

## CHAPTER 10.

# TERRESTRIAL BIOLOGICAL RESOURCES

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### 10.1 AFFECTED ENVIRONMENT

This chapter describes the plant and animal species and habitats that occur in terrestrial and wetland environments potentially impacted by the proposed action. The region of influence (ROI) encompasses the lands that support terrestrial biological resources (i.e., individual species, their habitats, and areas of habitat connectivity) that may be affected directly or indirectly by the proposed action. The ROI varies depending on the type of disturbance and the resource being considered. Construction, operations, and/or training activities have the potential to impact biological resources. Potential activities that may cause impact include, but are not limited to, ground-disturbing activities, noise, operational movement (e.g. vehicle traffic), and biosecurity mitigation. Site-specific ROIs are discussed for the following project areas: Andersen Air Force Base (AFB), Naval Computer and Telecommunications Site (NCTS) Finegayan, former Federal Aviation Administration (FAA) Parcel, South Finegayan, Harmon Annex, Andersen South, Route 15 lands, Air Force Barrigada, Navy Barrigada, Naval Base Guam, Cabras Parcel, Naval Munitions Site (NMS) and associated proposed access road, and Guam-wide roadways proposed for improvements (Figure 10.1-1).

#### 10.1.1 Definition of Resource

The analysis focuses on species and vegetation communities crucial to the functions of biological systems, of special public importance, or that are protected under federal or local law or statute. For the purposes of this document, terrestrial biological resources are divided into three categories: *vegetation communities*, *wildlife*, and *special-status species*. Special-status species include those species listed under the Endangered Species Act (ESA), candidates for ESA listing, and those listed as threatened or endangered by Guam law. Species mentioned in this section are described using the common name when there is an accepted English common name. Scientific names are provided in Appendix G. If available, the Chamorro name is provided in parentheses when the species is first mentioned in the text.

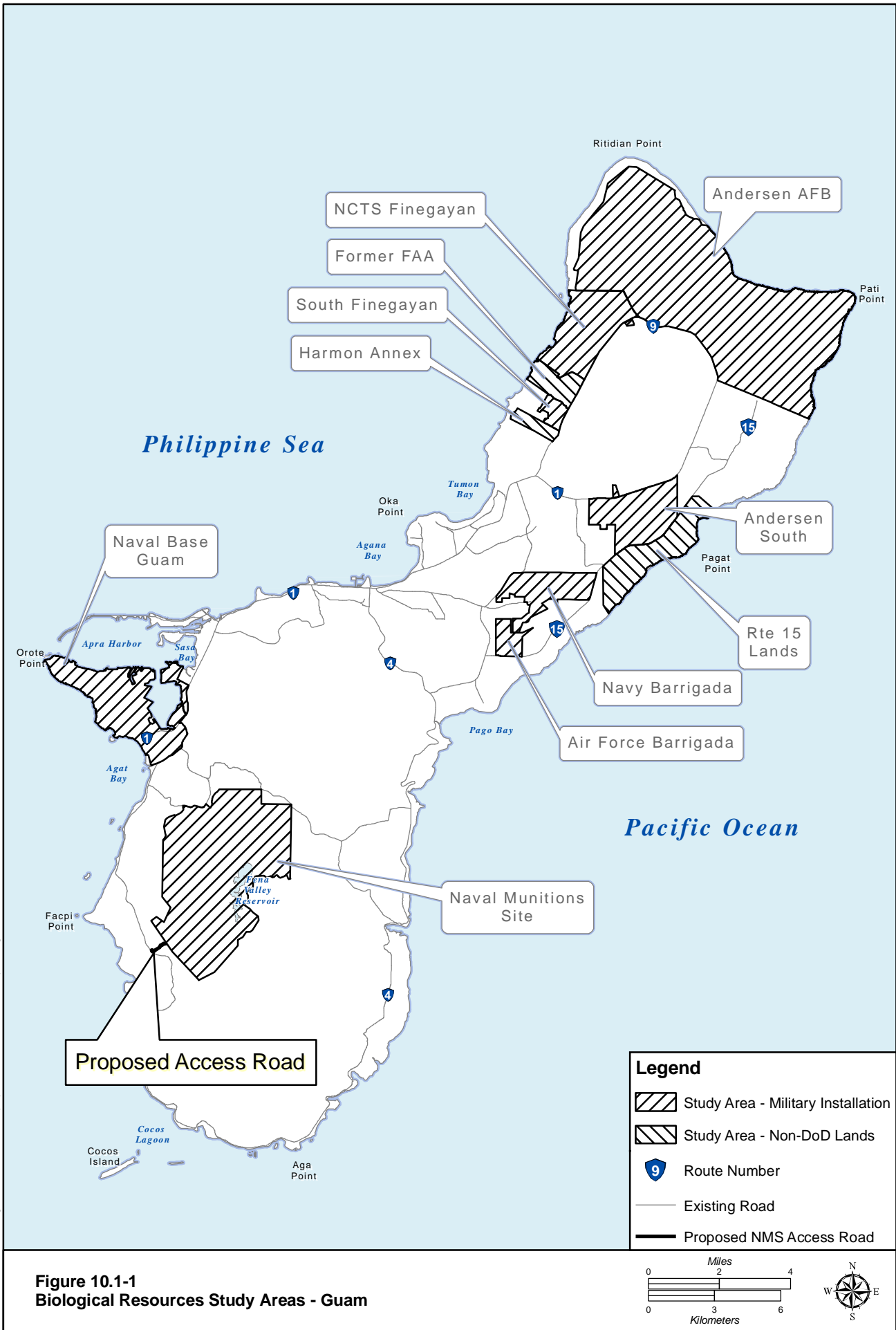
##### 10.1.1.1 Vegetation Communities

The vegetation of Guam was initially described by Fosberg (1960). A comprehensive flora was published a decade later (Stone 1970), and an update to Fosberg (1960) was published in 1998 (Mueller-Dombois and Fosberg 1998). These authors demonstrated that the flora of Guam is unique, with 21% of its native vascular plants endemic to the Mariana Islands.

Donnegan et al. (2004) completed a forest inventory and for Guam and they estimated that approximately 48 percent of the island was forested which consisted of 44,404 ac (17,970 ha) classified as limestone forest, with most found in northern Guam, and 19,129 ac (7,741 ha) classified as volcanic forest, with most found in southern Guam. Other vegetation or cover types included 44,455 ac (17,991 ha) of savanna and 23,956 ac (9,695 ha) of urban land.

Guam's vegetation types can be grouped into the following general plant communities: primary limestone forest (intact and never cleared), disturbed limestone forest (secondary, dominated by non-native species), halophytic/xerophytic scrub (adapted to grow in salt-laden air and dry conditions), scrub forest, tangantangan forest, strand, ravine forest, coconut groves, ironwood or Australian pine forest, savanna, wetlands, and developed.

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Intact limestone plant communities are floristically diverse, containing both native and non-native woody plants, ferns, and herbaceous plants adapted to shallow and excessively drained shallow limestone soils. Historically, the undisturbed limestone forest of Guam was a tall, closed canopy forest dominated by very large native breadfruit (called dugdug in Chamorro) and fig (nunu) trees with a maximum height of 60-70 feet (ft) (18-21 meters [m]). In areas of typhoon blowdowns, denser understory vegetation is dominated by ferns, herbaceous vegetation, and small shrubby species (Quinata 1994).

Most relatively accessible areas on Guam have been disturbed by human activity, and more inaccessible areas in southern Guam have been disturbed by fire. These disturbed plant communities in limestone regions are sometimes called degraded, or secondary communities, and are often dominated by *Vitex parviflora* (hereafter called *Vitex*), a non-native medium-sized tree.

Vegetation surveys and mapping have been completed for the Department of Defense (DoD) and non-DoD lands under consideration for use in this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). For some areas, mapping and associated vegetation naming occurred at different times using different categories. Island-wide vegetation mapping was completed in 2005 by the United States Forest Service (USFS) (USFS 2006), but the mapping had minimal ground-truthing and used only one category for limestone forest, as opposed to the more commonly accepted method of describing limestone forest with multiple categories based on their degree of disturbance. The island-wide mapping lacks the necessary detail for an accurate description of the smaller parcels proposed for use under the proposed action.

In the site-specific subsections to follow, vegetation categories and mapping for each parcel are described and presented based on the best available published data for that parcel, with some modifications based on observations during site-specific field surveys conducted in support of this EIS/OEIS. The published sources are the Integrated Natural Resources Management Plan (INRMP) for Guam Navy lands (Commander Navy Region [COMNAV] Marianas 2001), base-wide vegetation mapping for Andersen AFB (Andersen AFB 2008c), and mapping by the USFS (2006a). Although the USFS effort is a more recent vegetation mapping that includes Navy installations, it is island-wide and at a grosser scale; the level of detail is greater in the INRMP, which more accurately captures the complexity of the vegetation mosaic at a parcel-specific scale. Therefore, the more detailed mapping would be used in this document where it is available, for smaller parcels such as NCTS Finegayan, South Finegayan, and Navy Barrigada.

As a means of introduction to the vegetation communities present on Guam, a general description of the vegetation categories is provided below based on descriptions by Fosberg (1960) and modified in the 2001 Navy INRMP (COMNAV Marianas 2001), and with some additional modifications based on USFS (2006a). The vegetation types for recent mapping at Andersen AFB (2008c) are correlated to these vegetation types at the end of each description when their designated names are different.

### Limestone Forest

This community type is a relatively undisturbed (never totally cleared) forest dominated by native species, sometimes called primary limestone forest to distinguish it from disturbed limestone forest (see next category). It is found on elevated limestone terraces, plateaus, and slopes and is present on Andersen AFB, NCTS Finegayan, Naval Base Guam, Navy Barrigada, Route 15 lands, and NMS. Primary limestone plant communities are floristically diverse, containing both native and non-native woody plants, ferns, and herbaceous plants adapted to shallow and excessively drained shallow limestone soils. In its most undisturbed state, these plant communities characteristically have a stratified canopy consisting of scattered, large trees, native breadfruit, and fig with a maximum height of 60-70 ft (18-21 m). The limestone plant community is further broken down into five classes by Fosberg (1960): *Artocarpus-Ficus*

forest, *Mammea* forest, *Cordia* forest, *Merrilliodendron-Ficus* forest, and *Pandanus* forest. Other dominant genera comprising both the upper canopy and mid-canopy layers include *Aglaia*, *Neisosperma*, *Premna*, *Tristiropsis*, *Elaeocarpus*, *Intsia*, *Pisonia*, and *Claoxylon*. Mid-canopy layers may be 30-45 ft (9-14 m) in height. Smaller specimens of the above species, as well as individuals of *Guamia mariannae* (pai pai), *Cycas circinalis* (= *miconesica*), Indian mulberry, and limeberry, are often present as a shorter understory layer.

Vegetation types at Andersen AFB that are considered to correspond to primary limestone forest for the purposes of this EIS/OEIS are: *Eugenia* forest, mixed limestone forest-plateau/primary, mixed limestone forest-toe slope/primary, and *Neisosperma* forest (only *Neisosperma* is mapped separately in this EIS/OEIS).

#### Disturbed Limestone Forest

The disturbed sub-type of the limestone vegetation community is sometimes referred to as degraded limestone forest or secondary limestone forest. Disturbed limestone forests are dominated by woody species of relatively short stature (no canopy), or they have a canopy of non-native *Vitex*. The floristic composition represents subclimax seral stages following human induced disturbance, such as land clearing. The canopy of disturbed limestone forest is more open, allowing abundant sunlight to reach the forest floor. The majority of the woody biomass in the disturbed limestone forest is usually derived from non-native species, primarily tangantangan, limeberry, papaya, and others. Some areas of disturbed limestone forest are also dominated by larger non-native trees, such as African tulip tree. Vegetation types at Andersen AFB that are considered to correspond to disturbed limestone forest for the purposes of this EIS/OEIS are mixed limestone forest-plateau/secondary, *Hibiscus* scrub, mixed shrub, *Ochrosia* edge, *Vitex*-closed canopy, and *Vitex*-open canopy.

#### Halophytic/Xerophytic Scrub

The halophytic/xerophytic scrub sub-type of the limestone vegetation community is a unique plant community that exists on limestone terraces and cliff edges. The presence of drying winds, exposure to salt spray, and excessively drained limestone soils result in a microclimate that supports a stunted, wind-pruned plant community. The floristic composition may either be simple or complex and comprised of a few or many species. Vegetation types at Andersen AFB that are considered to correspond to halophytic/xerophytic scrub for the purposes of this EIS/OEIS are: mixed limestone forest-foreslope, *Hibiscus-Ochrosia* scrub, and mixed limestone forest-toe slope.

#### Shrub/Grasslands (Scrub Forest)

These are variable secondary thickets and partially cultivated scrub resulting from long-continued human disturbance, usually on argillaceous limestone. They may include small areas of coconut grove, bamboo clumps, patches of scrub or scrub forest, home sites, and small cultivated areas. The vegetation type at Andersen AFB that is considered to correspond to shrub/grasslands for the purposes of this EIS/OEIS is mixed herbaceous scrub.

#### Tangantangan

This community typically occurs on limestone and is dominated by the introduced small tree, tangantangan. The vegetation type at Andersen AFB that is considered to correspond to tangantangan for the purposes of this EIS/OEIS is *Hibiscus-Leucaena*.



### Strand

Strand plant communities are limited to narrow strips in coastal areas within Naval Base Guam and NCTS Finegayan. Strand vegetation is adapted to excessively drained soils and salt spray from the adjacent coastal waters. Many of the beach areas are occasionally inundated with salt water during storm events, which imposes a controlling influence on all biota. Vegetation types at Andersen AFB that are considered to correspond to strand for the purposes of this EIS/OEIS are: back strand/rock, back strand/sand, fore strand/sand, and strand/rock.

### Ravine Forest

Fosberg (1960) classified the forest vegetation in valleys and ravines in southern Guam as ravine forests. Although the floristic composition of the ravine communities is sometimes similar to limestone communities, these forests are generally located on volcanic soils or on argillaceous limestone soils, and are quite variable in floristic composition. Plant communities are often defined by the variability in soil moisture, which can be substantial in this varied topography. Species present often include sea hibiscus, pandanus, fig, *Glochidion mariannensis* (chosga), *Premna obtusifolia*, breadfruit, *Neisosperma oppositifolia*, *Ochrosia mariannensis*, and Alexandrian laurel. Due to their proximity to freshwater streams in southern Guam, these plant communities contain many species of cultivated plants. Epiphytes and common woody climbers are also present. Some areas of ravine forest are disturbed and these are usually dominated by non-native woody species with a more open canopy. *Vitex*, *Cananga odorata*, and Indian mulberry are common components of disturbed ravine forest on Navy lands. The open understory is occupied by various non-native grasses, vines and weeds. Swamps are delineated as ravine communities and these are often present on argillaceous limestone soils on bottomlands, and also in depressional areas. Sea hibiscus and pandanus are the most common woody species associated with these communities.

### Coconut Grove

These planted communities are inclusive within limestone, ravine, and strand communities.

### Casuarina Forest

Ironwood or Australian pine tolerates dry and salty conditions, and often occurs as a savanna habitat. In some locations, it forms a sparse woodland with little understory. Ironwood also occurs in exposed areas and in narrow bands at some locations along the coast.

### Savanna

Savannas, which are defined as grasslands with scattered trees or clumps of trees, cover extensive areas in southern Guam. Savannas are predominantly found on volcanic soils and are maintained by periodic human-ignited burning. Plants are adapted to the acidic and high aluminum content of the highly weathered volcanic soils. Fosberg (1960) recognized five savanna plant communities: sword grass (*Miscanthus*) community; *Dimeria* community, erosion-scar community; reed (*Phragmites*) community; and weed community. The *Miscanthus* community is dominated by Pacific Island silvergrass, which can reach 10-15 ft (3-4.6 m) in height. Because it is a bunch grass, as much as 30-40% of the ground surface is exposed mineral soil. The *Dimeria* community is dominated by the shorter grass species, *Dimeria chloridiformis*. Woody shrubs and trees are uncommon. The erosion-scar community has sparse plant growth, the result of top soil erosion from water and wind. The exposed sub-soil usually has a very low pH and lacks organic matter and many essential plant nutrients. *Gleichenia linearis* (a fern) is one of few plant species that can tolerate the low pH and lack of nutrients. The *Phragmites* community, dominated

by the reed *Phragmites karka*, usually indicates the presence of higher soil moisture resulting from seeps. The savanna weed community usually indicates recent disturbance in which the community is dominated by non-native pioneer plant species. Disturbance can be the result of fire, grazing, cultivation, or clearing.

### Wetlands

Wetlands are habitats that are subject to permanent or periodic inundation or prolonged soil saturation, including marshes, swamps, and similar areas. Areas described and mapped as wetland communities may include small streams, shallow ponds, and pond or lake edges. The recurrent excess of water in wetlands imposes controlling influences on all biota (plants, animals, and microbes). Stone (1970) referred to Fosberg's (1960) wetlands as marshes. Fosberg (1960) described seven subtypes of the wetland plant communities based on their dominant floristic composition. He defined swamps as supporting plant communities with a predominance of woody species (designated as ravine communities for the purpose of this vegetation classification), and marshes as supporting herbaceous plant communities.

Marshes are generally located in low places along the coast, along streams, in depressions and sinkholes with argillaceous limestones, or in poorly drained areas with volcanic soils. Marshes may be inundated with fresh water, or brackish water if near the ocean. Swamps are generally located along rivers, especially near the coast, or near sea level (along river valleys if inland), and are usually designated as ravine communities rather than wetland communities. Most marshes are floristically simple, with only a few plant species being dominant. The most common marsh species, *Phragmites karka*, a tall reedy perennial grass, often forms a dense monocultural plant community. *Scirpus littoralis*, a perennial bulrush that grows from rhizomes, also forms dense stands along stream banks and in estuaries. The large golden leatherfern can also dominate some marshes. Other floristic components of wetland plant communities can include sedge (*Cyperus* spp.), *Paspalum vaginatum*, and para grass.

### Developed Land (Urban/Alien)

These are human-occupied or otherwise highly disturbed areas that include lawns and other landscaped areas and impervious surfaces such as buildings, roads, and parking lots.

#### 10.1.1.2 Wildlife

For the purposes of this document, this category includes all common animal species, with the exception of those identified as listed, proposed for listing, or candidates under the federal ESA, and those species listed by Guam. The wildlife category includes invertebrates, fish, amphibians, reptiles, mammals, and birds, including native bird species protected under the Migratory Bird Treaty Act (MBTA). Assessment of a project's effects on migratory birds places an emphasis on "Species of Concern" as defined by Executive Order (EO) 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*.

To address the importance and problems associated with the introduction of non-native species to Guam and their impacts on native species, the wildlife discussion is subdivided into native and non-native species. EO 13112, *Invasive Species*, addresses responsibilities and initiatives of the Federal government for controlling invasive species, therefore these species are included as a significant component in of wildlife in this EIS/OEIS. Brief descriptions and life history information for wildlife species of special interest can be found in Volume 9, Appendix G.

