federal income taxes on wages paid to the new military and civilian personnel associated with Alternative B and other actions. Additional Government of Guam revenues would be generated by the Gross Receipts Tax, and gasoline, alcohol, tobacco, and other taxes.

Other cumulative indirect economic impacts would occur as a result of both the short-term and long-term direct impacts. The population resulting from construction and subsequent operations of Alternative B and the other actions would create additional demand for consumer goods and services. This new demand could foster new commercial development in the form of retail goods and service outlets. This new development would, in turn, require additional investment in the associated public infrastructure, and would enhance the property tax revenue base of Guam.

4.11 AIRFIELD OPERATIONS, AIRCRAFT SAFETY, AND BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD

Factors considered when evaluating airfield operations impacts include:

- The operations capacity of the airfield to accommodate the increase in operations associated with the action;
- The ability of the air traffic control procedures to accommodate the operations associated with the action;
- The probability of an aircraft involved in an accident striking a person or structure on the ground; and
- The probability of a bird/wildlife aircraft strike resulting in an aircraft accident, injuring either aircrews or the public, or damaging property (other than the aircraft).

4.11.1 Alternative A

4.11.1.1 Airfield Operations

Under Alternative A, annual airfield operations at the Base would increase by 38,868 operations from 85,734 to 124,602 operations (see Tables 2.3-1 and 2.2-2, respectively), a 45 percent increase when compared to the No Action Alternative. The 124,602 operations would equate to about 35 percent of the airfield capacity, an increase of approximately 11 percent when compared to the No Action Alternative. The operating characteristics of the ISR/Strike aircraft are similar to the fighter, bomber, and tanker aircraft that operate at the Base under the baseline condition. The ISR/Strike KC-135, B-1, B-2, B-52, and Global Hawks would primarily use Runway 06R/24L, and the F-22 and F-15E aircraft would use Runway 06L/24R. Many of the baseline condition traffic patterns could be used by the ISR/Strike aircraft. Additional arrival, departure, and closed pattern flight tracks and related air traffic control procedures would be added to Runway 06L/24R for use by the ISR/Strike fighter aircraft. The air traffic control tower and Guam Approach and Departure Control would establish procedures for the additional flight tracks. The airspace can accommodate the additional flight tracks and the control procedures needed for the additional traffic patterns would not conflict with the existing procedures. The aircraft flight profiles associated with the ISR/Strike aircraft would not be affected by, nor would they affect, the restrictions that limit aircraft overflight of MSA 1, Mariana crow territories, and the Mariana fruit bat colony.

4.11.1.2 Aircraft Safety

It is impossible to predict the precise location of an aircraft accident. However, aircraft flight tracks are developed to avoid overflying residences and built-up areas to the maximum extent practicable. As mentioned in Subchapter 3.11.2, 68 percent of the Air Force aircraft accidents that occur within a 10-NM radius of an airfield happen either on the airfield or within an area that is 3,000 feet wide and extends out to a distance of 15,000 feet from the end of the runway. Historical data show that large aircraft such as the tanker and bomber would have a 20 percent probability of being involved in an accident within the 10-NM radius and fighter aircraft would have an 80 percent probability. The types of landing and takeoff operations the ISR/Strike F-22, F-15E, B-1, B-2, B-52, KC-135 aircraft and Global Hawks would accomplish at Andersen AFB would be consistent with those currently flown at the Base and those associated with the operations on which the 10-year averages listed in Table 3.11-1 are based. Thus, the mishap distribution discussed in Subchapter 3.11.2 would apply to the operations projected under Alternative A. For these reasons, the probability is low that an aircraft involved in an accident at or around the Andersen AFB airfield would strike a person or structure on the ground.

4.11.1.3 Bird/Wildlife-Aircraft Strike Hazard

Bird/wildlife aircraft strike hazards can be assessed using a combination of bird distribution and behavior factors and aircraft operational factors. Some of these factors include:

- Size and behavior of the predominant bird species;
- Presence of specialized habitat or location that favors migration patterns or large concentrations of birds;
- Frequency and location of takeoffs and landings;
- Altitude of flight operations; and
- Flight characteristics of the aircraft, including size, airspeed, and number of engines.

Overall, it is estimated the total annual airfield operations at Andersen AFB would increase by about 45 percent when compared to the No Action Alternative. Thus, bird/wildlife aircraft strikes associated with airfield operations at Andersen AFB would be expected to increase commensurate with the increase in airfield operations. Based on the 8-year average data listed in Table 3.11-3 and the increase in airfield operations, it is estimated that approximately four annual bird/wildlife aircraft strikes would occur when applying the increase in airfield operations to the baseline strike rate per airfield operation. Table 4.11-1 lists the quarterly bird/wildlife aircraft strikes based on the baseline monthly average bird-aircraft strikes per airfield operation and the projected quarterly operations. The altitude distribution for bird/wildlife-aircraft strikes in Table 3.11-2 would apply to Alternative A.

The number of bird/wildlife aircraft strikes described in the previous paragraph could fluctuate as a result of the cyclical patterns of bird populations. Historically, one-half of 1 percent of all reported bird-aircraft strikes involving Air Force aircraft resulted in a serious mishap. Therefore, it is unlikely that any of these bird-aircraft strike incidents would result in an aircraft accident, involve injury either to aircrews or to the public, or damage to property (other than the aircraft).