A major factor in the current occurrence and distribution of all wildlife, including ESA- and Guam-listed species is the presence of the brown treesnake (BTS). The BTS impacts the economy, human health, and island ecology of Guam. This species was inadvertently introduced around 1949 from cargo that originated in New Guinea. There are numerous economic and safety considerations with the BTS, as

summarized by Fritts and Leasman-Tanner (2001). Since the snakes were introduced, they have been known to climb power poles and short circuit transformers resulting in an estimated outage in one out of three days, with more than 1,600 snake-caused outages occurred from 1978-1997 at costs of up to several million dollars per year. In addition, because the BTS is known to prey on eggs and birds, it has impacted the poultry industry and small farmers (most eggs for general consumption have to be imported). Regarding human health, BTS are a mildly venomous species, which has resulted in approximately 1 in 1,000 emergency room visits.

BTS were known to occur on Guam in the 1950-1980s but they were not seen as a threat as this is the first instance of a predatory snake arriving on an isolated island. BTS hunt and live in trees, and are active at night. The result of this introduction is 17 of 18 native bird species were severely impacted, and 12 of the 18 species were likely extirpated from the wild on Guam due to the direct impact of the BTS (Wiles et al. 2003). As a result of these impacts, Guam Department of Aquatic and Wildlife Resources (GDAWR) took into captivity the endemic Guam flightless rail and Guam Micronesian kingfisher to form the basis of a captive breeding program.

Efforts to control the BTS are mostly limited to preventing BTS from leaving Guam in cargo, by ship or air. DoD has collaborated with other partners and participated in the development of BTS-specific trapping techniques, BTS detection using sniffer dogs, fence design, and development of toxicants and delivery methods. While these efforts have had success, BTS originating on Guam have been found in Kwajalein, Pohnpei, Hawaii (Oahu), Diego Garcia, Spain, Alaska, Texas, Oklahoma, and CNMI (Rota, Tinian, and Saipan).

BTS has been determined as the greatest limiting factor to reintroduction and/or recovery of both Guam Micronesian kingfisher and Mariana crow on Guam (U.S. Fish and Wildlife Service [USFWS] 2005b, 2008a). Recovery plans for Mariana crow, Guam Micronesian kingfisher, Mariana fruit bat, Mariana swiftlet, Guam rail, and Mariana common moorhen call for BTS suppression and eradication. Unfortunately, over the last three decades, there has been limited funding for research on, 1) life history of BTS on Guam, 2) detection of snakes at low densities, and 3) heavy suppression over large geographic areas. In addition, there has not been a concentrated effort to eradicate the BTS island-wide. As a consequence, the few recovery efforts for ESA-listed species on Guam that have been attempted have been unsuccessful. The ultimate goal is to have Guam species successfully reproducing with individuals in the wild. Although habitat exists for these species, until BTS levels are controlled, recovery and/or reintroduction of ESA-listed bird species cannot occur. In addition, BTS numbers did not decrease after the loss of native birds because they eat a wide variety of prey. Now, the most abundant prey are introduced reptiles (e.g., skinks and geckos) that are common throughout the island.

#### 10.1.1.3 Special-Status Species

##### ESA-Listed and Candidate Species

ESA-listed species are defined as those plant and animal species currently listed by the USFWS under the ESA as threatened, endangered, or proposed as such. Candidates are plant or animal species for which USFWS has sufficient information on file regarding biological vulnerability and threats to support a proposal that would list them as endangered or threatened under the ESA, based on the most recent candidate review (USFWS 2008c). Brief descriptions and life history information for ESA-listed species can be found in Volume 9, Appendix G.

Of the ESA-listed and candidate species on Guam, seven ESA-listed and four candidate species are known to currently or potentially occur, on lands proposed for use under the proposed action

(Table 10.1-1). Currently DoD lands are the primary location, and often the only location, for most ESA-listed species remaining on Guam. Two endangered species have been extirpated (no longer present in the wild) from the island but have captive populations on Guam: Guam Micronesian kingfisher and Guam rail. Two candidate species – Mariana wandering butterfly and Pacific sheath-tailed bat – have been extirpated from Guam but are found in the Commonwealth of the Northern Mariana Islands (CNMI). Two ESA-listed endangered species are considered extinct: the Guam subspecies of the bridled white-eye and the little Mariana fruit bat.

**Table 10.1-1. Known or Potential Occurrence of ESA-listed, Candidate, and Guam-listed Species on Guam**

Group	Common Name/Chamorro Name/Scientific Name <sup>(1)</sup>	Status <sup>(2)</sup>	
		ESA	Guam
MAMMALS	<b>Mariana fruit bat/Fanihi</b>	T, CH	E
	†Little Mariana fruit bat/Fanihi	E	E
	×Pacific sheath-tailed bat/Payesyeyes	C	E
BIRDS	<b>Mariana crow/Aga</b>	E, CH	E
	†Guam bridled white-eye/Nossa	E	E
	‡Guam Micronesian kingfisher/Sihék	E, CH	E
	‡Guam rail/Koko	E	E
	<b>Micronesian starling/Sali</b>	-	E
	<b>Mariana swiftlet/Chuchaguak</b>	E	E
	<b>Mariana common moorhen/Palattat</b>	E	E
REPTILES	<b>Green sea turtle/Haggan bed'di</b>	T	T
	<b>Hawksbill turtle/Hagan karai</b>	E	E
	Micronesian gecko/Guali'ek	-	E
	Oceanic gecko/Achiek	-	E
	<b>Pacific slender-toed gecko/Guali'ek</b>	-	E
	Azure-tailed skink/Guali'ek Halom Tano'	-	E
	Slevin's skink/ Guali'ek Halom Tano'	-	E
	Snake-eyed skink /Guali'ek Halom Tano'	-	E
	Tide-pool skink /Guali'ek Kantun Tasi	-	E
<b>Moth skink/Guali'ek Halom Tano'</b>	-	E	
INVERTEBRATES	<b>Guam tree snail/Akaleha'</b>	C	E
	<b>Humped tree snail/Akaleha'</b>	C	E
	<b>Fragile tree snail/Akaleha'</b>	C	E
	×Mariana wandering butterfly/ -	C	-
	<b>Mariana eight-spot butterfly/Ababbang</b>	C	-
PLANTS	<b>Fire tree/Hayun lagu</b>	E	E
	<b>No common name/Ufa-halomtano/Heritiera longipetiolata</b>	-	E
	<b>No common name /-/Cyathea lunulata</b>	-	E

Notes: <sup>(1)</sup>Scientific names for all species with accepted common names are provided in Volume 9, Appendix G. **Bold** indicates present in the project areas; † = extinct; ‡ = extirpated in the wild, captive population established; × = extirpated on Guam but present in the CNMI.

<sup>(2)</sup> C = candidate, CH = critical habitat, E = endangered, T = threatened; Includes only nesting sea turtles;

Sources: Guam Division of Aquatic and Wildlife Resources (GDAWR) 2006; Andersen AFB 2008a; COMNAV Marianas 2008; USFWS 2008b, c.

### Guam-Listed Species

Guam-listed species are those designated by legislative authority in the Territory of Guam as species that are endangered or threatened (i.e., not ESA-listed species). A total of 15 species listed as either threatened or endangered by Guam are known to occur on lands proposed for use under the proposed action (see Table 10.1-1). Brief descriptions and life history information for Guam-listed species can be found in Volume 9, Appendix G.

### Critical Habitat, Overlay Refuge Lands, and Essential Habitat

Critical habitat is defined in section 3 of the ESA as, "... (i) the specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species." Conservation describes the use of all methods and procedures necessary to remove an endangered or a threatened species from listing under the ESA.

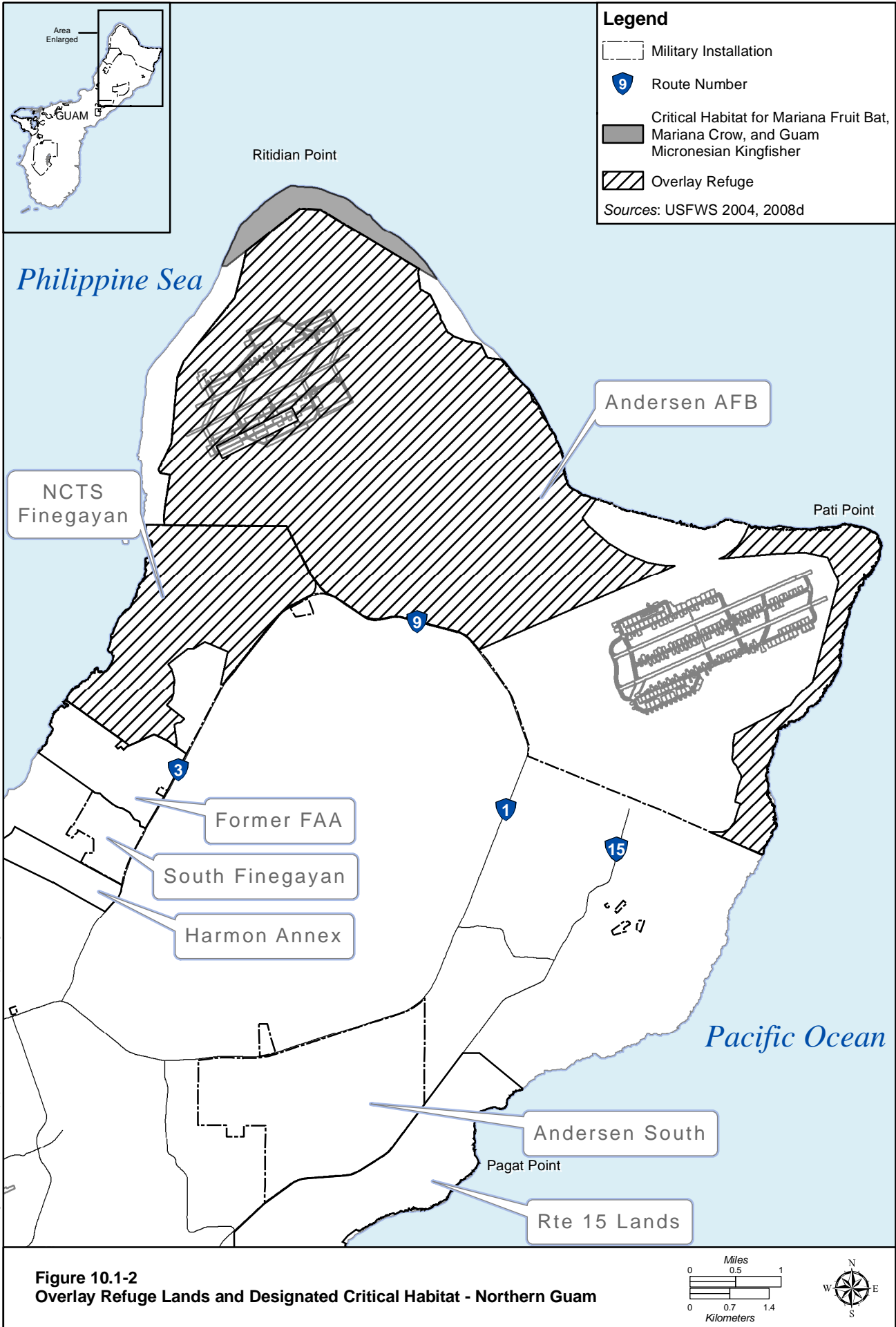
In 1991, the USFWS first issued a proposal for critical habitat for the Mariana fruit bat, Mariana crow, and Guam Micronesian kingfisher (USFWS 1991a). In 1993, the desire to create the Guam National Wildlife Refuge (NWR) was established by a Memorandum of Understanding with the USFWS, Navy, Air Force, and Government of Guam (GovGuam) (GovGuam et al. 1993). In 1994, Cooperative Agreements were signed between the Navy, Air Force, and USFWS to establish the Overlay Refuge (Air Force and USFWS 1994, Navy and USFWS 1994). The Cooperative Agreements defined the management and administrative roles and responsibilities of the Navy, Air Force, and USFWS for the Guam NWR. The 1994 Cooperative Agreements provide a commitment by the Navy, Air Force, and USFWS for a coordinated program centered on the protection of endangered and threatened species and other native flora and fauna, maintenance of native ecosystems, and the conservation of native biological diversity in cooperation with GDAWR, consistent with the national defense mission of the Navy and Air Force.

Excess military land at Ritidian Point was then transferred to USFWS under the federal excess property regulations for inclusion in the Guam NWR as the 376-ac (152-hectare [ha]) Ritidian Unit. The approximately 21,690 ac (8,778 ha) Guam Overlay Refuge are on lands administered by the Air Force and Navy (Figure 10.1-2 and Figure 10.1-3). The Overlay Refuge encompasses lands identified in recovery plans as essential habitat for the recovery of the Mariana fruit bat, Guam Micronesian kingfisher, Mariana crow, and Guam rail.

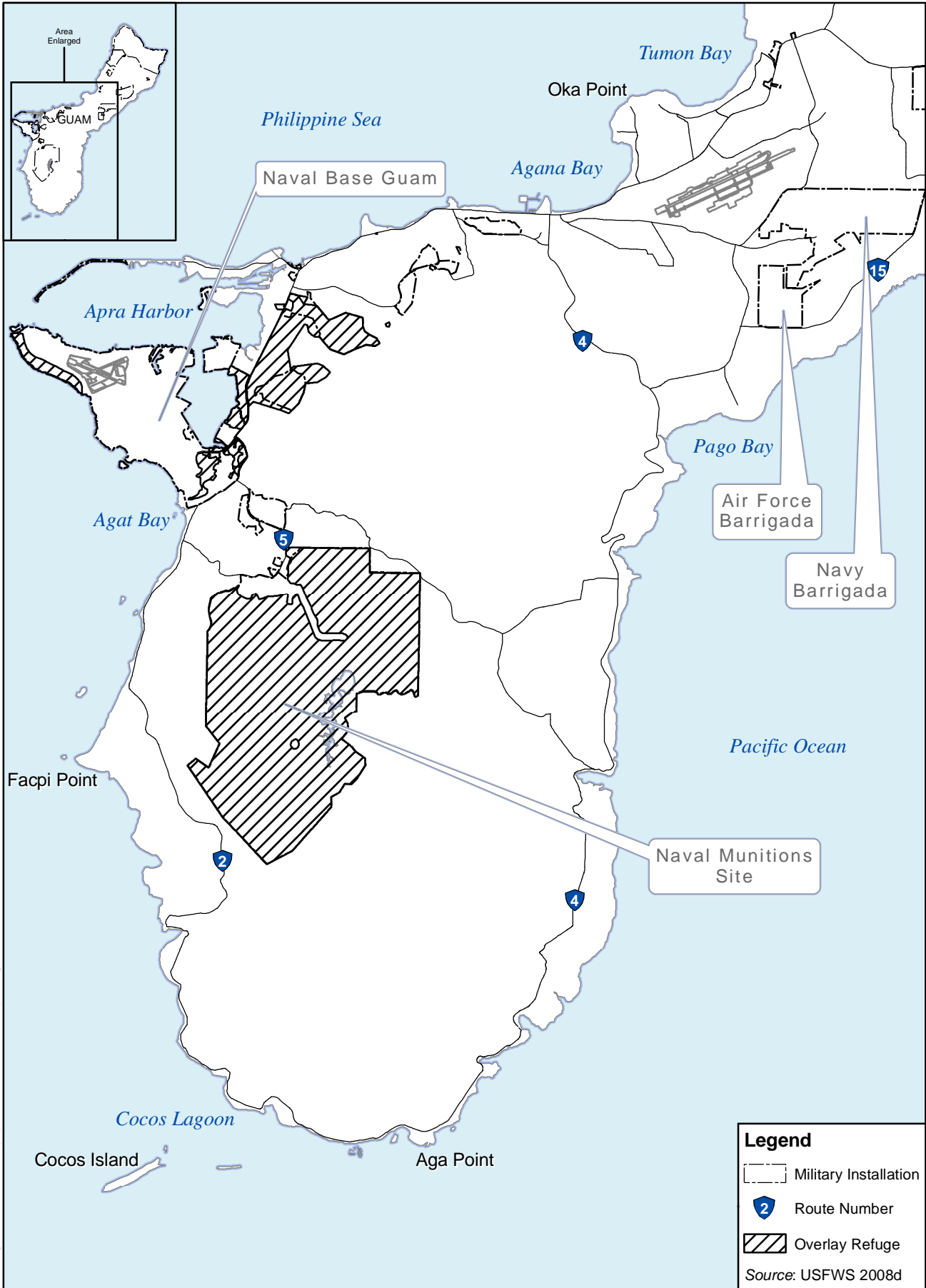
In October 2002, the USFWS again proposed critical habitat for the Mariana crow, Guam Micronesian kingfisher, and Mariana fruit bat (USFWS 2002). The areas proposed as critical habitat were primarily on Overlay Refuge lands but included additional areas as well. On October 28, 2004, the USFWS designated 376 ac (152 ha) of land as critical habitat for the Guam Micronesian kingfisher, Mariana crow, and Mariana fruit bat on the Ritidian Unit of the Guam NWR in northern Guam (Table 10.1-1 and Figure 10.1-2; USFWS 2004).

Overlay Refuge lands were excluded from this designation including 10,838 ac (4,386 ha) of Air Force lands, 7,977 ac (3,228 ha) of Navy lands, and 2,989 ac (1,210 ha) of GovGuam lands in northern and southern Guam. Air Force lands were excluded under section 4(a)(3) of the ESA, as amended by Section 318 of the fiscal year 2004 National Defense Authorization Act, based on the Air Force's INRMP for Andersen AFB. Navy lands were excluded under section 4(b)(2) because the benefits of excluding these lands, including benefits to national security and existing management plans and conservation efforts, outweighed the benefits of designating them as critical habitat. GovGuam lands were excluded under section 4(b)(2) because the benefits of excluding these lands, including continued and improved cooperation between Guam and the USFWS and implementation of Guam's natural resource plan, outweigh the benefits of designating these lands as critical habitat.

For the purposes of this EIS/OEIS and based on discussion with the USFWS, the areas originally proposed as critical habitat in 2002 would be considered as 'essential habitat' for the recovery of ESA-

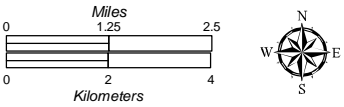


**Figure 10.1-2**  
**Overlay Refuge Lands and Designated Critical Habitat - Northern Guam**



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**Figure 10.1-3**  
**Overlay Refuge Lands - Southern Guam**



listed species on Guam, particularly the Mariana crow, Guam Micronesian kingfisher, and Mariana fruit bat (Figure 10.1-4). These include approximately 24,802 ac (10,040 ha) of essential habitat for the Mariana fruit bat and Micronesian kingfisher, of which 77% is on DoD land, 2% is on non-DoD land being considered for use under the actions described in this EIS/OEIS, and 21% is on other non-DoD land not associated with the proposed projects. Mariana crow essential habitat includes lands also considered essential habitat for the fruit bat and kingfisher, but over a more limited area (refer to Figure 10.1-4) of approximately 23,004 ac (9,309 ha). For crow essential habitat, 83% is on DoD land and 17% is on non-DoD land not associated with the proposed project.

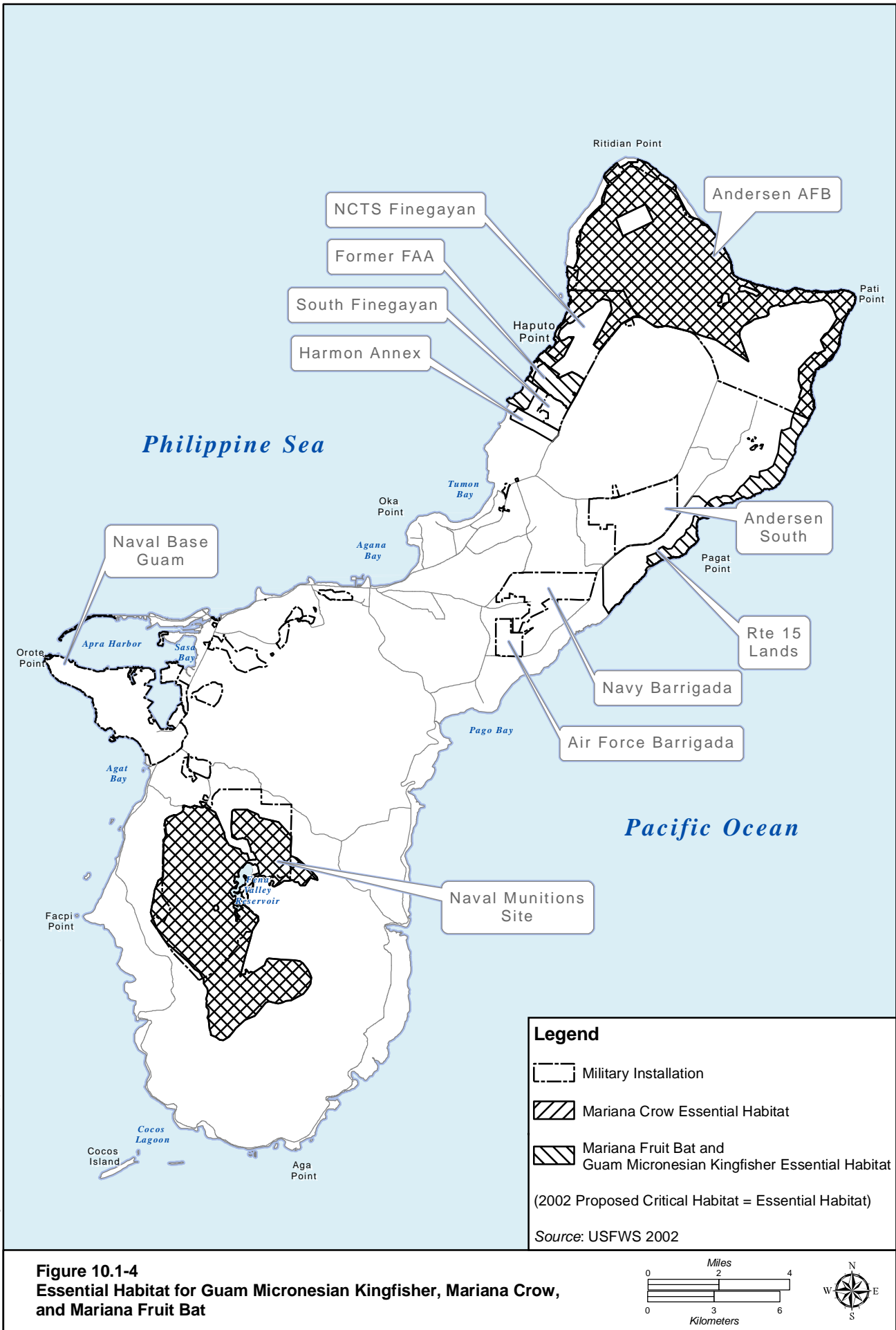
### Recovery Plans

USFWS has published recovery plans for the ESA-listed species present on Guam. A brief summary of the delisting or downlisting criteria from these plans for the species that have essential habitat as defined in the recovery plans are outlined below.

- *Guam Mariana Fruit Bat and Little Mariana Fruit Bat Recovery Plan* (USFWS 1990a) – The little Mariana fruit bat is considered extinct and is not considered here. The recovery goal for the Guam Mariana fruit bat was to recover the subspecies to allow downlisting from endangered to threatened status. The plan specified increasing the fruit bat population to at least 2,500 while maintaining a minimum of 3 permanent colonies of 400 bats each. Control of BTS was considered important. Since the recovery plan was published, the Mariana fruit bat population throughout the Marianas (Guam and CNMI) was determined to be one subspecies and the species was downlisted to threatened status based on the archipelago-wide population. The current population of the subspecies is unknown because of the lack of recent surveys on most islands; however, based on surveys conducted from the 1990s the population of the subspecies may be up to several thousand individuals (Andersen AFB 2008e). Additional discussion and detail is provided in the Biological Assessment (BA) for the proposed action. Because of the age of the recovery plan and change in status, there are no valid recovery criteria currently in place for the Mariana fruit bat on Guam.
- *Revised Recovery Plan for the Sihek or Guam Micronesian Kingfisher (Halcyon cinnamomina cinnamomina)* (USFWS 2008a) – This subspecies currently exists only in captivity. To delist this subspecies, the plan specified the establishment of two subpopulations, one in northern Guam and one in southern Guam, each with at least 500 adults. The recovery plan estimated that the island of Guam could support a population of between 3,600 and 6,800 kingfishers based on available density estimates. Using the estimate of 63,833 ac (25,832 ha) of forested habitat specified in the recovery plan results in a maximum estimate of 17.7 ac (7.2 ha) of habitat required per kingfisher. Multiplying this by the target of 1,000 kingfishers in the recovery plan results in a requirement for 9,400 ac (3,804 ha) of habitat to achieve the delisting criteria. Control of BTS was considered important.
- *Draft Revised Recovery Plan for the Aga or Mariana Crow (Corvus kubaryi)* (USFWS 2005b) – To delist this species, the plan specified the establishment of three populations, one each on Rota, northern Guam, and southern Guam, each consisting of a minimum of 75 territorial pairs. The most recent estimate of the Rota population was 170 breeding pairs in 2004. The current population on Guam is two individuals, both males (Andersen AFB 2008d). To help achieve the recovery goal, priority recovery zones were proposed in northern and southern Guam. Based on a territory estimate of 1 pair per 54 ac (22 ha) obtained from studies on Rota, the required acreage on Guam to achieve the recovery goal of 150 pairs (75



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pairs in northern and southern Guam) would be 8,100 ac (3,278 ha). Control of BTS was considered important.

*Native Forest Birds of Guam and Rota of the Commonwealth of the Mariana Islands Recovery Plan* (includes the Guam rail) (USFWS 1990b) – Currently the Guam rail only exists in captivity. The recovery goal was to recover the species to allow downlisting from endangered to threatened status. The plan specified increasing the rail population to at least of 2,000 birds: 1,000 in Northern Guam and 1,000 in Southern Guam. Control of BTS was considered important

#### 10.1.1.4 Study Areas and Survey Methods

For the purposes of this EIS/OEIS, the project area for biological resources has been divided into 13 study areas, including some smaller sub-areas (Table 10.1-2 and see Figure 10.1-1). The larger study areas were selected based on the site-specific ROIs and on the nature and physical extent of each project-specific component of the proposed action. Not all sites are being surveyed specifically for this EIS/OEIS because some sites have adequate existing studies and other sites have a low likelihood that a certain resource type would be present based on a thorough review of the studies and data available. Sites with the greatest likelihood of the presence of the various species have been surveyed.

**Table 10.1-2. Project-specific Terrestrial Biological Resources Field Studies within Proposed Project Locations**

Project Location*	<i>Biological Resource</i>						
	Vegetation	Tree Snails	Herps**	Birds	Bat	Butterflies	Fresh water
Andersen AFB		✓	✓	✓		✓	
NCTS Finegayan	✓	✓	✓	✓	✓		
Former FAA Parcel***	✓	✓	✓	✓			
South Finegayan	✓		✓	✓			
Andersen South	✓	✓	✓	✓		✓	
Route 15 Lands	✓	✓	✓	✓	✓	✓	
Navy Barrigada	✓	✓	✓	✓			
Air Force Barrigada			✓	✓			
Naval Base Guam	✓		✓	✓			
NMS	✓	✓	✓	✓	✓		✓
NMS Access Road	✓	✓	✓	✓			

Notes: \*Refer to Figure 10.1-1 for project locations. \*\*Herps = herpetological species, or surveys for reptiles and amphibians.

\*\*\*Former FAA is in the vicinity of Harmon Annex; with similar vegetation types and disturbance regimes it is assumed that habitat and species found on the Annex would be similar to those found on Former FAA.

#### Data Sources and Survey Methods

Key sources of information for this section include the existing and recent draft INRMPs for Navy lands (COMNAV Marianas 2001, 2008); existing and draft INRMPs for Andersen AFB (Andersen AFB 2003, 2008a); Natural Resource Survey and Assessment Report (Naval Facilities Engineering Command [NAVFAC] Pacific 2007) and references therein; *Guam Comprehensive Wildlife Conservation Strategy* (Guam CWCS) (GDAWR 2006); and previous EISs, Environmental Assessments, Biological Assessments, and resulting USFWS Biological Opinions (BOs) for recent actions on military lands on Guam. Site-specific natural resources geographic information system (GIS) data for the ROI were obtained from NAVFAC Pacific, NAVFAC Marianas, and Andersen AFB as of September 2008.

In addition to existing biological resources data for the study areas, project-specific mapping efforts or surveys were conducted for vegetation and ESA- and Guam-listed species (see Tables 10.1-1 and 10.1-2). Survey methods are provided in detail in the *Natural Resources Survey Report* (NR Survey Report, in

preparation, estimated completion in November-December 2009). Biological surveys were not conducted for the Harmon Annex due to access limitations, but baseline data was extrapolated from past and current natural resource studies in adjacent parcels.

### Species Evaluated

A total of 16 ESA-listed, Guam-listed, and candidate species may potentially occur within the study areas (see Table 10.1-1). Completed and on-going surveys/studies for these species are summarized in Table 10.1-1. Surveys for mammals, birds, reptiles, amphibians, invertebrates, and plants conducted for this EIS/OEIS documented all species encountered, not just listed or candidate species.

## **10.1.2 North**

### 10.1.2.1 Andersen AFB

#### Vegetation Communities

Andersen AFB is located in a limestone geologic region which generally consists of limestone plateaus with abrupt cliffs and dropoffs toward the ocean. The underlying limestone may be strongly weathered into a karst formation. Terrestrial vegetative communities at Andersen AFB have been recently mapped and described in detail (Andersen AFB 2008c). Vegetation was mapped using the basic vegetation types of Fosberg (1960) but with modifications and expanded categories to fit more recent mapping efforts in Guam and on Andersen AFB. The basic vegetation communities include limestone forest, secondary limestone forest, coastal strand vegetation, mixed shrub, mixed herbaceous scrub, communities dominated by one or two species, and disturbed areas. Vegetation types for the general project areas from this recent mapping are shown in Figure 10.1-5 and Figure 10.1-6. Acreages of each vegetation community on Andersen AFB are listed in Table 10.1-3.

**Table 10.1-3. Vegetation Communities at Andersen AFB**

<i>Vegetation Type</i>	<i>ac (ha)</i>
Developed Land	4,501 (1,821)
Limestone Forest – Secondary (disturbed)	4,107 (1,662)
Limestone Forest – Primary	1,722 (697)
<i>Vitex</i> -Closed Canopy	851 (344)
Mixed Limestone Forest-Foreslope (Halophytic-Xerophytic Scrub)	834 (337)
<i>Vitex</i> -Sparse Canopy	807 (327)
Mixed Herbaceous Scrub	732 (296)
<i>Hibiscus-Ochrosia</i> Scrub	624 (252)
Coconut Forest	487 (197)
<i>Hibiscus</i> Scrub	431 (174)
<i>Neisosperma</i> Forest	286 (116)
Strand	186 (75)
<i>Hibiscus-Leucaena</i>	109 (44)
<i>Casuarina</i> Forest	102 (41)
<i>Ochrosia</i> Edge	38 (15)
Mixed Shrub	32 (13)

In East Andersen AFB, the North Ramp project area consists primarily of developed land, but there are small areas of mixed herbaceous scrub and mixed limestone forest- in the northern portion of the site. The South Ramp project area consists primarily of developed land, but there are small areas of *Ochrosia* edge and mixed herbaceous scrub habitats in the eastern portion of the site. The North Gate project area consists of mixed limestone forest, *Vitex*-dominated forest, and developed land.

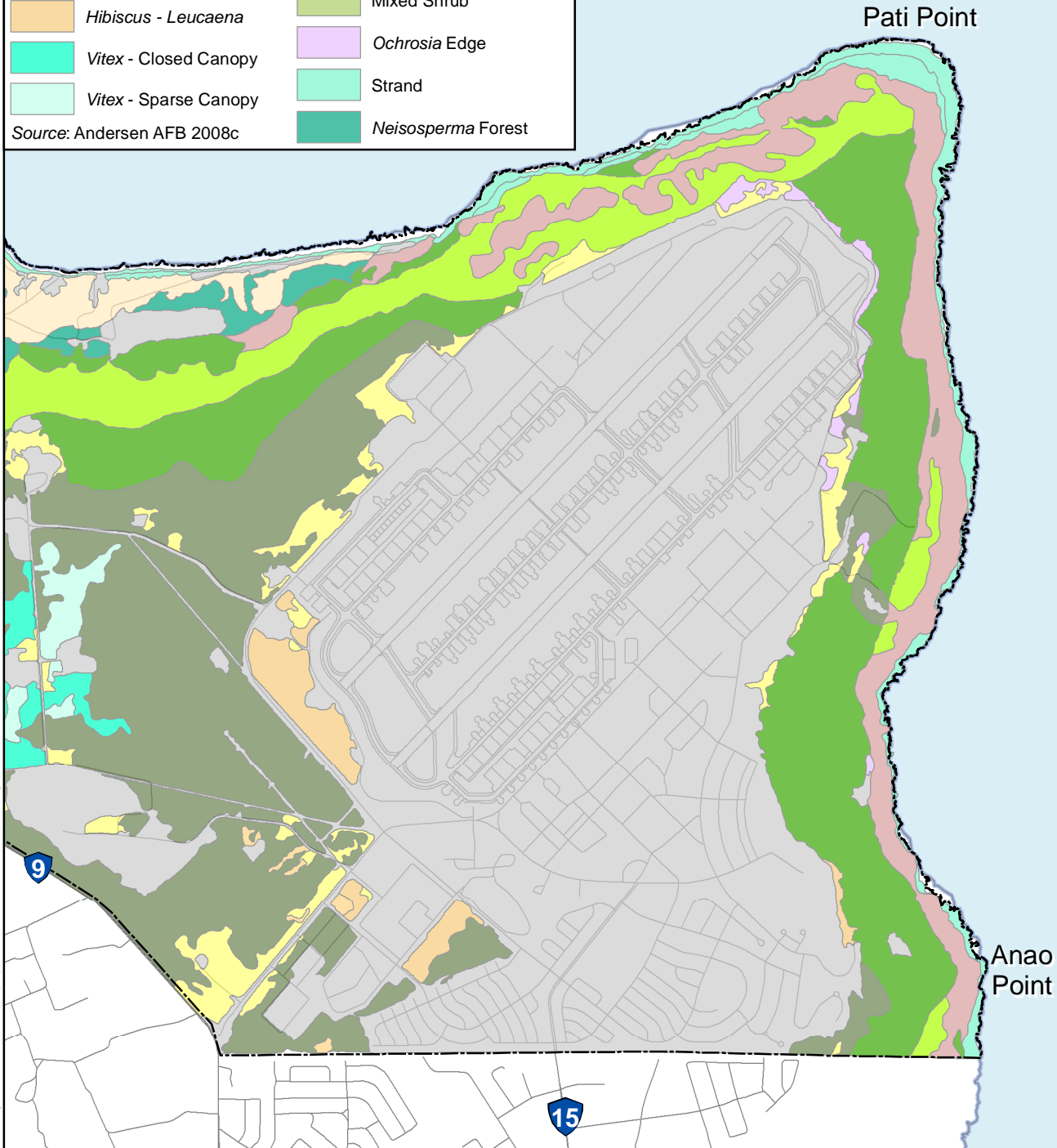
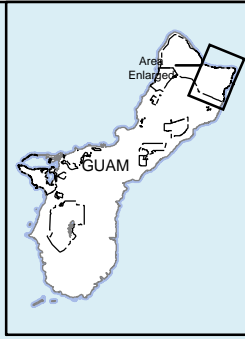
**Legend**

Andersen AFB Boundary
  Route Number

**Vegetation**

Casuarina Forest	Limestone Forest - Primary
Coconut Forest	Mixed Herbaceous Scrub
Developed	Mixed Limestone Forest - Foreslope
Hibiscus - Ochrosia Scrub	Mixed limestone Forest - Secondary
Hibiscus Scrub	Mixed Shrub
Hibiscus - Leucaena	Ochrosia Edge
Vitex - Closed Canopy	Strand
Vitex - Sparse Canopy	Neisosperma Forest

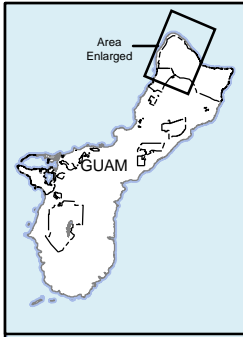
Source: Andersen AFB 2008c



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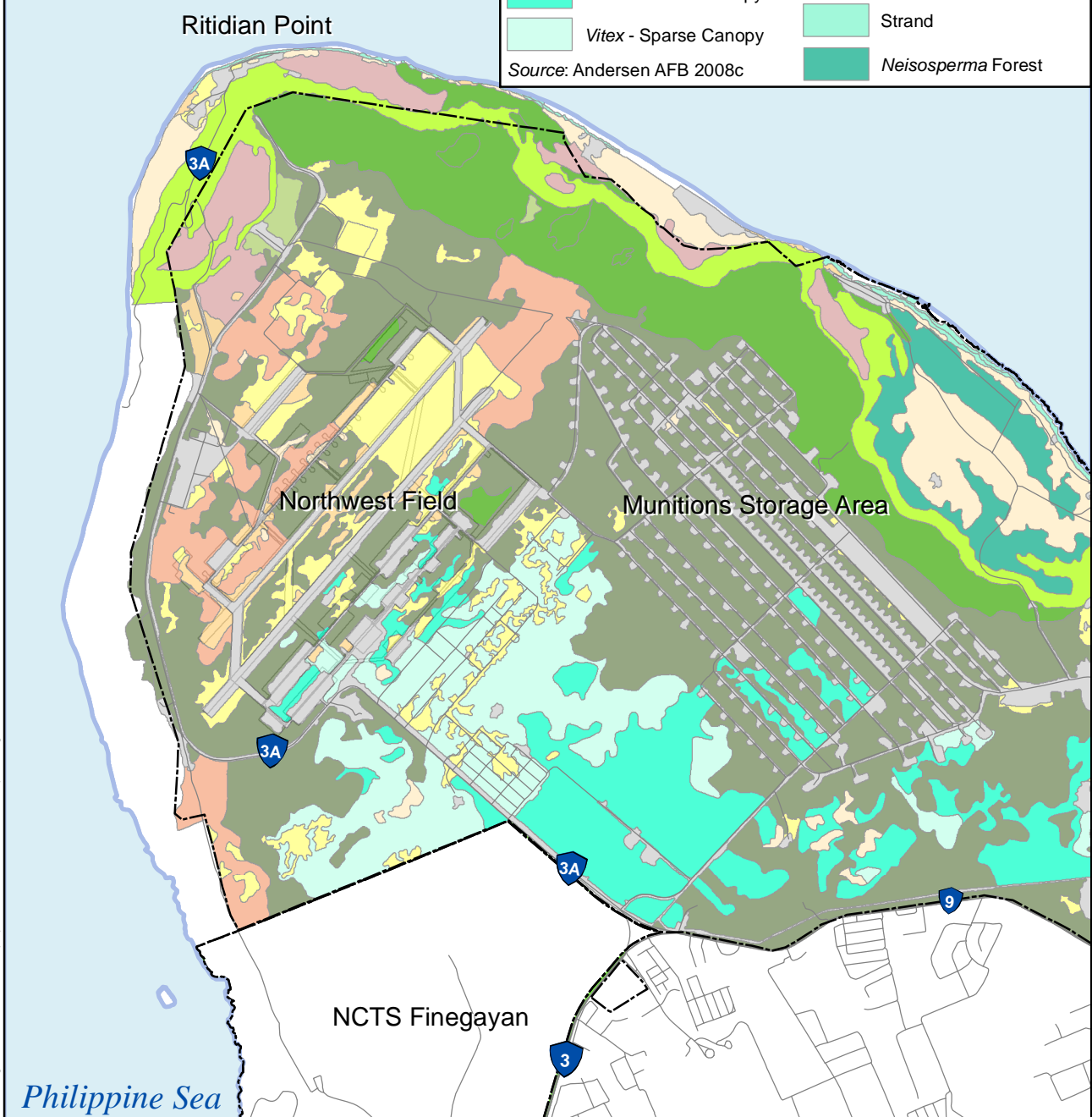
**Figure 10.1-5  
Vegetation Communities - Andersen AFB East**





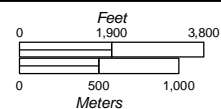
**Legend**

- Andersen AFB Boundary
  - Route Number
  - Vegetation**
  - Casuarina* Forest
  - Coconut Forest
  - Developed
  - Hibiscus* - *Ochrosia* Scrub
  - Hibiscus* Scrub
  - Hibiscus* - *Leucaena*
  - Vitex* - Closed Canopy
  - Vitex* - Sparse Canopy
  - Limestone Forest - Primary
  - Mixed Herbaceous Scrub
  - Mixed Limestone Forest - Foreslope
  - Mixed limestone Forest - Secondary
  - Mixed Shrub
  - Ochrosia* Edge
  - Strand
  - Neisosperma* Forest
- Source: Andersen AFB 2008c



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**Figure 10.1-6**  
Vegetation Communities - Andersen AFB West



In West Andersen AFB, Northwest Field (NWF), the Munitions Storage Area (MSA), and surrounding areas consist primarily of mixed limestone forest, *Vitex*-dominated forest, mixed herbaceous scrub, mixed shrub, *Casuarina* forest, and developed land.