Table 4.11-1 Estimated Alternative A Bird/Wildlife Aircraft Strikes

Month	Baseline Quarterly Average	Estimated Quarterly/Annual Bird-Aircraft Strikes	Net Change	Percent Change
January-March	0.875	1.272	+0.397	+45.4%
April-June	0.625	0.908	+0.283	+45.3%
July-September	0.250	0.363	+0.113	+45.2%
October-December	1.250	1.817	+0.567	+45.4%
Annual	3.000	4.360	+1.360	+45.3%

Note: *Baseline average strikes per quarter based on the 8-year average quarterly bird/wildlife aircraft strike (1997-2004) divided by average quarterly aircraft operations.*

Source: *Andersen AFB 2005b.*

There is little information on the possibility of aircraft-bird or aircraft-bat strikes on either the Mariana crow or the Mariana fruit bat. The Mariana crow nests in trees between 15 and 55 feet tall, and the Mariana fruit bat roosts in trees of similar height. The crows forage on the ground or along the tree trunks, and the bats forage on fruit trees that are generally smaller than the trees in which they roost. At Pati Point, aircraft altitude would not be expected to be lower than 900 feet AGL, and at Tarague Channel, aircraft would be no lower than 1,000 feet AGL. Even if the birds or the bats fly above the tree canopies, based on their foraging activities, they would likely not be higher than 100 feet AGL, an altitude that would provide 800 to 900 feet of separation between the crow or bat and aircraft. Continued use of the restriction that limits aircraft overflight altitude along the Andersen AFB cliff line to 1,000 feet AGL or above would reduce the potential for bird/wildlife aircraft strike hazards.

4.11.2 Alternative B

4.11.2.1 Airfield Operations

Under Alternative B, annual airfield operations at the Base would increase by 35,009 operations from 85,734 to 120,743 operations (see Tables 2.3-1 and 2.2-11, respectively), a 41 percent increase when compared to the No Action Alternative. The 120,743 operations would equate to about 34 percent of the airfield capacity, an increase of approximately 10 percent when compared to the No Action Alternative. The type of aircraft associated with Alternative B are identical to Alternative A. The only difference between Alternative B and Alternative A is that there would be 3,859 fewer annual operations under the alternative. Therefore, the discussion and analysis for Alternative A apply to Alternative B.

4.11.2.2 Aircraft Safety

The type of aircraft associated with Alternative B are identical to Alternative A. Therefore, the discussion and analysis for Alternative A apply to Alternative B and the probability is low that an aircraft involved in an accident at or around the Andersen AFB airfield would strike a person or structure on the ground.

4.11.2.3 Bird/Wildlife Aircraft Strike Hazard

The factors used for Alternative A analysis were used for Alternative B. Overall, it is estimated the total annual airfield operations at Andersen AFB under Alternative B would increase by about 34 percent when compared to the No Action Alternative. Thus, bird/wildlife aircraft strikes associated with airfield operations at Andersen AFB would be expected to increase commensurate with the change in airfield operations. Based on the 8-year average data listed in Table 3.11-3 and the increase in airfield operations, it is estimated that approximately four annual bird/wildlife aircraft strikes would occur when applying the increase in airfield operations to the baseline strike rate per airfield operation. Table 4.11-2 lists the quarterly bird/wildlife aircraft strikes based on the baseline monthly average bird/wildlife aircraft strikes per airfield operation and the projected quarterly operations. The altitude distribution for bird/wildlife aircraft strikes in Table 3.11-2 would apply to Alternative B. The bird/wildlife aircraft strike fluctuation, the bird/wildlife aircraft strike mishap, and the Mariana crow and Mariana fruit bat discussion for Alternative A apply to Alternative B. It is unlikely that any of these bird/wildlife aircraft strike incidents would result in an aircraft accident, involve injury either to aircrews or to the public, or damage to property (other than the aircraft). Continued use of the restriction that limits aircraft overflight altitude along the Andersen AFB cliff line to 1,000 feet AGL or above would reduce the potential for bird/wildlife aircraft strike hazards.

Table 4.11-2 Estimated Alternative B Bird/Wildlife Aircraft Strikes

Month	Baseline Quarterly Average	Estimated Quarterly/Annual Bird-Aircraft Strikes	Net Change	Percent Change
January-March	0.875	1.232	+0.357	+40.8%
April-June	0.625	0.880	+0.255	40.8
July-September	0.250	0.352	+0.102	+40.8%
October-December	1.250	1.760	+0.510	+40.8%
Annual	3.000	4.224	+1.224	+40.8%

Note: *Baseline average strikes per quarter based on the 8-year average quarterly bird/wildlife strikes (1997-2004) divided by average quarterly aircraft operations.*

Source: *Andersen AFB 2005b.*

4.11.3 No Action Alternative

Under the No Action Alternative, the ISR/Strike capability would not be established and the type and level of airfield operations would continue at the baseline condition. The existing air traffic control procedures accommodate the baseline airfield operations and the airfield has the capacity for the 85,734 annual operations. The existing conditions for aircraft safety and bird-aircraft strikes would continue because there would be no change in the type and level of airfield operations.

4.11.4 Mitigation

There are no airfield operations, aircraft safety, or bird-aircraft strike impacts from either Alternative A or Alternative B that require mitigation.

4.11.5 Cumulative Impacts

None of the other actions proposed at Andersen AFB include aircraft basing or airfield operations. Therefore, no cumulative airfield operations, aircraft safety, or bird/wildlife aircraft strike impacts would occur.