*Tabernaemontana rotensis*, considered a Species of Greatest Conservation Need (SOGCN) by GDAWR (2006), is a rare tree species whose distribution has been recently evaluated on Andersen AFB (University of Guam [UoG] 2007), including within the North Ramp, North Gate, and NWF project areas. Over 21,000 *T. rotensis* individuals were found in that study throughout Andersen AFB at 265 locations, primarily in the central portion of the base and near the limestone cliffs in the northwest and southeast corners (Figure 10.1-7 and Figure 10.1-8).

The UoG (2007) study reported that *T. rotensis* had a patchy distribution and was often associated with other native and rare species. In support of the Intelligence, Surveillance, Reconnaissance (ISR) Strike EIS/OEIS, additional surveys adjacent to the proposed North Ramp Air Combat Element (ACE) project area identified 15 locations of *T. rotensis*, with a total of approximately 1,000 saplings (Pacific Air Forces [PACAF] 2006a). No individuals of this species were identified in the commercial gate area in the ISR Strike EIS studies.

*Cycas circinalis* is a common endemic cycad species found in many limestone forests throughout Guam, including Andersen AFB, but it is also identified as a SOGCN because of the cycad scale insect that is devastating the species. Plant species that are federally or Guam-listed are discussed in the relevant subsections below.

### Wildlife – Native Species

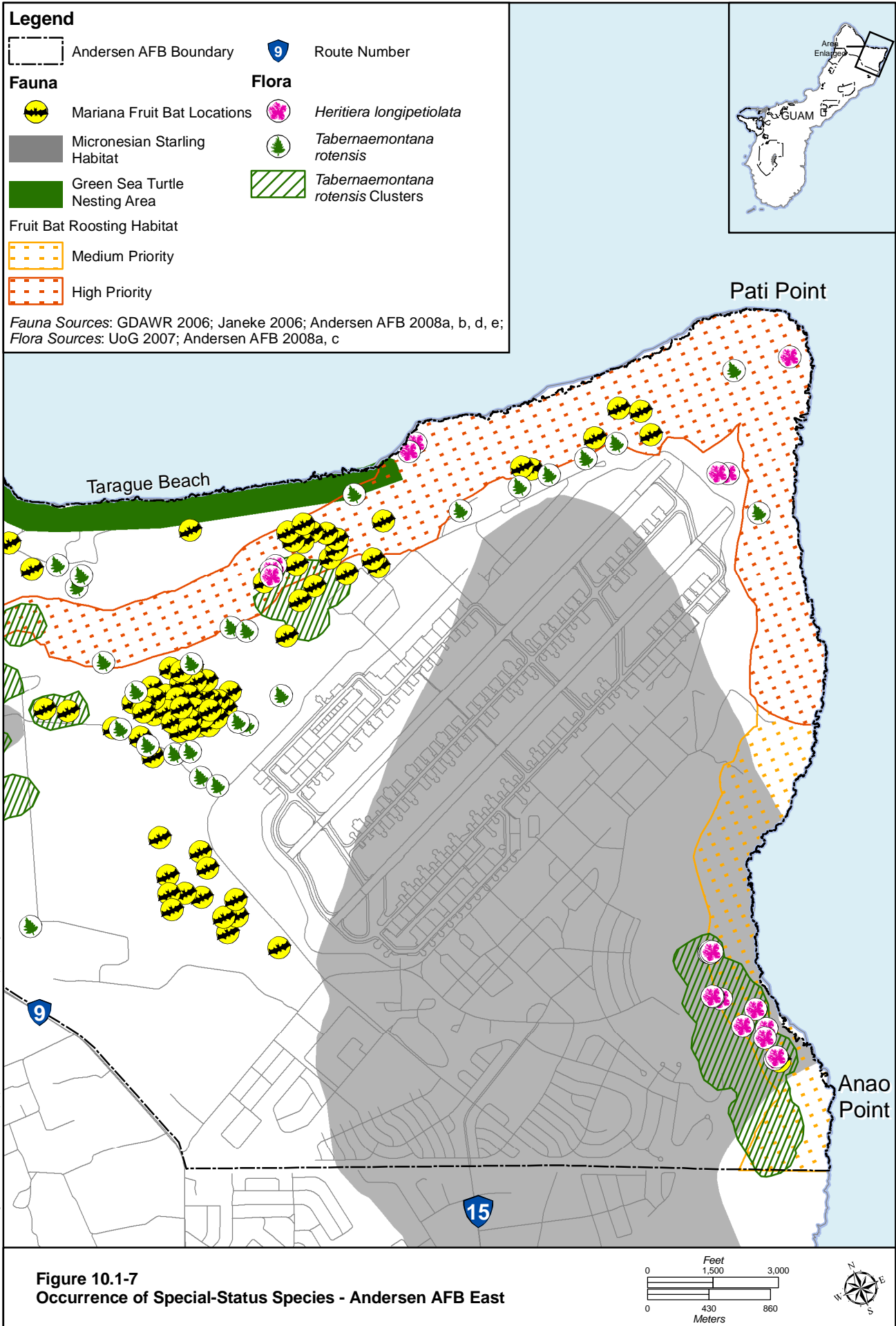
#### *Birds*

At least 13 seabird species occur at coastal islets, reef flats, and open oceans around Guam (Andersen AFB 2003). Black and brown noddies have been observed between Scout Beach and Pati Point (National Oceanic and Atmospheric Administration [NOAA] 2005) and brown noddies are known to frequent the flight line. Fairy (white) terns are common in the developed areas of Andersen AFB, including service areas such as the exchange, the flight line, and housing. The more common shorebirds include wintering birds such as Pacific golden plover, Mongolian plover, wandering tattler, gray-tailed tattler, whimbrel, and ruddy turnstone. One wading bird that may be seen at Andersen AFB is the Pacific reef heron, which forages on exposed reefs (Andersen AFB 2003). Other observed bird species include fork-tailed swifts at Pati Point and several groups of barn swallows at the main airfield (GDAWR 2000a). Migratory seabirds and shorebirds are not currently monitored at Andersen AFB (Andersen AFB 2008a). The only native bird species observed at Andersen AFB during forest transects and roadside point stations conducted in support of this EIS/OEIS were the yellow bittern, Micronesian starling, and Pacific golden plover (NR Survey Report in preparation). All of the aforementioned species are protected by the Migratory Bird Treaty Act (MBTA).

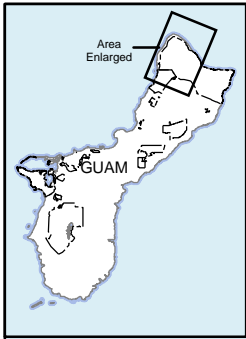
#### *Reptiles*

Ten reptile species, including two ESA-listed sea turtle species, are considered native to Guam (GDAWR 2006; see Special-status Species section below; refer to Chapter 11, Marine Biological Resources, for a discussion of sea turtles in the marine environment). Native terrestrial reptiles are generalized insectivores and widely distributed within appropriate major habitat types. These are all small lizards and none are ESA-listed, but Guam lists eight species as threatened or endangered (these are discussed below under Guam-listed species). The non-listed native reptiles include mutilating gecko, blue-tailed skink, and



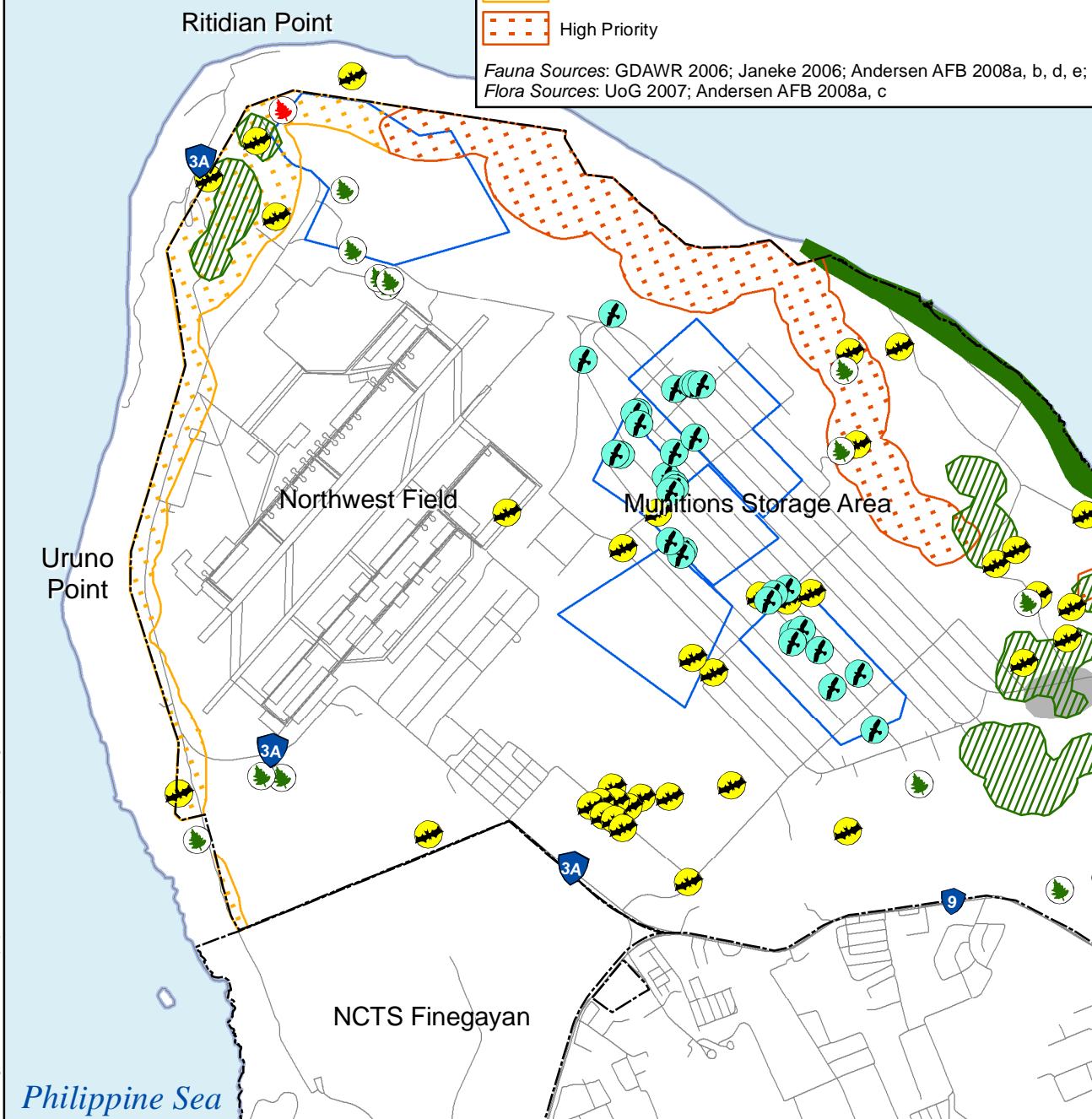


**Figure 10.1-7**  
**Occurrence of Special-Status Species - Andersen AFB East**



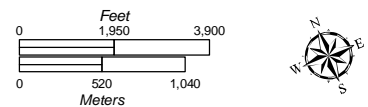
**Legend**

- Andersen AFB Boundary
  - Mariana Crow Locations (Sept 2006)
  - Mariana Fruit Bat Locations
  - Mariana Crow Locations
  - Micnesian Starling Habitat
  - Green Sea Turtle Nesting Area
  - Fruit Bat Roosting Habitat
  - Medium Priority
  - High Priority
  - 9 Route Number
  - + Fire Tree
  - + *Heritiera longipetiolata*
  - + *Tabernaemontana rotensis*
  - Tabernaemontana rotensis* Clusters
- Fauna Sources:* GDAWR 2006; Janeke 2006; Andersen AFB 2008a, b, d, e;  
*Flora Sources:* UoG 2007; Andersen AFB 2008a, c



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**Figure 10.1-8**  
**Occurrence of Special-Status Species - Andersen AFB West**





mourning gecko. The blue-tailed skink and mutilating gecko were observed in forested areas at Andersen AFB during surveys in support of this EIS/OEIS (NR Survey Report in preparation).

#### *Invertebrates*

Numerous native butterflies potentially occur on Andersen AFB including the blue-banded king crow, common emigrant, common mormon, crow eggfly, great eggfly, lesser grass blue, three-spot grass yellow, and tiny grass blue (Andersen AFB 2008a). Some butterflies may be limited by the herbivory on nurse plants by Philippine deer and other habitat degradation associated with feral pigs.

Native land hermit and coconut crabs are present in coastal areas at Andersen AFB. Coconut crabs are a prized human food item and are often overharvested. Coconut crab harvesting is regulated by permit on Andersen AFB. They may be hunted year-round, but the carapace of harvested crabs must have a minimum width of 3 inches (7.5 centimeters). Other threats to these species include introduced predators, such as rats, wild pigs, dogs, and monitor lizards (Andersen AFB 2008a).

#### Wildlife – Non-Native Species

##### *Birds*

Non-native bird species are generally the only birds that are seen frequently on Andersen AFB. These include black francolin, island collared dove, black drongo, and Eurasian tree sparrow. Because they are non-native, none of these species are protected by the MBTA. These species are found in open, grassland areas as well as the developed (or urbanized) areas of the base where the brown treesnake (BTS) is not as prevalent. Due to the presence of the BTS and its preference for preying on the adults, young, and eggs of many bird species, the forested areas of Andersen AFB are generally devoid of birds.

##### *Reptiles and Amphibians*

The BTS has had a profound effect on the both native and introduced faunal populations in Guam, and is widely regarded as being responsible for extirpating or limiting many bird species on Guam (Fritts and Rodda 1998). The peak density of BTS in favorable habitats was probably in excess of 40 per ac (16 per ha) in the 1980s, but by the mid 1990s the snake's populations on Guam seemed to have reached a dynamic equilibrium of approximately 20 per ac [8 per ha] (Rodda and Savidge 2007).

The Air Force provides annual funding to support a BTS trapping program and other studies. In one study, dead mice injected with acetaminophen were distributed throughout the MSA as a control method, and a single 80-mg dose was found to be acutely toxic to BTS, resulting in 100% mortality within 24 hours (Savarie et al. 2001). Additional testing determined that the risk to non-target species (e.g., the fish crow, a species closely related to the Mariana crow, feral dogs, and coconut crabs) was very low, suggesting that acetaminophen mouse baits may at least reduce population sizes of the BTS, particularly when used in conjunction with trapping efforts (Johnston et al. 2002). Andersen AFB has base-wide instructions regarding procedures for BTS control and awareness (Andersen AFB 2006a). The base cooperates with USDA APHIS-Wildlife Services (USDA APHIS-WS) to conduct daily inspections with detector dog teams for all outbound cargo in order to help prevent the spread of BTS.

The curious skink, house gecko, cane toad, and blind snake were observed in forested areas of Andersen AFB. In particular, the curious skink has become a large part of the BTS diet, and therefore serves to maintain high numbers of BTS throughout Guam (Fritts and Leesman-Tanner 2008). Monitor lizards are also distributed throughout Guam, and they are present in forested areas on Andersen AFB (Andersen AFB 2008a).

### *Mammals*

Philippine deer and pigs were introduced to Guam in the 1600s and 1700s by the Spanish and feral populations are still present throughout most of the island's undeveloped lands. Density estimates for Guam are 0.07 deer/ac (0.17 deer/ha) (NAVFAC Marianas 2009) and 0.15 pigs/ac (0.38 pigs/ha) 474 (Knutson and Vogt 2002). Deer grazing on native tree seedlings is suspected to adversely affect native tree regeneration and cause erosion. Pigs dig up soil while foraging and wallowing which also causes erosion and creates openings for invasive weeds.

Control of both species is attempted through public hunting at Andersen AFB. Recreational gun and archery hunting are allowed in designated areas in portions of the NWF. However, due to chronic low-level poaching of the Mariana fruit bat, the USFWS 5-year review of the Mariana fruit bat recommended that this recreational hunting program be replaced with a sustained control program (USFWS 2007a).

In 1991, the Civil Engineer Squadron built an ungulate enclosure at Area 50, a 60-ac (24-ha) site containing native limestone forest, as an experimental area for removal of pigs and deer (PACAF 2006b). In 1998, removal of the BTS from this area was also undertaken. This enclosure area is currently not used and has fallen into disrepair.

Other introduced predators on native species include feral cats, dogs, rats, and the musk shrew. Reintroduction efforts in Area 50 and the MSA at Andersen AFB determined that cat predation was a major limiting factor to native species recovery efforts on Guam (Beuprez and Brock 1999). Various species of rats are a major obstacle to recovery of species on Pacific Islands (Atkinson 1985). The musk shrew may be a significant predator on native geckos and skinks (Fritts and Leasman-Tanner 2008), although its numbers are kept low by snake predation.

### *Invertebrates*

Predatory snails, such as the rosy wolf snail, and the predatory flatworm *Platydemus manokwari*, were introduced to control the giant African snail. They have directly affected Guam-listed and ESA candidate tree snail populations and are considered a serious threat to Partulid snail populations on Guam and CNMI (USFWS 2007c).

The Asian cycad scale is an unintended pest introduction to Guam, and has effectively eliminated the cycad *Cycas circinalis*, a dominant mid-level canopy species of limestone forests (Moore et al. 2005). In one permanent transect at Ritidian, *Cycas circinalis* declined from 686 individuals in 2004 (before the Cycad aulacaspis scale entered the habitat) to only 87 in January 2007 (UoG 2007). The cycad is also an important food source for the Mariana fruit bat and Mariana crow.

### ESA-Listed Species and Critical Habitat

Twelve ESA-listed or candidate species have been observed, or suitable habitat is present, on Andersen AFB (Table 10.1-4). Most of Andersen AFB outside the cantonment and housing areas is within the Overlay Refuge (see Figure 10.1-2). Essential habitat for the Mariana fruit bat, Mariana crow, and Guam Micronesian kingfisher, based on the 2002 proposed critical habitat ruling (USFWS 2002) and Mariana crow Recovery Zones (USFWS 2005b), include much of the installation outside of the cantonment and housing areas (Figure 10.1-9). These areas are predominantly limestone forests which are an important habitat for these threatened and endangered species.

**Table 10.1-4. Known or Potential Occurrence of ESA-listed, Guam-Listed, and Candidate Species at Andersen AFB**







Common Name	Status		Habitat	Occurrence at Andersen AFB
	ESA	Guam		
<b>MAMMALS</b>				
Mariana fruit bat	T	E	Limestone forest, coastal forest, and coconut plantations	Average of 40 bats in 2007/08.
<b>BIRDS</b>				
Mariana crow	E	E	All forests with a preference for native limestone forest	Recent surveys indicate only 2-3 individuals remaining in the wild; recovery zone and essential habitat present
Guam Micronesian kingfisher	E	E	Forest and scrub with preference for native limestone forest	Extirpated but essential habitat present
Guam rail	E	E	Secondary habitats, some use of savanna and limestone forests	Extirpated but essential habitat present
Mariana swiftlet	E	E	Nests in caves; forages over grasslands and forests	Historically used swiftlet caves on Andersen AFB are currently unoccupied
Micronesian starling	-	E	All habitats but higher density in forests	1 small population, not more than several hundred
<b>REPTILES</b>				
Green sea turtle	T	T	Suitable beaches for basking and nesting	Nests at Tarague Beach
Hawksbill sea turtle	E	E	Suitable beaches for basking and nesting	No recorded activity since 1984
Moth skink	-	E	Forest areas with large tree trunks	Not found in recent project-specific surveys
Pacific slender-toed gecko	-	E	Forest edge	Not found in recent project-specific surveys
<b>INVERTEBRATES</b>				
Marianas eight-spot butterfly	C	-	Intact limestone forest with host plants	Several sporadic observations
Guam tree snail	C	T	Cool shaded forested areas with high humidity	Historically present in Tarague Basin, but none observed in 1989 survey
Humped tree snail	C	E	Cool shaded forested areas with high humidity	Historically present in Tarague Basin, but none observed in 1989 survey
Fragile tree snail	C	E	Cool shaded forested areas with high humidity	Historically present in Tarague Basin, but none observed in 1989 survey
<b>PLANTS</b>				
Fire tree	T	E	Limestone and ravine forests.	Only 1 mature tree remaining at NWF
<i>Heritiera longipetiolata</i>	-	E	Limestone forest	Small population of trees at Pati Point

Legend: C = candidate, E = endangered, T = threatened.

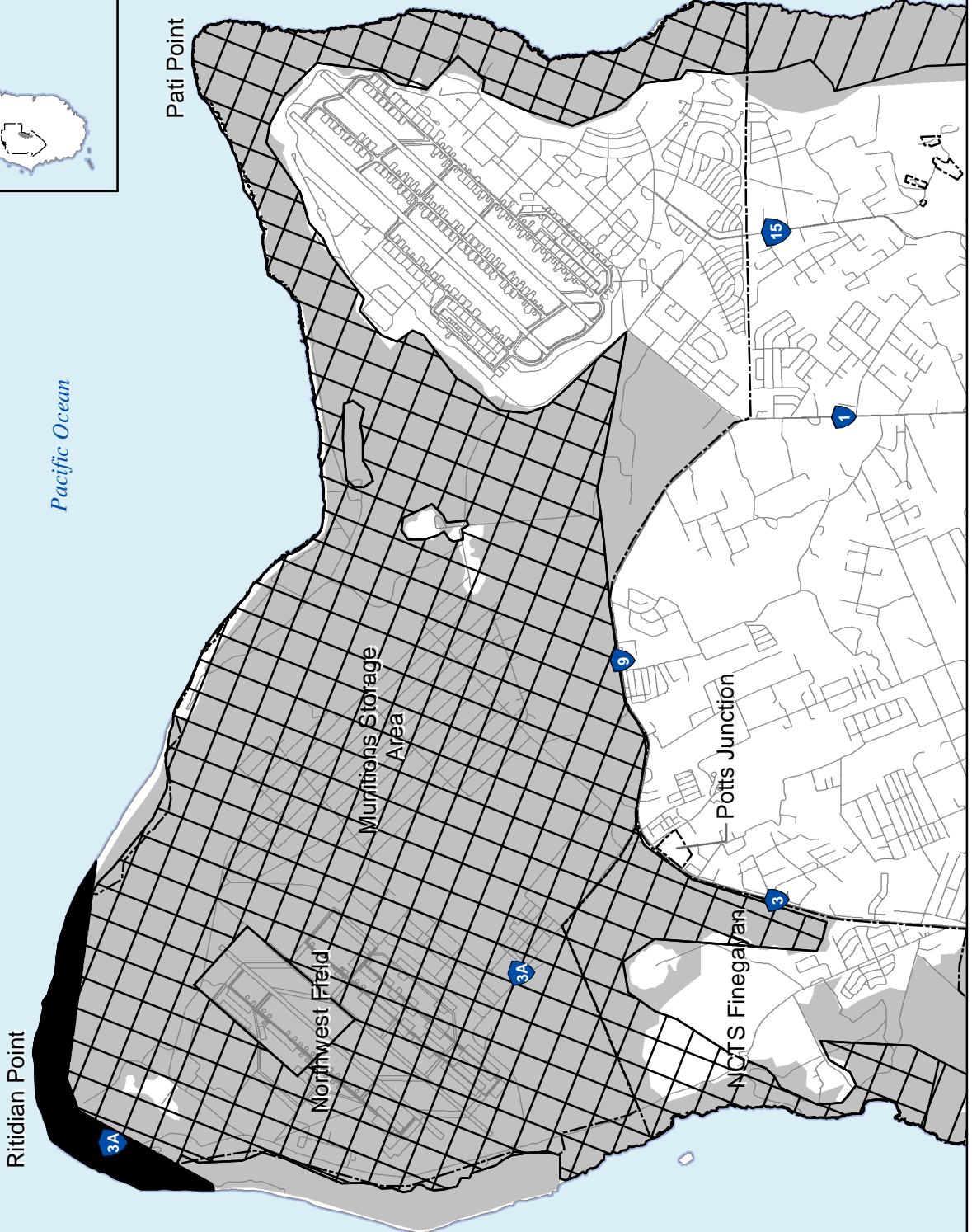
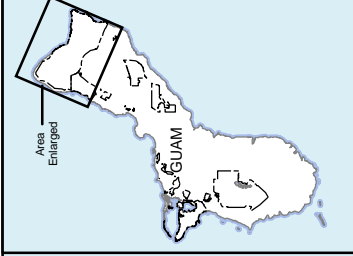
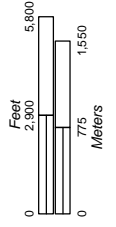
Sources: GDAWR 2006, USFWS 2006, Andersen AFB 2008a, Smith et al. 2008, NR Survey Report in preparation.

**Figure 10.1-9**  
Essential Habitat,  
Recovery Zones,  
and Critical Habitat  
for ESA-listed Species  
on or in the Vicinity of  
Andersen AFB

Legend

-  Military Installation
-  Route Number
-  Mariana Crow  
Essential Habitat
-  Mariana Fruit Bat  
and Guam  
Micronesian  
Kingfisher Essential  
Habitat
-  Mariana Crow,  
Mariana Fruit Bat,  
and Guam  
Micronesian  
Kingfisher Critical  
Habitat
-  Mariana Crow  
Recovery Zones

Sources: USFWS 2002, 2004,  
2005b



### *Mariana Fruit Bat*

The Guam population of the Mariana fruit bat is federally listed as threatened, recently downgraded from endangered (USFWS 2005a). Critical habitat for this species was designated in 2004 at the Ritidian Unit of the Guam NWR, which lies immediately to the northwest of Andersen AFB (USFWS 2004).

On Andersen AFB, individuals and small groups were observed roosting in both primary (mature and native-dominated) and secondary growth limestone forest cover (Janeke 2006). Figure 10.1-7 shows individual sightings at Andersen AFB from Janeke (2006) and others. Over the past several decades, the population of fruit bats in Guam has declined in number. The majority of the bats had been roosting at a single site on Pati Point on Andersen AFB since 1994, and an unknown number of solitary bats utilize the limestone and secondary forests of Guam. Fruit bats forage over the forests and coastal areas, and are occasionally sighted at Tarague Beach (Andersen AFB 2008d). At the Pati Point colony, there have been less than 100 bats since 2002, with only 20 to 60 individuals sighted since 2004 (USFWS 2006, NAVFAC Pacific 2007). This population has undergone dramatic short-term fluctuations in the past indicating that members of the colony may be able to migrate easily between Rota and Guam (COMNAV Marianas 2001). Surveys conducted from June 2007 through April 2008 recorded 31 to 54 individuals with an average of 40 (Andersen AFB 2008d). Inland from the beach area, the Tarague Basin is a major conduit for Mariana fruit bat travel between the main Pati Point colony and foraging areas in NWF, Ritidian Point, MSA, and portions of Andersen Main Base. Chronic, low-level poaching is suspected as contributing to the steady decline in fruit bat numbers on Guam (USFWS 2007a), in addition to BTS predation on young bats.

The 1990 recovery plan for the Mariana fruit bat identified the majority of Andersen AFB, except the housing and airfield areas, as essential habitat for the recovery of the fruit bat, and generally corresponds with the Overlay Refuge. This area includes large tracts of primary and secondary limestone forest which are known to contain roosting and foraging sites for fruit bats (USFWS 1990a). In 2002, the USFWS proposed critical habitat for this species on Andersen AFB which included this essential habitat (see Figure 10.1-9) (USFWS 2002); however, the final rule did not designate critical habitat - partly because Overlay Refuge lands were already being managed to benefit the Mariana fruit bat on the base (USFWS 2004).

Andersen AFB recently established a management plan for Mariana fruit bat that identifies important roosting and foraging habitat on base, and describes management activities to benefit the species (Andersen AFB 2008e; refer to Figures 10.1-7 and 10.1-8). Additional information about the species can be found in Appendix G.

### *Mariana Crow*

This is a forest dwelling crow that is endemic to the Mariana Islands of Guam and Rota. Mariana crows utilize a wide variety of forested habitats including limestone, strand, ravine, agricultural forests, and secondary forests; all of which are present on Andersen AFB. However, their preference seems to be primary limestone forests. Mariana crow nests on Guam were found in 11 tree genera, and all but one are native tree species. Most nests are located high in fig or loquat trees (USFWS 2005b), all of which are abundant in primary limestone forests on Andersen AFB.

The Mariana crow survives on northern Guam in critically low numbers – only two crows are known to live in the wild on Guam. Of the 11 crows on Guam in 2006, all were located at Andersen AFB with 9 territories in the MSA, and 1 territory in the northern part of the base near the Guam NWR (USFWS 2006). Recent information indicates that Mariana crow numbers are continuing to decline on Guam and

Rota, and no female crows were observed on Guam in 2007 (Rodda 2007). Surveys conducted from June 2007 through April 2008, indicated that the Mariana crow population declined from an estimated ten individuals observed in 2006, all of which were originally trans-located from Rota, to two males (Andersen AFB 2008d).

Critical habitat was designated for the species in 2004 in the Ritidian Unit of the Guam NWR; however, no critical habitat occurs on Andersen AFB (Figure 10.1-9) (USFWS 2004). The Draft Revised Recovery Plan for the Mariana crow identifies recovery zones on Andersen AFB (Figure 10.1-9) (USFWS 2005b). The highest priority areas (Priority 1) for recovery of the crow on Andersen AFB include the northern (from Ritidian Point to Pati Point) and eastern (from Pati Point to Anao Point) coastal forests and the MSA. Each area contains large, relatively undisturbed tracts of forest, currently or historically utilized by crows, and are considered core areas for crow conservation in northern Guam. The northern and eastern coastal areas consist of mature and secondary limestone and strand forest, and contains areas utilized by Mariana crows as recently as the 1990s. The MSA area contains the remaining crow population on Guam (USFWS 2005b).

Priority 2 areas for recovery of crows include an area to the east of the MSA, the coconut plantation in the Tarague Basin, and the western area of Andersen AFB. The area to the east of the MSA primarily contains secondary limestone forest that has been heavily disturbed. However, crows have utilized the area as recently as the 1990s. This area could provide additional habitat to a recovering crow population. The coconut plantation adjacent to Tarague Beach consists of large stands of coconut trees that were formally utilized for copra production. These coconut forests are not high quality crow breeding habitat, but they do provide good foraging habitat. The western area consists mostly of secondary forest with some mature limestone forest along the cliff lines (USFWS 2005b).

Crow recovery zones include an area in the mid-southern portion of Andersen AFB and NWF. Each of these areas is highly degraded and primarily composed of secondary forest or other disturbed habitats that are not widely utilized by crows. However, these areas do contain some patches of good quality limestone forest and have recovery potential. With appropriate management and reforestation efforts, they would provide additional habitat for a recovering crow population (USFWS 2005b).

#### *Guam Micronesian Kingfisher*

A Guam endemic subspecies of forest kingfisher, the Guam Micronesian kingfisher was considered “fairly common” and occurred throughout forested areas on Guam in 1945; but by 1988, they were believed to be extirpated from the wild (Wiles et al. 2003). A captive breeding program is currently underway. Kingfishers utilized a wide variety of habitats including limestone forest, strand forest, agricultural forest, secondary forest, edge habitats, and forest openings; however, mature forests with appropriate nest sites in cavity trees may be an important requirement for kingfisher reproduction (USFWS 2008a); all of these are abundant on Andersen AFB.

The USFWS proposed critical habitat for this species on Andersen AFB that included nearly the entire base, except the housing and airfield areas (USFWS 2002). However, the final rule did not designate critical habitat, partly because Overlay Refuge lands were already being managed to benefit this species (USFWS 2004). Based on the proposed critical habitat areas, ‘essential habitat’ does occur on base (refer to Figure 10.1-9).

#### *Guam Rail*

The flightless Guam rail was once distributed throughout Guam; however, in 1983 it was estimated that fewer than 100 individuals remained. By 1987, the Guam rail was considered extirpated from the wild

(Witteman et al. 1990). A captive breeding program on Guam by GDAWR is currently underway. Experimental releases occurred in a snake-free zone on Andersen AFB in 1998 and 2003. Although nesting attempts were observed (GDAWR 2006), the adult birds did not survive. Evidence indicated that feral cats were responsible for the eradication of the released population (Andersen AFB 2008a). The Guam rail utilized all habitats except wetlands; although it prefers open, scrubby habitats (USFWS 1990b). Open, scrubby habitat is common throughout the limestone plateau area of Andersen AFB.

#### *Mariana Swiftlet*

This species nests and roosts in caves, and leaves the caves to forage on small insects over a wide variety of terrain and vegetation. However, they seem to favor ridge crests and open grassy areas (USFWS 1991c), which are common habitats on Andersen AFB. Although the Mariana swiftlet is not currently present on Andersen AFB, caves on the base were historically used by swiftlets (Andersen AFB 2008a).

#### *Green Sea Turtle*

The green sea turtle nests on Guam beaches. Foraging and resting green turtles are often seen near Guam's well-developed seagrass beds and reef flats. Green turtle nesting on Guam is most prevalent at the northern and southern ends of the island. GDAWR surveys identified eight beaches as active nesting sites, including Tarague Beach on Andersen AFB (Gutierrez 2004). The highest incidence of sea turtle nesting in northern Guam has been reported at Tarague Beach, and the highest recorded activity (17 occurrences) at Tarague Beach was in 1993. However, most of these were recorded as false crawls (sea turtle nesting effort that was abandoned). In 2000, 16 crawls were counted on Andersen AFB beaches. In 2005, 11 occurrences of crawls, body pits, nesting, or hatchlings were documented at Tarague Beach. Most recently, the 2006 season recorded five occurrences of green turtles at Tarague Beach (Andersen AFB 2008b).

#### *Hawksbill Turtle*

Hawksbills nest sporadically in Guam. Historical records indicate a likely presence of this species in the coastal waters (Wiles et al. 1995, Gutierrez 2004). At Andersen AFB, there have been no hawksbill turtles on beaches since 1984, except for a dead individual reported in 1997 on Tarague Beach (Andersen AFB 2008b).

#### *Marianas Eight-Spot Butterfly*

This butterfly species, which is endemic to Guam and Saipan, has been observed at Andersen AFB. One specimen was collected on the base in April 1982 (GDAWR 2006). In 2006, a Mariana eight-spot butterfly was reported, along with its host plants *Procris pedunculata* and *Elatostema calcareum*, along a rocky pinnacle karst area near Pati Point (PACAF 2006a). Its current status at this location, and potential presence at other locations on Andersen AFB, is unknown (Andersen AFB 2008a). The current Guam-wide status and distribution of this species is unknown.

#### *Tree Snails*

The native Guam, humped, and fragile tree snails are candidate species for listing under ESA. In 1989, Hopper and Smith (1992) resurveyed a previously known site in the Tarague Basin for these snails and none were found. During focused tree snail surveys in 2008 in support of this EIS/OEIS, four partulid colonies were located, two at NCTS Finegayan (Pugua Point and Haputo Beach) consisting of fragile, Guam, and humped tree snails, and two at the NMS (Kitts Road area) consisting of just Guam tree snails. Of the four colonies, only the Haputo colony at NCTS Finegayan was previously known. The fragile tree

snail colony at Pugua Point is the only known colony on Guam and the status of the only other known colony on Rota is unknown (Smith et al. 2008).