4.12 ENVIRONMENTAL JUSTICE

Environmental justice analysis considers if minority and/or low-income populations would bear a disproportionate amount of adverse health and environmental effects as a result of an action.

4.12.1 Alternative A

The off-Base community surrounding Andersen AFB is characterized by disproportionately higher minority and low-income populations, with approximately 23 percent of persons living below the federally designated poverty level. This community is also approximately 93 percent minority. Some of the villages near Andersen AFB exhibit a higher percentage of low-income individuals and minority population than Guam as a whole. For this reason, an environmental justice evaluation was performed to determine if Alternative A would result in environmental impacts that would be considered disproportionately adverse to this specific community.

Due to the nature of Alternative A, the key environmental resource that could potentially contribute to localized impacts to communities with disproportionately higher minority and low-income populations is limited to noise. Alternative A would result in an increase in the number of persons within the DNL 65 dBA noise level resulting from aircraft operations. The noise analysis has determined that:

- Alternative A would result in a 475 percent increase in acres of land that would be exposed to a noise level of DNL 65 dBA and greater when compared to the baseline condition. The area within the DNL 65 dBA for Alternative A would extend approximately 4 miles farther southwest to the village of Dededo when compared to the No Action Alternative (baseline) condition.
- Alternative A would result in an exposure of 2,566 off-Base persons to a noise level of DNL 65 dBA and greater. This would result in an 902 percent increase in the number of persons who would be exposed to a noise level of DNL 65 dBA and greater when compared to the baseline condition. Approximately 6 percent of the population living within the Andersen AFB airfield airspace would be exposed to a noise level of DNL 65 dBA and greater. The density of residences in the newly exposed areas would be consistent with adjacent residential areas exposed to aircraft noise under the No Action Alternative.
- Alternative A would result in a 952 percent increase in number of persons potentially highly annoyed by noise resulting from aircraft operations when compared to baseline conditions. It is estimated that 552 persons could be potentially highly annoyed by this noise exposure.
- Single event noise from Alternative A at four locations (Dededo, Pati Point, Tarague Channel, and Uruno Point) would be up to 6 dBA greater than baseline conditions. A change of 3 dB is just perceptible, while a change of 5 dB is clearly noticeable (Bies

and Hanson 1988). No structural damage would be expected to result from ISR/Strike aircraft operations.

- The potential for speech disruption from aircraft overflight would increase.

Increases in noise exposure from Alternative A, which may occur in areas that exhibit a disproportionately higher minority and low-income population, would not be expected to result in adverse effects on human health. Alternative A would not cause adverse impacts to human health or the environment of neighboring populations. Because significant environmental impacts would not result, no disproportionately high or adverse effects to minority and low-income populations in the Andersen AFB area are anticipated.

4.12.2 Alternative B

As discussed in Subchapter 4.1.2, noise modeling for Alternative B indicated no discernable difference in the Alternative B noise contours and noise exposure when compared to Alternative A. Therefore, the discussion and analysis of environmental justice for Alternative A apply to Alternative B.

4.12.3 No Action Alternative

The No Action Alternative would result in no changes to existing and planned noise conditions. Disproportionately adverse effects to minority and low-income populations would not result from the No Action Alternative.

4.12.4 Mitigation

No environmental injustice would occur. Therefore, no mitigation would be required.

4.12.5 Cumulative Impacts

There would be no other actions with potential off-Base noise impacts in the area of Andersen AFB. Environmental justice concerns have been addressed in the NEPA analysis for other projects, and appropriate mitigation would be accomplished for these projects by each proponent. Establishment and operation of the ISR/Strike capability, when combined with other planned projects, would not contribute cumulative impacts to minority or low-income populations in the area.

4.13 COMPARISON OF ENVIRONMENTAL EFFECTS OF ALL ALTERNATIVES

4.13.1 Alternative A Impacts

Table 4.13-1 summarizes the impacts of Alternative A, Alternative B, and the No Action Alternative.

4.13.2 Cumulative Impacts

Table 4.13-2 summarizes the cumulative impacts.

4.14 MITIGATION

Mitigation and conservation measures would be recommended to reduce the potential for adverse effects (noise, cultural resources, and biological resources).

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Table 4.13-1 Summary of Environmental Impacts for Alternative A, Alternative B, and No Action Alternative