#### *Fire Tree*

This is a large tree reaching 60 ft (18 m) or more in height, with an average trunk diameter of nearly 6 ft (2 m). It grows along limestone cliffs, usually in primary forest, but Fosberg (1960) reported that it also occurred in low numbers in late successional secondary forest. At the time of its listing as endangered in 1987, there were only two known native mature fire trees on Guam, located in limestone forest at Andersen AFB (Andersen AFB 2008a). In 2002, super typhoon Pongsona uprooted one mature tree. The second mature seed-bearing tree was above Ritidian Point in limestone forest on Andersen AFB. Subsequent to the typhoon, seedlings were observed around the felled tree, but it is currently unknown if any wild seedlings still exist. In 2000, 67 fire tree seedlings were planted in three locations: (1) Area 50, (2) the MSA, and (3) Tarague Beach. The number of outplanted seedlings that have survived is currently unknown (Andersen AFB 2008a). According to recent information, only 1 mature fire tree remains on Guam and it is at NWF on Andersen AFB (Adams 2009).

#### Guam-Listed Species

Fifteen Guam-listed threatened and endangered species are known to occur on Andersen AFB, or they may occur because suitable habitat is present (refer to Table 10.1-5). Species that are both Guam-listed and federally listed are discussed above.

#### *Micronesian Starling*

A subspecies endemic to Guam, Rota, Tinian, and Saipan, the starling was historically found throughout the island occupying all habitats, but it was more commonly found in forested areas nesting in cavities. As with the other Guam bird species, the principal cause of decline is believed to be predation by BTS. A 1981 survey determined that the starling on Guam was one of the most abundant species. It is now found at Andersen AFB in small numbers in the housing areas, forests north of the flightline, east of the golf course, and in an area south of the Naval Base Guam (refer to Figures 10.1-7 and 10.1-8) (Andersen AFB 2008a). The population is probably less than several hundred on Andersen AFB (GDAWR 2006).

#### *Heritiera Longipetiolata*












A Guam-listed endangered tree that is an uncommon endemic species found in primary limestone forest at Andersen AFB. It typically grows in crevices of rough limestone. In a recent study (UoG 2007), this species was documented as occurring at 265 locations on Andersen AFB, primarily in the central portion of the base, and near the limestone cliffs in the northwest, northeast, and southeast corners (Figure 10.1-10). The numbers and distribution of this species on Guam are not well known.

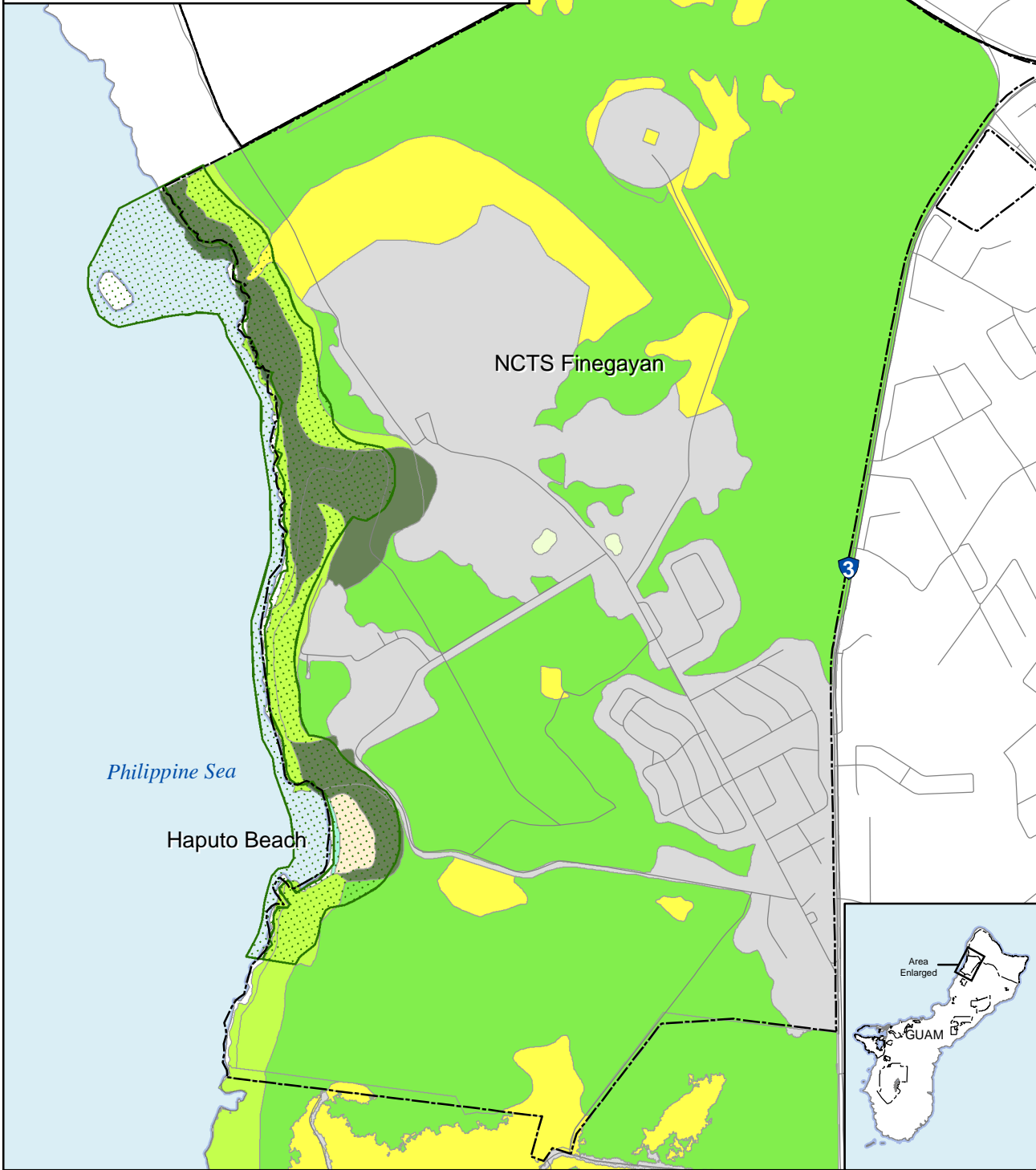
#### *Skinks and Geckos*

The Pacific slender-toed gecko was detected in recent natural resource surveys in northeastern NCTS Finegayan (NR Survey Report, in preparation), however it has not been documented in project-specific surveys on Andersen AFB. Habitat is present for the moth skink, but it was not found in recent project-specific surveys. The numbers and current distribution of these species on Guam are not well known.



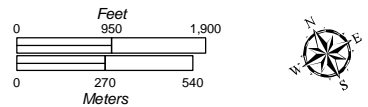
**Legend**

 Military Installation	 Route Number	
 Haputo ERA	 Limestone Forest - Disturbed	
<b>Vegetation</b>	 Shrub/Grasslands	
 Coconut Forest	 Strand	
 Developed	 Tangantangan	
 Halophytic/Xerophytic Scrub	<i>Source: COMNAV Marianas 2001 (modified by TEC Inc)</i>	
 Limestone Forest		



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**Figure 10.1-10**  
Vegetation Communities - NCTS Finegayan



## 10.1.2.2 Finegayan

NCTS Finegayan*Vegetation Communities*

The following terrestrial communities occur on NCTS Finegayan, including the Haputo Ecological Reserve Area (ERA): limestone forest, disturbed limestone forest, halophytic/xerophytic scrub, Tangantangan, shrub/grasslands, coconut forest, strand communities, and developed land. Figure 10-1-10 depicts the vegetation communities found within the NCTS Finegayan boundaries, which is based on the mapping within the 2001 INRMP (COMNAV Marianas 2001) with recent field-verified adjustments for conversion from disturbed limestone forest to shrub/grasslands. Acreages for each community are provided in Table 10.1-5.

**Table 10.1-5. Vegetation Communities at NCTS Finegayan**

<i>Vegetation Type</i>	<i>ac (ha)</i>
Limestone forest, disturbed	1,345 (544)
Developed Land	630 (255)
Shrub/grasslands	208 (84)
Halophytic/xerophytic scrub	110 (45)
Limestone forest	102 (41)
Coconut forest	8.8 (3.6)
Tangantangan	2.4 (1.0)
Strand	1.3 (0.5)

Within NCTS Finegayan is the Haputo ERA, established in 1984 as a mitigation measure for the construction of Kilo Wharf on Orote Peninsula (COMNAV Marianas 2001). The Haputo ERA includes submerged lands from the shoreline to a depth of 120 ft (37 m) at Double Reef. At Haputo Beach the marine lands stop at the reef edge. Inland, the ERA extends to the top of the limestone ridge along the length of the coast of NCTS Finegayan. The terrestrial unit of this ERA totals about 252 ac (102 ha), and the submerged lands total 72 ac (29 ha). As part of the management plan for this area, ungulate control is required.

Relatively intact limestone communities occupy limited areas along the cliff areas, along with halophytic-xerophytic scrub vegetation, primarily within or adjacent to Haputo ERA. The majority of the plateau area supports communities of disturbed limestone and urban/developed. Most of these areas contain a *Vitex* canopy and a mixed woody understory (with *Triphasia trifolia* being the most common understory species) containing openings dominated by non-native herbs, such as Siam weed. In the area where Haputo ERA extends eastward and a dirt road leads down (into the area), conditions are similar with a dominance of non-native woody vegetation (particularly *Annona reticulata*) extending to the west.

Below the plateau in the Haputo ERA, the limestone community is dominated in one area by *Merrilliodendron megacarpum*. This species is designated in the Guam CWCS as an SOGCN species. Only several other known colonies of *Merrilliodendron* are present on Guam, and these are located within the NMS in south-central Guam. The Haputo ERA *Merrilliodendron* forest provides habitat for at least two species of tree snails eligible for ESA listing (see discussion below for these species). At least one species has been observed on *Merrilliodendron* (NR Survey Report in preparation).

Near the sea in areas that are exposed to salt-laden winds and intense sun, *Pemphis acidula* is the most abundant component of this vegetation type; it often forms monotypic low-lying stands. A short distance landward of the *P. acidula* zone, other species appear, often in stunted forms. These include numerous

tree and shrub species such as beach naupaka, *Bikkia tetrandra*, and beach heliotrope (COMNAV Marianas 2001).

#### *Wildlife – Native Species*

A study of Haputo ERA was conducted shortly after it was established (USFWS 1986a). Based on that study, the shoreline and cliff line along NCTS Finegayan historically supported roosting and nesting sites for brown boobies and brown noddies, although probably in limited numbers. However, boobies and noddies are no longer found at NCTS Finegayan, likely due to predation and disturbance by BTS. Shorebirds observed in 1986 included the wandering tattler and common sandpiper. The common sandpiper is actually ‘uncommon,’ but a regular winter visitor to Guam and the Marianas. The Pacific golden plover was the only native bird species observed at NCTS Finegayan during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation). The blue-tailed skink, mourning gecko, and mutilating gecko were the only reptiles observed in forested areas of NCTS Finegayan during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation). Coconut crabs, land crabs, and hermit crabs were noted at the ERA after being incidentally caught or injured in traps set out for mammal surveys (USFWS 1986a). A 2001 study estimated the coconut crab population for Haputo ERA at 964 (USFWS 2001).

#### *Wildlife – Non-Native Species*

Abundant sign of ungulates, both feral pig and Philippine deer, was observed on the upper plateau area of NCTS Finegayan during recent vegetation surveys. Evidence of deer browse was particularly noteworthy in the northern portion adjacent to Andersen AFB, resulting in a very open understory. Pig damage was prevalent throughout, but was more intense in areas farther away from human activity. Ungulate impacts included extensive wallowing, scat, and bark rubbings. Extensive pig wallows and rooting of vegetation directly impacts native vegetation and causes secondary impacts such as facilitating invasive weed encroachment, reducing or eliminating recruitment of emergent tree species, erosion of essential top soil, and spreading of invasive species through ingestion and subsequent defecation of seed material. The effects of erosion from ungulate damage to the vegetation on the upper plateau can be found in the lower coastal forests and cliffs.

Black francolin, Eurasian tree sparrow, island collared dove, black drongo, and rock pigeon were observed at NCTS Finegayan during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation). In addition, the BTS, curious skink, house gecko, and cane toads were observed in forested areas of NCTS Finegayan during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation).

#### *ESA-Listed Species and Critical Habitat*

Ten ESA-listed or candidate species have been observed, or potential habitat is present, on NCTS Finegayan (Table 10.1-6 and Figure 10.1-11). Habitat for some species is only found at Haputo ERA. Two of these species, Guam Micronesian kingfisher and Guam rail, do not currently occur in the wild and are only found in captivity. Forested areas of the facility are within the Overlay Refuge lands (refer to Figure 10.1-2). Essential habitat for the Mariana fruit bat, Mariana crow, and Guam Micronesian kingfisher are designated in the northern and eastern portions of the facility (refer to Figure 10.1-11) (USFWS 2002). Mariana Crow Recovery Zones cover most of the forested areas of the facility (refer to Figure 10.1-11) (USFWS 2005b). These areas are predominantly limestone forest which is an important habitat for these threatened and endangered species.









**Table 10.1-6. Known or Potential Occurrence of ESA-listed, Guam-listed, and Candidate Species at NCTS Finegayan**

Common Name	Status		Habitat	Occurrence at NCTS Finegayan
	ESA	Guam		
<b>MAMMALS</b>				
Mariana fruit bat	T	E	Limestone forest, coastal forest, and coconut plantations	None currently occur, but essential habitat present
<b>BIRDS</b>				
Mariana crow	E	E	All forests with a preference for native limestone forest	None currently occur, but recovery zones and essential habitat present
Guam Micronesian kingfisher	E	E	Forest and scrub with a preference for native limestone forest	Extirpated but essential habitat present
Guam rail	E	E	Secondary habitats, some use of savanna and limestone forests	Extirpated but habitat present
Micronesian starling	-	E	All habitats but higher density in forests	Reported in the 1990s in southeast corner
<b>REPTILES</b>				
Green sea turtle	T	T	Suitable beaches for basking or nesting	Potential nesting at Haputo Beach
Moth skink	-	E	Forest areas with large tree trunks	Reported in the early 1990s at Haputo Beach area
Pacific slender-toed gecko	-	E	Forest edge	Detected in recent natural resource surveys in northeastern NCTS Finegayan
<b>INVERTEBRATES</b>				
Marianas eight-spot butterfly	C	-	Intact limestone forest with host species	Present at Hilaan Point but presence here unknown
Guam tree snail	C	T	Cool shaded forested areas with high humidity	Reported in 1989 and in 2007 at Haputo ERA
Humped tree snail	C	E	Cool shaded forested areas with high humidity	Reported in 1989 and in 2007 at Haputo ERA.
Mariana Islands fragile snail	C	E	Cool shaded forested areas with high humidity	Reported in 1989 and in 2007 at Haputo ERA.
<b>PLANTS</b>				
Fire Tree	E	E	Limestone and ravine forests.	Not known from the area but habitat present
<i>Heritiera longipetiolata</i>	-	E	Limestone forest	Not known from the area but habitat present

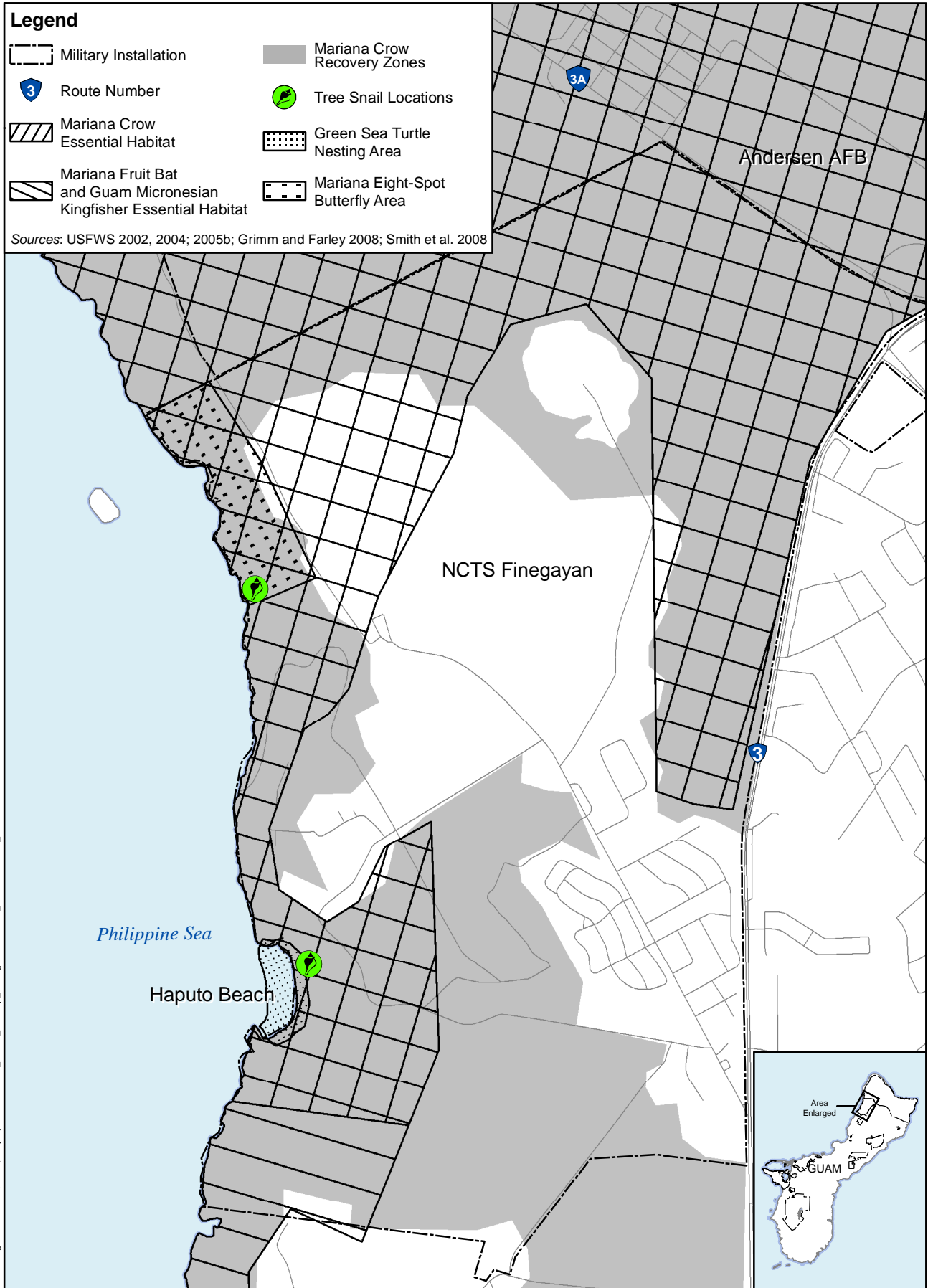
Notes: T = threatened, E = endangered, C = candidate.

Sources: Wiles et al. 1995; COMNAV Marianas 2001, 2008; GDAWR 2006; USFWS 2006; Smith et al. 2008; NR Survey Report in preparation.