Resource	Alternative A	Alternative B	No Action Alternative
Noise	An additional 2,566 people would be exposed to DNL 65 dBA and greater; however, nobody would be exposed to DNL 75 dBA and greater. These 2,566 people would equate to 6 percent of the persons who live within the 5-mile radius associated with the airfield airspace environment. The density of residences in the newly exposed area would be consistent with adjacent residential areas exposed to aircraft noise under the baseline condition. New facilities and family housing would be constructed to achieve an indoor noise level of DNL 45 dBA or less. The nearby off- and on-Base schools would continue to be exposed to noise from aircraft operations. The on-Base high school would be constructed to meet NLR standards. It is doubtful an individual would be exposed to noise that would produce hearing loss. Noise during an aircraft overflight could cause a decrease in speech intelligibility or cause individuals to have to move closer together to be heard. Construction noise would be temporary, would occur only during daytime, and would cease when the project is completed.	Noise modeling for Alternative B indicated there is no discernable difference in the alternative action noise contours and noise exposure when compared to Alternative A. The discussion, analysis, and conclusions for Alternative A for noise from aircraft operations and construction activities apply to Alternative B.	The types and levels of activities, to include airfield operations, would remain at the current conditions, and the existing noise environment would continue. Approximately 256 off-Base persons would continue to be exposed to DNL 65 dBA and greater.
Land Use	On-Base land use conflicts would not occur because land use categories in the General Plan were developed by considering the proposed ISR/Strike activities. There would be no change to the aesthetic view from adjacent off-Base properties. None of the facilities that would be constructed would interfere with existing access to non-Air Force land between Andersen AFB, the Pacific Ocean, and the Philippine Sea. Based on the increased area of exposure and the AICUZ program guidance, Andersen AFB would provide the noise contours and land use sections of this EIS to local planning agencies to serve as an interim AICUZ report. A full update to the AICUZ Report would be provided to the community within 1 year after the completed mission change. Housing for construction workers who may temporarily relocate to Guam would be based on GovGuam regulations.	The discussion and analysis for Alternative A apply to Alternative B.	Routine facilities actions at Andersen AFB would be accomplished in accordance with the Base's General Plan. Based on the increased area of exposure and the AICUZ program guidance for updating the most recent AICUZ report, Andersen AFB would prepare an update to the 2001 AICUZ Report to identify potential land use incompatibility from aircraft noise.
Air Quality	Construction emissions would be temporary, fall off rapidly with distance from the proposed construction site, and would not result in any long-term impacts. Neither construction nor recurring aircraft and vehicle emissions from Alternative A would cause a violation of federal standards. A Final General Conformity Rule Conformity Determination would not be required.	The summary for Alternative A applies to Alternative B.	Emissions from current aircraft operations, aircraft maintenance, vehicles, boilers, generators, fueling operations, and industrial processes would continue at current levels, which do not exceed air quality standards.

Table 4.13-1 Summary of Environmental Impacts for Alternative A, Alternative B, and No Action Alternative (*continued*)

Resource	Alternative A	Alternative B	No Action Alternative
Infrastructure and Utilities	Water consumption would equate to about 20 percent of the system capacity. Wastewater generation would result in the WWTP operating at 82 percent of capacity. The Base would continue negotiating with the GWA to determine the amount of wastewater the Base will be allowed to send to the Northern WWTP. Electricity consumption would equate to approximately 4 percent of the GPA generation capacity. Where practicable, facilities would be constructed in an energy-efficient and sustainable manner. The existing drainage basins and storm water management systems would handle the increase in run off due the increase in impervious cover. The loss of the three wells that inject storm water into the aquifer should not present a problem because there are other nearby wells that currently are under capacity and to which storm water can be channeled. New designs that incorporate devices to increase ponding and retention (pre-treatment) would be implemented. New oil/water separator systems would also be required. Construction contractors would ensure an EPP is prepared, provided to Andersen AFB for submittal to Guam EPA, and approved before initiating activities. It is estimated the landfill would reach 100 percent capacity by December 2007, regardless of Alternative A activities. A study is currently being conducted to investigate the possibility of vertically extending the current landfill for use beyond 2009. The study scheduled for completion in January 2007. Thus, Andersen AFB plans to use the expanded on-Base landfill until 2009 or later if the current study supports expansion, and then use a permitted landfill. Although it is not known at this time which landfill would be used, there are three possible options: (1) the proposed GovGuam landfill after it becomes available in 2009-2010; (2) the on-Base landfill that would be constructed as an ISR/Strike project; and (3) the Navy landfill. Planning for the GovGuam and ISR/Strike landfills has not progressed to the point where the capacities or life spans are known. Therefore, quantitative analysis of the impact of the ISR/Strike project on the landfill cannot be accomplished. The Base would submit the permit application for Guam EPA coordination for the ISR/Strike landfill project. All green waste would continue to be segregated and collected for mulching, chipping, and composting or burned in small piles on site after obtaining a burning permit from the local fire department. Andersen AFB would continue its aggressive pollution prevention and recycling program to divert solid waste. Contracts issued for construction activities would require the contractor to recycle construction and demolition debris to the maximum extent possible.	Water consumption would equate to about 17 percent of the system capacity. Wastewater generation would result in the WWTP operating at 82 percent of capacity. The negotiation analysis for Alternative A applies. Electricity consumption would equate to approximately 4 percent of the GPA generation capacity. The energy efficiency analysis for Alternative A applies. The Alternative A storm water, landfill, pollution prevention, recycling, and traffic discussions apply.	Water consumption equates to about 13 percent of the system capacity. The WWTP would continue to operate at about 79 percent of capacity. The Base would continue to consume electricity at a rate that equates to about 4 percent of the GPA generation capacity. The existing communications system would meet the immediate needs of the Base. Storm water would be managed using existing procedures and runoff would continue at existing rates. A study is currently being conducted to investigate the possibility of vertically extending the current landfill for use beyond 2009. The study should be completed in January 2007. Thus, Andersen AFB plans to use the expanded on-Base landfill until 2009 or later if the current study supports expansion, and then use a permitted landfill. Although it is not known at this time which landfill would be used, there are two possible options: (1) the proposed GovGuam landfill after it becomes available in 2009-2010; and (2) the Navy landfill. Planning for the GovGuam landfill has not progressed to the point where the capacities or life span is known. Therefore, quantitative analysis of the impact of the No Action Alternative on the landfill cannot be accomplished.

Table 4.13-1 Summary of Environmental Impacts for Alternative A, Alternative B, and No Action Alternative (*continued*)

Resource	Alternative A	Alternative B	No Action Alternative
Infrastructure and Utilities (cont'd)	The LOS for the intersection of Arc Light Boulevard and Highway 1 and Route 9 at the Main Gate would be LOS C or better during the peak hours of traffic. At LOS C most experienced drivers are comfortable, roads remain safely below but efficiently close to capacity, and posted speed is maintained. Traffic at the intersection of the Commercial Gate and Route 9 would operate at LOS B or better. Some congestion and impingement of maneuverability occur at LOS B and two motorists might be forced to drive side by side, limiting lane changes.		The LOS for the intersection of Arc Light Boulevard and Highway 1 and Route 9 at the Main Gate would remain at LOS B during the peak hours of traffic.
Biological Resources	Construction activities associated with Alternative A would remove 73.9 hectares (182.6 acres) of vegetated land. Vegetated community types subject to removal vary in composition and structure, and therefore, have varying importance to biological resources. Of the 73.9 hectares (182.6 acres) that would be subject to clearing, 57.5 hectares (142.1 acres) can be considered suitable habitat for the listed species. amounting to 1.3 percent of the Refuge Overlay and the Ritidian Unit of the GNWR. Alternative A would also displace ungulates into adjacent habitats, as well as exotic predators (BTS, rats, cats, dogs). Indirect effects from facility operation and construction include the loss of between 80 and 147 hectares (197 – 334 acres) of foraging habitat and between 101 and 147 hectares (249 – 363 acres) of foraging/nesting habitat for the various listed species considered in this EIS. Aircraft operations would increase incrementally under Alternative A. Overflights of Mariana fruit bat foraging and roosting areas, as well as areas suitable for foraging and nesting for Mariana crows, would occur. Much of the acoustic noise associated with aircraft noise is below 2 kHz. Habituation to noise resulting from aircraft overflight would be expected, especially since aircraft overflights would be incrementally increased over a multi-year period. Construction activities and aircraft operations may affect listed species; however, conservation measures would offset any adverse effects. These conservation measures, as part of Alternative A, include an ungulate management program involving ungulate exclosure units near Ritidian Point (200 hectares or 494 acres). Conservation measures also propose to reduce predation of Mariana fruit bat pups at the Pati Point bat colony, foraging plot outplanting, *T.rotensis* sapling transplanting, as well as a BTS interdiction program. Management activities would be conducted by a Wildlife Management Specialist working in cooperation with GovGuam and federal resource agencies. Vegetation studies would also be accomplished as part of Alternative A. Alternative A conservation measures support projects outlined in the Andersen AFB INRMP recovery actions listed in various USFWS recovery plans, and address general conservation issues on Guam.	The discussion analysis for Alternative A apply to Alternative B.	No clearing of vegetation would occur under the No Action Alternative. The degradation of forest communities would continue under current conditions, including browse pressure and encroachment of herbaceous species. Plant and animal species resources, which include threatened and endangered species, would not change from current conditions. Further, recovery actions outlined in various USFWS recovery plans would not be supported under the No Action alternative.

Table 4.13-1 Summary of Environmental Impacts for Alternative A, Alternative B, and No Action Alternative (*continued*)

Resource	Alternative A	Alternative B	No Action Alternative
Biological Resources (cont'd)	Formal consultation with USFWS under Section 7 of the ESA resulted in the issuance of a BO, which concluded that the ISR/Strike project is not likely to jeopardize the continued existence of the Mariana fruit bat, Mariana crow, Micronesian kingfisher, Guam rail, or other off-site species listed under the ESA. An incidental take statement, as part of the BO, anticipates the harm of one Mariana fruit bat, mortality of 21 fruit bats on Guam, mortality of 36 fruit bats on Rota, and the harassment of two colonies. This determination is based on the conservation measures described in Subsection 2.2.1.2, as well as Air Force commitments to non-discretionary measures in the BO that seek to minimize disturbance, injury, and death to Mariana fruit bats due to the ISR/Strike project. Take is not anticipated for the other species considered in the analysis of this EIS.		
Groundwater Resources	Water withdrawal from the aquifer would increase by 0.71 percent and the resulting withdrawal would be 6.52 percent of the daily water withdrawn from the aquifer. The use of erosion control techniques during and after construction completion would minimize the potential for groundwater contamination. Base personnel would continue to monitor all construction activity and require an EPP that identifies the actions necessary to reduce or preclude surface contamination from entering the UIC wells.	Water withdrawal from the aquifer would increase by 0.44 percent and the resulting withdrawal would be 6.25 percent of the daily water withdrawn from the aquifer. The erosion control and monitoring discussion for Alternative A applies.	Water withdrawal from the aquifer for Base activities would remain at approximately 2.5 mgd, which is about 5.81 percent of the total daily water withdrawal from the aquifer. The erosion control and monitoring discussion for Alternative A applies.
Earth Resources	New facilities would be constructed to ensure structural stability due to the potential for seismic activity on Guam. Ground disturbance would occur in areas previously disturbed by construction, and no topographic features would be affected. Erosion control measures identified in the EPP that would be prepared for the construction projects, and which would be implemented by the construction contractor, would minimize erosion. Local government clearances from the Depart of Agriculture, Department of Parks and Recreation, and the Historic Preservation Office would be obtained Prior to the commencement of earthmoving activities.	The Alternative A discussion applies.	Continued use of the erosion control measures identified in the Base's SWPPP would minimize erosion.