**Legend**

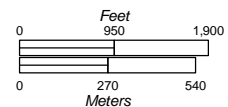
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|---|---|
|  Military Installation   |  Mariana Crow Recovery Zones       |
|  Route Number  |  Tree Snail Locations              |
|  Mariana Crow Essential Habitat                                      |  Green Sea Turtle Nesting Area     |
|  Mariana Fruit Bat and Guam Micronesian Kingfisher Essential Habitat |  Mariana Eight-Spot Butterfly Area |

Sources: USFWS 2002, 2004; 2005b; Grimm and Farley 2008; Smith et al. 2008



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**Figure 10.1-11**  
**Occurrences of Special-Status Species and Essential Habitat and Recovery Zones for ESA-listed Species on or in the Vicinity of NCTS Finegayan**



*Mariana Fruit Bat.* Currently, Mariana fruit bats are only occasionally observed at NCTS Finegayan. During morning observations on 10 nonconsecutive days in 2008, there were two sightings of Mariana fruit bats on NCTS, one below the cliff line in the northern section of the Haputo ERA near Falcona, and the other of an individual flying westward across Route 3A from Andersen AFB onto NCTS Finegayan (Brooke 2008). A single fruit bat was observed in March 2008 from an observation point at Double Reef Overlook at NCTS Finegayan during recent surveys in support of this EIS/OEIS (NR Survey Report, in preparation). There are no known roost areas for Mariana fruit bat at NCTS Finegayan but, based on the proposed critical habitat areas (USFWS 2002), essential habitat for the species does occur here (see Figure 10.1-11).

*Mariana Crow.* NCTS Finegayan was occupied by the Mariana crow as recently as the 1990s (USFWS 2005b). Priority 2 and 3 Recovery Zones for this species have been identified at NCTS Finegayan by the USFWS (USFWS 2005b) (see Figure 10.1-11). In addition, based on the proposed critical habitat areas (USFWS 2002), essential habitat for the Mariana crow occurs on NCTS Finegayan (see Figure 10.1-11).

*Guam Micronesian Kingfisher.* Kingfishers utilized a wide variety of habitats including limestone forest, strand forest, agricultural forest, secondary forest, edge habitats, and forest openings, but mature forests with tree cavities suitable for nesting may be an important requirement for kingfisher reproduction (USFWS 2008a); all of these habitat components are present on NCTS Finegayan. Based on the proposed critical habitat areas (USFWS 2002), essential habitat for the kingfisher occurs on NCTS Finegayan (see Figure 10.1-11).

*Guam Rail.* This bird species utilizes all habitats on Guam except wetlands. It prefers open, scrubby habitats and savanna and mature forest are deemed only marginal for Guam rail (USFWS 1990b). The preferred habitat type (disturbed limestone forest) is present at NCTS Finegayan. Specific areas of essential habitat were not defined for the Guam rail in the recovery plan (USFWS 1990b).

*Green Sea Turtle.* This sea turtle may utilize Haputo Beach at NCTS Finegayan and may nest there. Green sea turtles utilize offshore waters in the area for feeding, and are known to nest on other beaches in the area (Wiles et al. 1995). Intensive surveys have only been conducted for nesting attempts in 2007 and 2008; two suspected nest attempts and two false crawls were documented in April 2008 (presumably of green sea turtles, although this is not confirmed) (Grimm and Farley 2008).

*Tree Snails.* Three ESA candidate native tree snails (Guam tree snail, humped tree snail and fragile tree snail) were reported in 1989 when Hopper and Smith (1992) surveyed a site within the Haputo ERA. A recent survey found two colonies within Haputo ERA, one known historically at Haputo Beach and another further north at Pugua Point, but still within Haputo ERA (Smith et al. 2008). A heavy canopy cover (approximately 80%) was present at each site. The Pugua Point colony was small, with specimens of the Guam and fragile tree snails, with the latter being the most abundant and not observed on Guam since 1996. The Haputo colony, the only one known from previous studies, contained the Guam and humped tree snails. The Haputo ERA beach site is particularly important because it is the only known population of the humped tree snail on Guam. The density of snails at the Haputo ERA beach site has decreased significantly since 1996 (from a minimum of 4.7/m and a maximum of 17.2/m in 1996 to 2.2/m in 2008), possibly due to a change in forest structure (Smith et al. 2008).

*Mariana Eight-spot Butterfly.* This species has been historically observed at Andersen AFB and Hilaan Point (GDAWR 2006). There are 10 known populations on Guam with two populations reported for Tweed's Cove in Haputo ERA (USFWS 2007b).

### *Guam-Listed Species*

Thirteen Guam-listed species have been observed, or their potential habitat exists, on NCTS Finegayan (see Table 10.1-6). Those species that are both federally listed and Guam-listed are discussed above.

*Micronesian Starling.* A small territory was reported in the 1990s at the southeastern corner of NCTS Finegayan (Wiles et al. 1995). However, this species is not discussed in the recent draft INRMP (COMNAV Marianas 2008) and was not observed during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation), and it may no longer be present on the installation.

*Skinks and Geckos.* The Pacific slender-toed gecko was detected in recent natural resource surveys in northeastern NCTS Finegayan (NR Survey Report, in preparation). Previously there had only been an undocumented report of the species from the area. The moth skink was documented in the early 1990s as occurring on the Haputo ERA (Wiles et al. 1995). However, it was not observed at NCTS Finegayan during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation).

### South Finegayan

#### *Vegetation Communities*

Vegetation communities based on the 2001 INRMP (COMNAV Marianas 2001) at South Finegayan are listed in Table 10.1-7 and shown in Figure 10.1-12.

**Table 10.1-7. Vegetation Communities at South Finegayan**

<i>Vegetation Type</i>	<i>ac (ha)</i>
Developed Land	219 (89)
Limestone forest, disturbed	57 (23)
Shrub/Grasslands	12 (4.9)
Tangantangan	1.4 (0.6)

#### *Wildlife – Native Species*

The Pacific golden plover and yellow bittern were the only native bird species observed at South Finegayan during recent surveys in support of this EIS/OEIS. The blue-tailed skink and mourning gecko were observed in forested areas during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation).

#### *Wildlife – Non-Native Species*

Sign of ungulates, both feral pig and Philippine deer, was observed at South Finegayan during recent surveys. Soil and vegetation damage was moderate. Also, Eurasian tree sparrow, island collared dove, black drongo, rock pigeon, curious skink, house gecko, and cane toad were all observed in forested areas on South Finegayan during surveys in support of this EIS/OEIS (NR Survey Report in preparation).

USDA Wildlife Service conducts trapping and removal of the BTS on Navy property. These efforts include snake trapping around Navy housing.

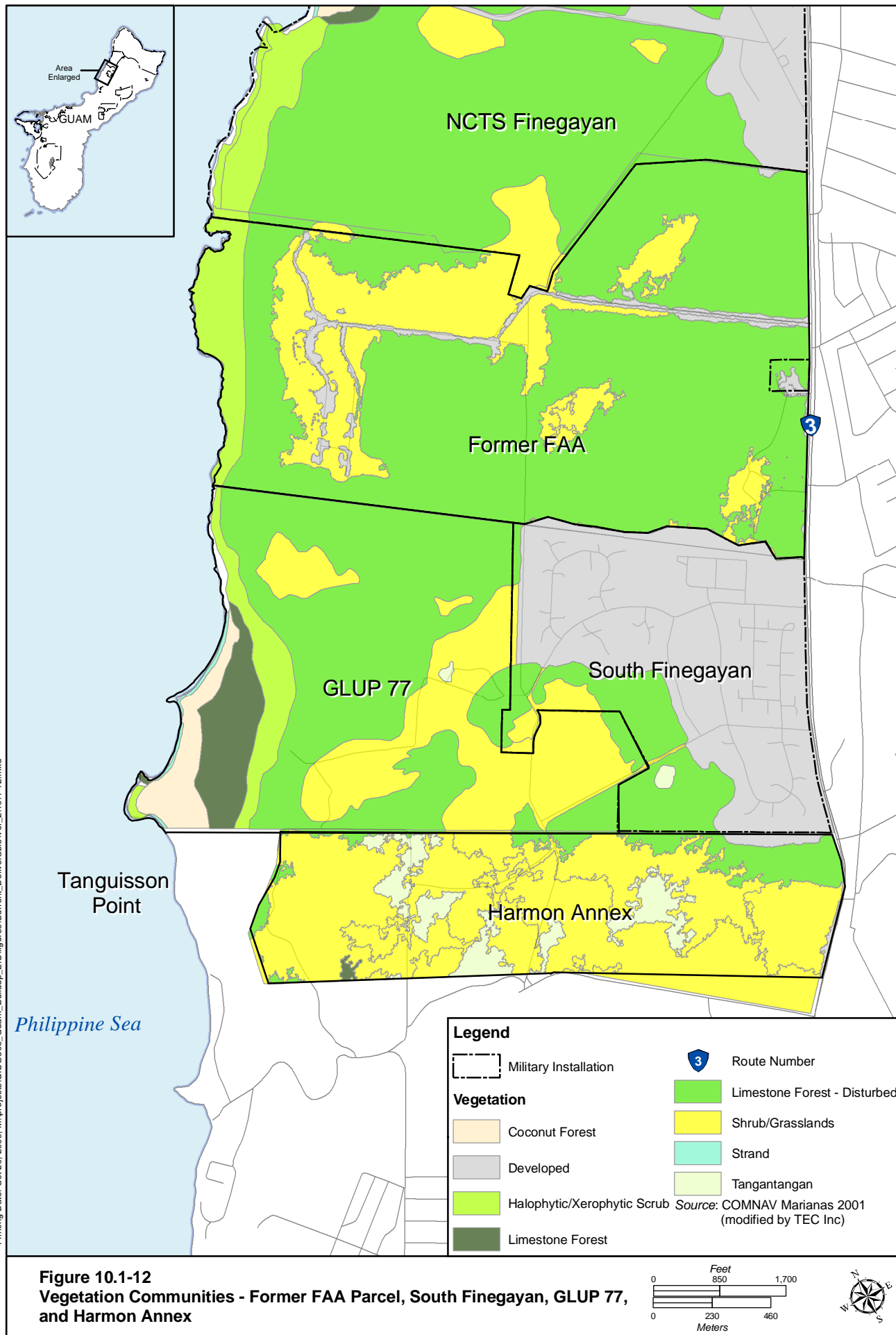
#### *ESA-Listed Species and Critical Habitat*

No critical habitat, essential habitat, or Recovery Zones have been designated for ESA-listed species at South Finegayan, and it is not within Overlay Refuge lands.

#### *Guam-Listed Species*

No Guam-listed species are known to occur on South Finegayan.

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**Figure 10.1-12**  
**Vegetation Communities - Former FAA Parcel, South Finegayan, GLUP 77,**  
**and Harmon Annex**



### 10.1.2.3 Non-DoD Lands

#### Vegetation Communities

The vegetation of the Former FAA Parcel was not mapped for the Navy INRMP (COMNAV Marianas 2001); however, the vegetation for the entire island of Guam, including these areas, has been mapped recently (but at a lesser level of detail for some community types) by the USFS (2006a). This recent vegetation mapping was modified to match the vegetation community types in the Navy INRMP and is also based on observations conducted in 2008 surveys. Vegetation communities on these lands are shown in Figure 10.1-13 and acreages are listed in Table 10.1-8. Vegetation communities shown do not include the coastal area of the former FAA parcel.

**Table 10.1-8. Vegetation Communities at Former FAA and Harmon Annex Parcels**

<i>Vegetation Type</i>	<i>Former FAA Parcel ac (ha)</i>	<i>Harmon Annex ac (ha)</i>
Limestone forest, disturbed	443 (179)	31 (13)
Shrub/Grassland	148 (60)	236 (96)
Developed land	25 (10)	3.9 (1.6)
Limestone forest, undisturbed	0	1 (0.4)
Tangantangan	0	32 (13)

#### Wildlife – Native Species

The Pacific golden plover and yellow bittern were the only native bird species observed at the former FAA parcel during recent surveys. No project-specific surveys were conducted at Harmon Annex, but species are likely to be similar to those found on the former FAA parcel. The blue-tailed skink and mourning gecko are reptiles that were observed in forested areas during recent surveys at the former FAA parcel in support of this EIS/OEIS (NR Survey Report in preparation). It is assumed that the Harmon Annex parcel would have similar wildlife based on the vegetation mapped by USFS (2006) and vegetation and habitat observed in the adjacent GLUP 77 parcel during project-specific surveys (NR Survey Report, in preparation).

#### Wildlife – Non-Native Species

Evidence of ungulate use, including both feral pig and Philippine deer, was prevalent on the former FAA parcel during recent surveys. Soil and vegetation damage was moderate. Eurasian tree sparrow, island collared dove, black drongo, rock pigeon, curious skink, house gecko, and cane toad were also observed on the former FAA parcel. Species occurrence and habitat conditions at Harmon are likely to be similar.

#### ESA-Listed Species and Critical Habitat

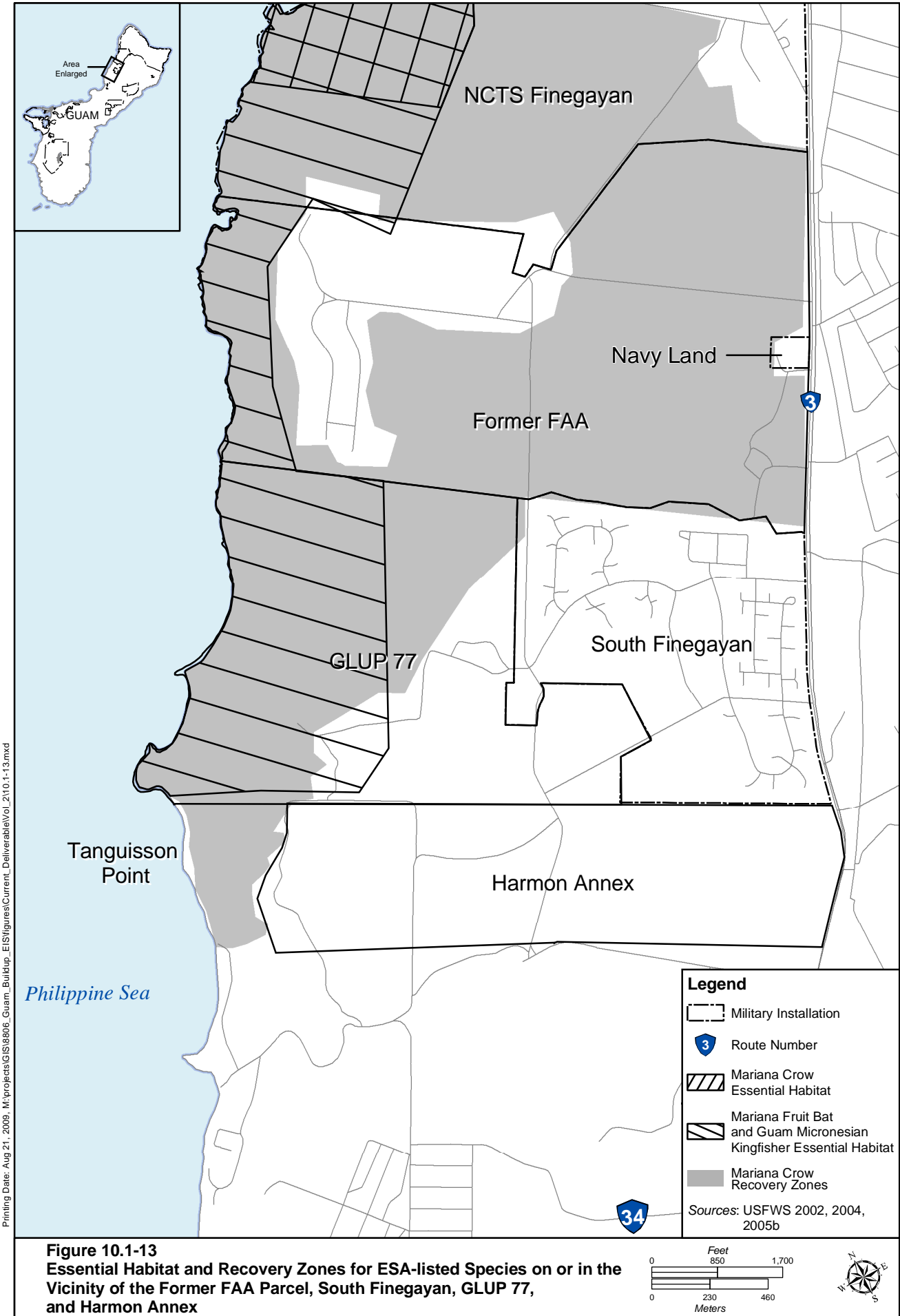
Four ESA-listed or candidate species have been observed, or habitat is present on some or a portion of these parcels (Table 10-1.9). While no critical habitat has been designated, a portion of the former FAA parcel is considered essential habitat for the Mariana fruit bat and Guam Micronesian kingfisher. In addition, recovery zones for the Mariana crow are designated within the former FAA parcel (Figure 10.1-13) (USFWS 2002). No listed species were observed during recent surveys. Based on the lack of designated habitat and vegetation types present, the Harmon parcel is unlikely to support the fruit bat, kingfisher, or crow. Habitat that could support the Guam rail is present.

**Table 10.1-9. Known or Potential Occurrence of ESA-listed, Candidate, and Guam-listed Species at the Former FAA and Harmon Annex Parcels**

Common Name	Status		Habitat	Occurrence at Former FAA and Harmon Annex Parcels
	ESA	Guam		
<b>MAMMALS</b>				
Mariana fruit bat	T	E	Limestone and coastal forests, coconut plantations	Does not currently occur, but essential habitat present at former FAA parcel
<b>BIRDS</b>				
Mariana crow	E	E	All forests, with a preference for native limestone forest	None currently occur, but recovery zone habitat present
Guam Micronesian kingfisher	E	E	Forest and scrub, prefers native limestone forest	Extirpated; essential habitat present at former FAA parcel
Guam rail	E	E	Secondary habitats, also savanna and limestone forests	Extirpated but habitat present throughout
<b>REPTILES</b>				
Pacific slender-toed gecko	-	E	Forest edge	Potential habitat present

Legend: T = Threatened, E = Endangered.

Sources: USFWS 1990b, 2006; Wiles et al. 1995; COMNAV Marianas 2001, 2008; GDAWR 2006.



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**Figure 10.1-13**  
**Essential Habitat and Recovery Zones for ESA-listed Species on or in the Vicinity of the Former FAA Parcel, South Finegayan, GLUP 77, and Harmon Annex**

### Guam-Listed Species

Species that are both Guam-listed and federally listed are discussed above. There is habitat present for the Pacific slender-toed gecko which prefers forest edge habitat that is present on these parcels. The species was not detected during recent surveys at the former FAA parcel (NR Survey Report in preparation). The Harmon Annex parcel would also be unlikely to harbor this species based on the similarity of vegetation and survey results from the nearby former FAA parcel and GLUP77 parcels (NR Survey Report, in preparation).

#### 10.1.2.4 Off Base Roadways

The proposed action includes on base roadway construction projects that would be implemented by the DoD. An affected environment description for on base roadway construction projects is included beneath the appropriate subheadings in other sections of this chapter. The following section describes the affected environment for off base roadway construction projects that would be implemented by the Federal Highway Administration (FHWA).

There are numerous proposed roadway projects in the north region. For the proposed Guam Road Network (GRN) projects, the areas evaluated are termed the Biological Resources Study Area (BRSA). The north region BRSA is shown in Figure 10.1-14.

### Vegetation Communities

Table 10.1-10 lists each vegetation community type within the area evaluated for each project, along with the acreage calculation for each type. Figure 10.1-15 shows the vegetation communities evaluated for GRN #8, 57, and 124. Similarly, Figure 10.1-16 depicts GRN #9, 10, 22, and 22A, and Figure 10.1-17 shows GRN #23. Vegetation includes maintained vegetated road shoulders (i.e., areas periodically mowed are considered urban cultivated), shrub and grasslands along the outer portions of the road shoulder, and developed areas. Depending on land use history and past surface disturbance along the roadways, the herbaceous scrub may transition into higher stature tangantangan and hibiscus thickets or degraded secondary limestone forests.