Table 4.13-1 Summary of Environmental Impacts for Alternative A, Alternative B, and No Action Alternative (*continued*)

Resource	Alternative A	Alternative B	No Action Alternative
Hazardous Materials and Waste	Contractors would be required to use and store hazardous materials in accordance with Base procedures. The contractor would manage hazardous materials and waste in accordance with Andersen AFB, local, and federal guidance, and would be responsible for the storage, treatment, disposal, and transportation off-Guam of any hazardous waste and hazardous material with an expired shelf-life, is out dated, unopened, and/or unused. Hazardous waste and overages of hazardous material would not become the burden of the 36th Wing, Andersen AFB, or the Department of Defense. The existing Base hazardous materials handling processes and procedures would be modified to include any materials needed for the ISR/Strike activities not currently purchased for on-Base use. The quantity of waste generated during construction would be negligible and limited to equipment maintenance products. Any hazardous waste generated during construction would be handled in accordance with federal and local laws and regulations. The Base would dispense about 64,000 gallons of jet fuel daily, which is 0.1 percent of the storage capacity. It is not likely any new hazardous waste streams would occur because of the similarity between the aircraft that operate from the Base under the baseline and those expected with implementation of Alternative A. The existing hazardous waste management processes and procedures should accommodate the waste generated under Alternative A. However, Andersen AFB would increase the 90-day waste storage capacity because the volume of hazardous waste would increase with the addition of as many as 70 aircraft. The construction contractor would be responsible for impacted soil materials at a construction site. Should impacted soil be removed from the site, the construction contractor would be responsible for sampling and characterizing the soil prior to disposal to determine the proper disposal and transportation management methods. Soil that meets hazardous criteria must be managed in accordance with applicable federal requirements, including proper disposal, treatment (if necessary), and transportation. The construction contractor would be responsible for handling and disposal of any Installation Restoration Program (IRP)-related material at an Alternative A site, including a site that is built on top of a known IRP or military munitions response site that has not been completed under the remedial action process. Alternative A construction projects must not hinder access to current IRP sites, areas of concern, other contaminated areas, monitoring wells, and remedial systems for sampling and O&M activities. Average daily jet fuel consumption would equate to about 0.1 percent of the Base's fuel storage capacity.	The Alternative A discussion applies.	Hazardous media and the IRP would continue to be managed using current procedures and guidance. The Base would continue to dispense about 6,027 gallons of jet fuel daily, which is 0.01 percent of the storage capacity.

Table 4.13-1 Summary of Environmental Impacts for Alternative A, Alternative B, and No Action Alternative (*continued*)

Resource	Alternative A	Alternative B	No Action Alternative
Cultural Resources	The Air Force completed the Section 106 process with the GSHPO and accomplished cultural resource surveys in the previously unsurveyed area in which ISR/Strike facilities would be constructed. A report of findings and management recommendations for these properties was submitted to the GSHPO. Based on review of the Executive Summary of the cultural resources inventory, the GSHPO responded in an October 3, 2006 letter that "Further archaeological investigation on prehistoric sites at ISR/Strike will not provide any new information about the project area, but such an investigation will only be redundant to what we already know about the project."	The Alternative A discussion applies.	Cultural resources would continue to be managed in accordance with procedures defined in the Base's ICRMP
Socioeconomic Resources	There would be an overall increase of 3,000 on-Base personnel when considering military personnel and dependents. The off-Base population would temporarily increase for the duration of construction activities because as many as 1,800 skilled U.S. workers from elsewhere in the U.S. would be necessary due to the shortage of local labor on Guam. Construction of on-Base family housing units and dormitories would accommodate the additional personnel. Additional housing for skilled U.S. workers from elsewhere in the U.S. would have to be augmented and supplied from alternative housing sources. Expansion of the DoDEA schools and the addition of teaching/staff support would most likely be necessary to accommodate the potential enrollment increase. The addition of as many as 440 elementary/middle school students to the existing enrollment would exceed the school capacity by about 218 students. The addition of as many as 110 high school students would exceed the school capacity by about 95 students. One of the ISR/Strike projects would construct a DoDEA high school, which would accommodate the additional high school students. Vacated space in the existing high school could be used to accommodate the additional elementary/middle school students. Employment generated by construction activities would result in wages paid, and increase expenditures for local and regional services and supplies during construction. The addition of personnel would result in an increase in wages paid, business sales, and income to the local and regional economy. Interrelated impacts on the physical and natural environment were minimum due to social and economic effects.	There would be an overall increase of 1,850 on-Base personnel when considering military personnel and dependents. The off-Base population would temporarily increase for the duration of the construction activities because as many as 1,600 skilled U.S. workers from elsewhere in the U.S. would be necessary due to the shortage of local labor on Guam. Use of the current inventory of on-Base family housing units and construction of dormitories would accommodate the additional personnel, with some renovations necessary. New dormitory spaces would be constructed to accommodate unaccompanied military personnel. The addition of as many as 70 elementary/middle school students to the existing enrollment would expand the student population, but not exceed capacity. The addition of as many as 20 high school students would exceed the school capacity by about 5 students. One of the ISR/Strike projects would construct a DoDEA high school, which would accommodate the additional high school students. The wages paid, business sales, income to the local and regional economy, and interrelated impacts on the physical and natural environment discussion for Alternative A apply.	The activities and operations that occur under the baseline would continue and there would be no change to the population, housing, education, or economic conditions.

Table 4.13-1 Summary of Environmental Impacts for Alternative A, Alternative B, and No Action Alternative (*continued*)

Resource	Alternative A	Alternative B	No Action Alternative
Airfield Operations, Aircraft Safety, and Bird-Aircraft Strike Hazard	The airfield has the capacity to accommodate the approximate 45 percent increase in airfield operations. Additional arrival, departure, and closed pattern flight tracks and related air traffic control procedures would be added to Runway 06L/24R for use by the ISR/Strike fighter aircraft. The air traffic control tower and Guam Approach and Departure Control would establish procedures for the additional flight tracks. The airspace can accommodate the additional flight tracks, and the control procedures needed for the additional traffic patterns would not conflict with the existing procedures. The aircraft flight profiles associated with the ISR/Strike aircraft would not be affected by, nor would they affect, the restrictions that limit aircraft overflight of MSA 1, Mariana crow territories, and the Mariana fruit bat colony. The probability is low that an aircraft involved in an accident at or around the Andersen AFB airfield would strike a person or structure on the ground. It is estimated that approximately four annual bird/wildlife aircraft strikes would occur. It is unlikely that any of these bird/wildlife aircraft strike incidents would result in an aircraft accident, involve injury either to aircrews or to the public, or damage to property (other than the aircraft). The flight regimes of the Mariana crow and Mariana fruit bat and the altitudes of aircraft would provide sufficient separation to avoid strikes with aircraft.	The airfield has the capacity to accommodate the approximate 41 percent increase in airfield operations. The flight track addition, airspace, aircraft safety, and bird/wildlife aircraft strike analyses for Alternative A apply.	The existing air traffic control procedures accommodate the 85,734 annual airfield operations and the airfield has the capacity for the operations. The existing conditions for aircraft safety and bird/wildlife aircraft strike incidents would continue because there would be no change in the type and level of airfield operations.
Environmental Justice	Alternative A would not result in any environmental impacts to low-income or minority populations that are disproportionately high or adverse as compared to the impacts on the general population. Alternative A would not cause adverse impacts to human health or the environment of neighboring populations. Because significant environmental impacts would not result, no disproportionately high or adverse effects to minority and low-income populations in the Andersen AFB area would occur.	The Alternative A discussion applies.	No changes to existing and planned noise conditions would occur. Disproportionately adverse effects to minority and low-income populations would not occur.

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Table 4.13-2 Summary of Cumulative Impacts

Resource	Cumulative Impacts
Noise	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. Receptors in the vicinity of ISR/Strike and other action facility construction projects could include persons within 100 feet of noise emanating from equipment operating simultaneously at two construction sites. Construction noise would be temporary, would occur only during daytime, and would cease when the project is completed.
Land Use	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. As with Alternative A, the other facility actions would be accomplished in accordance with the Andersen AFB General Plan. Facility construction and use would be consistent with land use plans and programs identified in the General Plan. None of the other facilities that would be constructed would interfere with existing access to non-Air Force land between Andersen AFB, the Pacific Ocean, and the Philippine Sea. Existing access procedures would be continued.
Air Quality	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. None of the construction emissions or the recurring emissions cause a violation of federal standards. A General Conformity Rule Conformity Determination would not be required.
Infrastructure and Utilities	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. Water consumption would be about 20 percent of system capacity. The WWTP would operate at 82 percent of capacity. The Base would continue negotiating with the GWA to determine the amount of wastewater the Base will be allowed to send to the Northern WWTP. Electricity use would equate to about 46 percent of the GPA generation capacity. The additional impervious cover would equate to a 19 percent increase, and the amount of storm water runoff could increase accordingly. The loss of wells that inject storm water into the aquifer should not present a problem because there are other nearby wells that currently are under capacity and to which storm water can be channeled. New designs that incorporate devices to increase ponding and retention (pre-treatment) would be implemented. New oil/water separator systems would also be required. Construction contractors would ensure an EPP is completed, provided to Andersen AFB for submittal to Guam EPA, and approved before initiating activities. It is estimated the landfill would reach 100 percent capacity by December 2007, regardless of Alternative A and other action activities. A study is currently being conducted to investigate the possibility of vertically extending the current landfill for use beyond 2009. The study is scheduled for completion in January 2007. Thus, Andersen AFB plans to use the expanded on-Base landfill until 2009 or later if the current study supports expansion, and then use a permitted landfill. Although it is not known at this time which landfill would be used, there are three possible options: (1) the proposed GovGuam landfill after it becomes available in 2009-2010; (2) the on-Base landfill that would be constructed as an ISR/Strike project; and (3) the Navy landfill. Planning for the GovGuam and ISR/Strike landfills has not progressed to the point where the capacities or life spans are known. Therefore, quantitative analysis of the impact of the ISR/Strike project on the landfill cannot be accomplished. The Base would submit the permit application for Guam EPA coordination for the ISR/Strike landfill project. All green waste would continue to be segregated and collected for mulching, chipping, and composting or burned in small piles on site after obtaining a burning permit from the local fire department. Andersen AFB would continue its aggressive pollution prevention and recycling program to divert solid waste. One of the other action projects would construct a waste-to-energy plant at Andersen AFB. Construction and operation of the facility would reduce the amount of material that would be landfilled. It is not possible to determine at this time how much MSW could be diverted to the WTE plant because planning for the plant has not been initiated. Contracts issued for construction activities would require the contractor to recycle construction and demolition debris to the maximum extent possible. The LOS for the intersection of Arc Light Boulevard and Highway 1 and Route 9 at the Main Gate would be LOS C or better during the peak hours of traffic. Traffic at the intersection of the Commercial Gate and Route 9 would operate at LOS B or better.

Table 4.13-2 Summary of Cumulative Impacts (*continued*)

Resource	Cumulative Impacts
Biological Resources	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. Under Alternative A and other actions, 122.7 hectares (303.2 acres) of vegetated land would be subject to removal, which represents 2.7 percent of the Refuge Overlay and the Ritidian Unit of the GNWR. Removal of habitat for ungulates and exotic predators would displace these species into adjacent habitats. The cumulative effects of noise on Mariana fruit bats and Mariana crows include periodic noise events from training activities in Northwest Field, as well as an incremental increase in aircraft overflights at Andersen main. No action of Alternative A or other actions would affect Area 50, or the proposed HMU; therefore, recovery efforts would not be affected. Because clearing activities and noise events occur in areas suitable for foraging and roosting/nesting for the Mariana fruit bat, Mariana crow, and potential habitat for recovery of other species, cumulative actions may affect listed species. Construction associated with the ASA project would impact a known female Mariana fruit bat foraging area. Therefore, clearing for the ASA project would represent an adverse effect. This forest removal would not jeopardize the continued existence of the Mariana fruit bat or adversely modify overall habitat. Conservation measures of Alternative A and other actions, however, reduce adverse effects. Under Alternative A and other actions, 336 hectares (830 acres) would be subject to ungulate exclosure fencing and ungulate depredation hunting. Of these 336 hectares (830 acres), Area 50 (22 hectares or 54 acres) and the new HMU (60 hectares or 148 acres) would be subject to exotic predator control with suitable exotic predator exclosure fencing. Conservation measures seek to create alternative habitat for Mariana fruit bats and Mariana crows by outplanting of foraging plots within exclosure areas. BTS control would be put into place at Pati Point, along with the 36 WI 32-7004 (100 percent inspection of outbound flights). Pursuant to §7 of the Endangered Species Act, the foreseeable cumulative effects would not result in any demonstrable adverse consequences.
Groundwater Resources	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. Water withdrawal from the aquifer would increase by 1.15 percent and the resulting withdrawal would be 6.96 percent of the daily water withdrawn from the aquifer. The use of erosion control techniques and monitoring storm water during construction and after the projects are completed would minimize the potential for groundwater contamination.
Earth Resources	The types of construction activities associated with the other actions would be almost identical to those for Alternative A. Therefore, the discussion and analysis for Alternative A applies to the cumulative impact analysis.
Hazardous Materials and Waste	The construction contractor for other projects would be required to comply with the regulatory requirements identified for the No Action Alternative and Alternative A. Although some of the other actions may be adjacent to a project site under the No Action Alternative and Alternative A, use of regulatory requirements identified for these alternatives would minimize the potential for cumulative impacts. When completed, activities at the other facilities would be managed in accordance with applicable environmental plans and policies.
Cultural Resources	The ISR/Strike project is one of a number of other planned projects involving construction on Andersen AFB. The potential for cumulative impacts from the ISR/Strike and other actions is minimal based on the distance between project sites, especially for the Northwest Field project. Additionally, the Air Force accomplished the Section 106 process for the Northwest Field project. The potential for cumulative impacts between the ISR/Strike projects and other projects would be prevented or minimized through implementation of the procedures identified in the Andersen AFB ICRMP When combining the other actions with the ISR/Strike project through the consultation process, no cumulative adverse effects on significant cultural resources, including visual resources, would occur.

Table 4.13-2 Summary of Cumulative Impacts (*continued*)

Resource	Cumulative Impacts
Socioeconomic Resources	Alternative A has the potential for greater impacts than Alternative B and, therefore, only the summary for Alternative A is presented. On-Base population would increase by 4,248 personnel when considering military personnel, dependents, and students undergoing training. Off-Base population would temporarily increase for the duration of the construction activities because importing as many as 2,080 contract workers would be necessary due to the shortage of local labor on Guam. Nearly all the inventory of 484 off-Base units would be needed to meet the shortfall of 474 on-Base family housing units. The addition of as many as 765 elementary/middle school students to the existing enrollment would exceed the school capacity by about 543 students. The addition of as many as 185 high school students to the existing enrollment would exceed the school capacity by about 170 students. One of the ISR/Strike projects would construct a DoDEA high school, which would accommodate the additional high school students. Vacated space in the existing high school should be able to accommodate the additional elementary/middle school students. Should additional space be needed, portable buildings similar to those used by public school districts could be used to alleviate overcrowding. Employment generated by construction activities would result in wages paid, and increase expenditures for local and regional services and supplies during construction. The addition of 1,100 personnel authorizations would result in an increase in wages paid, business sales, and income to the local and regional economy.
Airfield Operations, Aircraft Safety, and Bird-Aircraft Strike Hazard	None of the other actions proposed at Andersen AFB include aircraft basing or airfield operations. Therefore, no cumulative airfield operations, aircraft safety, or bird/wildlife aircraft strike impacts would occur.
Environmental Justice	None of the other actions would have the potential for off-Base noise. Establishment and operation of the ISR/Strike capability, when combined with other planned projects, would not contribute cumulative impacts to minority or low-income populations in the area.

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CHAPTER 6
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The following persons and agencies consulted during preparation of this EIS.

Federal Agencies

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