**Table 10.1-10. Vegetation Communities within North Region BRSA for the Proposed GRN Projects (ac [ha])**
















GRN #	Route	Limestone Forest, Disturbed	Mixed limestone Forest- Plateau/ Secondary	Vitex - Closed Canopy	Scrub Forest	Tangantangan	Mixed Herbaceous Scrub	Agricultural Field	Developed
8	3	45 (18)	0	0	132 (53)	3.5 (1.4)	53 (22)	9.6 (3.9)	206 (83.4)
9	3	133 (54)	0	0	77 (31)	0	0	0	208 (84.3)
10	3	43 (17.6)	12 (4.9)	8.2 (3.3)	8.0 (3.2)	0	0	0	73 (29.6)
22	9	2.3 (0.9)	92 (37)	11 (4.8)	36 (14)	0	6.4 (2.6)	0	106 (43.1)
22A	9	12.3 (5.0)	118 (76)	4.9 (2.0)	75 (30)	0	15 (6.2)	0	89 (36)
23	1	14 (5.7)	4.6 (1.9)	0	216 (87)	0	8.3 (3.4)	7.1 (2.9)	213 (86)
57	28	10 (4.0)	0	0	205 (82)	0	37 (14)	1.6 (0.6)	420 (170)
124	Finegayan Connection	12 (5.0)	0	0	138 (60)	70 (28)	91 (36)	0	40 (16)
<b>Total</b>		<b>272 (111)</b>	<b>227 (120)</b>	<b>24.0 (10)</b>	<b>887 (360)</b>	<b>74 (29)</b>	<b>211 (84)</b>	<b>18 (7.4)</b>	<b>1355 (549)</b>

As discussed earlier in this chapter for the different study areas, survey/mapping occurred at different times and using different vegetation categories for some areas. For GRN projects that expand into DoD parcels, vegetation categories and mapping for each parcel are described and presented based on the best

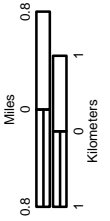
**Figure 10.1-14**

**North Region Proposed Road Improvements**

**Legend**

-  Military Installation
-  Route Number
-  Project Locations and GRN#
-  Intersection Improvement
-  Military Access Gate
-  Pavement Strengthening
-  Widening/Pavement
-  Strengthening
-  Realignment/ New Construction
- Vegetation**
-  Agricultural Field
-  Developed
-  Tangantangan
-  Limestone Forest
-  Scrub Forest
-  Shrub/Grassland
















Source: USFS 2006



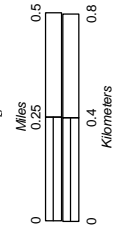
**Figure 10.1-15**

North Region Proposed Road Improvements GRNs 8, 57, & 124

**Legend**

-  Military Installation
-  Route Number
-  Project Locations and GRN#
-  Intersection Improvement
-  Military Access Gate
-  Pavement Strengthening
-  Widening/Pavement Strengthening
-  Realignment/ New Construction
-  Vegetation
-  Agricultural Field
-  Developed
-  Tangantangan
-  Limestone Forest - Disturbed
-  Scrub Forest
-  Shrub/Grassland

Source: COMNAV Mananas 2001 (modified by TEC Inc)

















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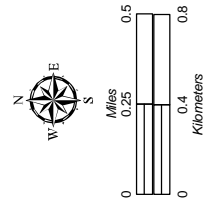
**Figure 10.1-16**

North Region Proposed Road Improvements  
GRNs 9, 10, 22 & 22a

**Legend**

-  Military Installation
-  Route Number
-  Project Locations and GRN#
-  Intersection Improvement
-  Military Access Gate
-  Pavement Strengthening
-  Widening/Pavement Strengthening
-  Vegetation
-  Agricultural Field
-  Developed
-  Tangantangan
-  Limestone Forest - Disturbed
-  Scrub Forest
-  Shrub/Grassland

Sources: COMNAV Marianas 2001  
(modified by TEC Inc);  
Andersen AFB 2008c















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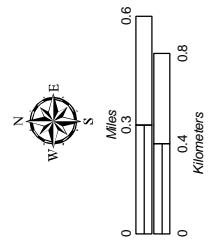
**Figure 10.1-17**

North Region Proposed  
Road Improvements  
GRN 23

**Legend**

-  Military Installation
-  Route Number
-  Project Locations and GRN#
-  Intersection Improvement
-  Military Access Gate
-  Pavement Strengthening
- Vegetation**
-  Agricultural Field
-  Developed
-  Tangantangan
-  Limestone Forest - Disturbed
-  Scrub Forest
-  Shrub/Grassland

Sources: USFS 2006;  
Andersen AFB 2008c





available published data for that parcel, with some modifications based on observations during recent field surveys (COMNAV Marianas 2001, Andersen AFB 2008c). The 2005 USFS (2006a) mapping effort represents the best available data for describing vegetation communities on non-DoD properties.

*Tabernaemontana rotensis*, considered a SOGCN by GDAWR, has been mapped recently on Andersen AFB (UoG 2007). This species was not recorded within the BRSA that overlaps onto Andersen AFB. The species is typically found in edge habitats of limestone forest areas, which do occur within some areas of the BRSA, however presence in these areas is unknown.

#### Wildlife – Native Species

Because of the presence of non-native predators and invasive plant species, the relatively intact forested areas within the BRSA do not currently support resident native bird species. However, these areas do contain potential forage for future recovery of native forest birds. On maintained road shoulders, Pacific golden plovers were observed foraging in mowed grass in November 2006 during their autumnal migration from their northern breeding grounds.

Based on the habitats present, the BRSA would support the blue-tailed skink and the mutilating gecko, but predation by BTS is a limiting factor. These species are described earlier in this chapter for other project areas in sections describing wildlife within the North Region.

Although numerous native butterflies potentially occur within the BRSA, the blue-banded king crow, a member of the subfamily Danainae (milkweed butterfly subfamily), has been observed most frequently. Other butterflies may be limited by the herbivory on nurse plants by Philippine deer and other habitat degradation associated with feral pigs.

#### Wildlife – Non-Native Species

Based on the habitat present, non-native bird species within the BRSA of the north region's proposed GRN projects may include the black francolin, Philippine turtle dove, black drongo, Eurasian tree sparrow, and semi-feral chickens associated with residences on the east side of Route 3 and the south side of Route 9.

Feral and domesticated cats and dogs, rats, Philippine deer, and feral pigs are known to inhabit roadway project areas in the North Region. Ungulate nighttime spotlight counts and daytime reconnaissance during field studies in support of the ISR/Strike EIS (Andersen AFB 2006b) noted the presence of "somewhat emaciated" feral cats and dogs and "collared" domestic cats and dogs. Ungulate impacts are well evidenced within the GRN project areas including extensive wallowing, scat, and bark rubbings. These types of impacts were readily observed during field reconnaissance for this EIS/OEIS and during earlier field studies (Andersen AFB 2006b) in support of the ISR/Strike EIS.

As discussed earlier in this chapter regarding non-native predator impacts on Guam, the extirpation, extinction, or severe population declines of Guam's native avifauna are attributed to the presence of BTS. Other introduced reptilian species that may occur within the BRSA include the curious skink and monitor lizard.

#### ESA-Listed Species

Six ESA-listed species are potentially present in the BRSA. Table 10.1-11 lists special-status species that are known to occur, or habitat is present, within northern Guam. and these species are described below.

**Table 10.1-11. Known or Potential Occurrence of ESA-listed, Candidate, and Guam-listed Species within North Region for Proposed GRN Projects**

Common Name	Status*		Occurrence in the BRSA
	ESA	Guam	
<b>MAMMALS</b>			
Mariana fruit bat	T	E	Few, if any, present; essential habitat present on DoD lands west of Route 3 and north of Route 9 on Andersen AFB; some foraging tree species present
<b>BIRDS</b>			
Mariana crow	E	E	Not currently present; essential habitat present and recovery zones on DoD lands west of Route 9 and North of Route 3 on Andersen AFB
Guam Micronesian kingfisher	E	E	Extirpated in the wild; essential habitat present on DoD lands west of Route 9 and North of Route 3 on Andersen AFB
Guam rail	E	E	Extirpated in the wild; suitable habitat is present
<b>REPTILES</b>			
Moth skink	-	E	Not found in Northern Guam in recent surveys; last reported occurrence is at Haputo Beach area
Pacific slender-toed gecko	-	E	Detected in recent natural resource surveys in northeastern NCTS Finegayan
<b>INVERTEBRATES</b>			
Mariana eight-spot butterfly	C	-	Not known to be present; forested habitat with host plants that typically occur on epikarst are absent
Guam tree snail	C	T	Currently not known from the area and not known to be present; limited habitat due to the lack of undisturbed understory

Legend: \*E = endangered; T = threatened; C = candidate.

Sources: COMNAV Marianas 2001; GDAWR 2006; Andersen AFB 2008a.

#### *Mariana Fruit Bat*

Within the forested areas of the North Region BRSA for the proposed GRN projects, solitary bats may forage and roost in relatively intact forested areas. Colonial bats from the Pati Point colony may also forage on suitable tree species within these areas as well. Earlier in this chapter under discussions of biological resources within Andersen AFB and NCTS Finegayan. Approximately 280 ac (117 ha) of Mariana fruit bat essential habitat is within the BRSA for proposed GRN projects within the North Region.

#### *Mariana Crow*

Within the forested areas of the BRSA for the North Region proposed GRN projects, the intact forested areas are considered Mariana crow essential habitat. Currently, the remaining crows are confined to the interior portions of Andersen AFB and were last seen within NCTS Finegayan in the 1990s (USFWS 2005b). Approximately 280 ac (113 ha) of Mariana crow essential habitat and 435 ac (176 ha) of recovery zone area is within the BRSA for proposed GRN projects within the North Region.

#### *Guam Micronesian Kingfisher*

Edges between forest and shrub or herbaceous areas along road corridors may be important to Guam Micronesian kingfishers, and the BRSA extends into areas considered essential habitat on both NCTS Finegayan and Andersen AFB. Approximately 280 ac (113 ha) of Guam Micronesian kingfisher essential habitat is within the BRSA for proposed GRN projects within the North Region. This species is extirpated, only persisting in captive breeding programs.

#### *Guam Rail*

The Guam rail is extirpated and persists in captive breeding programs. This species is associated with open areas usually created by typhoons, which often removes patches of forest. Critical habitat has not

been proposed for the Guam rail; however, open areas within Andersen AFB may be considered important to the recovery of this species.

#### *Tree Snails*

The Guam tree snail is associated with closed canopy forests with undisturbed mesic substrates. Some of these areas are found within the BRSA; however, the presence of predatory flatworms within Guam's northern forests is a major limiting factor (USFWS 2007c).

#### Guam-Listed Species

Seven Guam-listed species have been observed, or their potential habitat exists, within north region for proposed GRN project. Those species that are both federally listed and Guam-listed are discussed above.

#### *Skinks and Geckos*

Neither the Pacific slender-toed gecko nor the moth skink were observed at the former FAA parcel during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation). BTS infestations within the northern Guam habitats are believed to be a limiting factor on the Pacific slender-toed gecko (Fritts and Leesman-Tanner 2008).

### **10.1.3 Central**

#### 10.1.3.1 Andersen South

##### Vegetation Communities

Figure 10.1-18 depicts the cover types within the boundaries of Andersen South based on USFS (2006a) mapping, modified by project-specific field surveys, and acreages are provided in Table 10.1-12. Vegetation communities mapped by USFS (2006b) within Andersen South indicate significant land disturbance.

**Table 10.1-12. Vegetation Communities at Andersen South**

<i>Vegetation Type</i>	<i>ac(ha)</i>
Limestone Forest, disturbed	1,482 (600)
Shrub/Grasslands	443 (179)
Developed	54 (22)
Tangantangan	83 (34)

A reconnaissance survey was conducted in support of a Military Operations in Urban Terrain (MOUT) training Environmental Assessment by GDAWR and Navy biologists for the rare plant species *Tabernaemontana rotensis* in areas proposed for clearing and the species was not found (Marine Corps 2003). Recent surveys in support of this EIS/OEIS did not find any rare plant species at Andersen South (NR Survey Report in preparation). As indicated in the table, much of the area is dominated by disturbed limestone forest and shrub and grassland vegetation. While USFS (2006a) classified most of the vegetation as scrub forest, more recent field observations indicate that this site would be better characterized as open/disturbed limestone forest. Recent surveys also found that the southwest and southeast corners of the facility support more mature vegetation canopy layers, and in at least some locations these are dominated by native species. For example, the findings from a survey transect in the southwest corner of the site demonstrate that a limestone forest dominated with native species exists, including some large grand devil's claw and Marianas breadfruit and relatively low numbers of invasive plants. In a reconnaissance of the southeast corner, it was noted that the understory was heavily damaged by ungulates and conditions indicated a large feral pig population was present.

**Figure 10.1-18**

Vegetation  
Communities -  
Andersen South and  
Rte 15 Lands

**Legend**

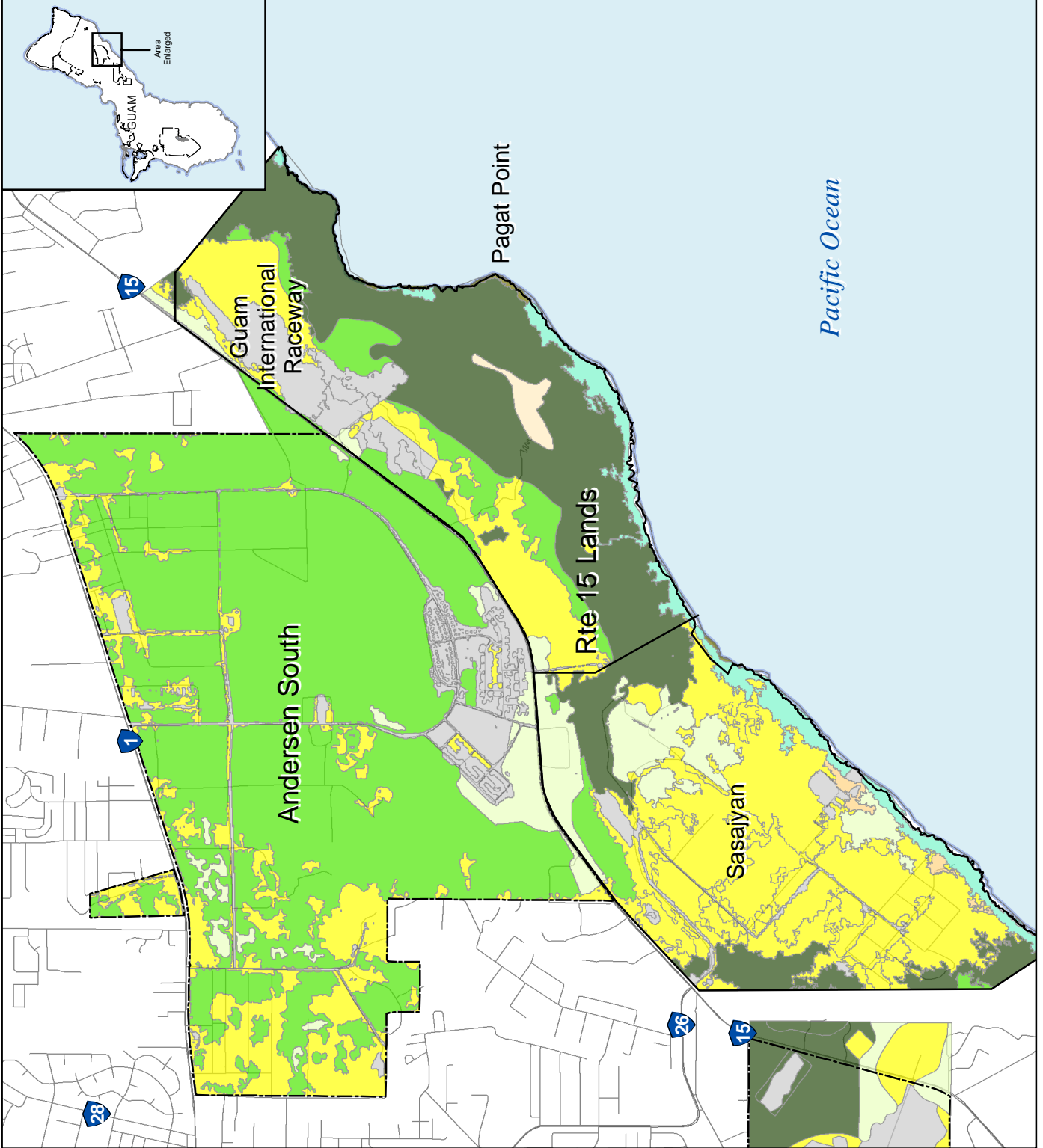
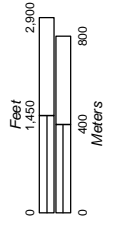
Military Installation

Route Number

Vegetation

- Casuarina Forest
- Coconut Forest
- Tangantangan
- Limestone Forest
- Limestone Forest - Disturbed
- Shrub/Grasslands
- Strand
- Developed

Source: USFS 2006  
(modified by TEC Inc)



Wildlife – Native Species

The yellow bittern has been reported as occurring in the area by GDAWR (2000a). Also, the blue-tailed skink and mourning gecko were observed in forested areas during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation).

Wildlife – Non-Native Species

Sign of ungulates, both feral pig and Philippine deer, was observed at Andersen South during recent surveys (NR Survey Report in preparation). Soil and vegetation damage ranged from moderate to severe. Eurasian tree sparrow, island collared dove, black francolin, curious skink, house gecko, greenhouse frog, and cane toads were also observed in forested areas during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation).

ESA-Listed Species and Critical Habitat

No critical habitat, essential habitat, or recovery zones for ESA-listed species has been designated at Andersen South, and no ESA-listed species have been reported or observed at Andersen South during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation).

Guam-Listed Species

No Guam-listed species have been observed during recent surveys at Andersen South in support of this EIS/OEIS. Andersen South was not covered in the Air Force current and draft INRMPs prepared for the base (Andersen AFB 2003, 2008a).

## 10.1.3.2 Non-DoD Land

Vegetation Communities

Figure 10.1-18 depicts the vegetation communities within the boundaries of the Route 15 lands based on USFS (2006a) mapping and acreages are provided in Table 10.1-13.

**Table 10.1-13. Vegetation Communities at the Route 15 Lands (ac [ha])**

<i>Vegetation Type</i>	<i>North Parcel</i>	<i>South Parcel</i>
Limestone forest	423 (171)	144 (58)
Developed	234 (95)	36 (15)
Limestone forest, disturbed	120 (49)	33 (13)
Shrub/Grasslands	79 (32)	559 (226)
Strand	34 (14)	45 (18)
Tangantangan	21 (8.5)	137 (55)
Coconut Forest	19 (7.7)	0
<i>Casuarina</i> Forest	0	11 (4.5)

The parcels encompass large areas of limestone forest on the upper plateau at cliff edges and on the coastal bench below the cliff line. Some forests on the upper plateau are on rugged limestone terrain of sharp pinnacles and narrow fissures and, as a result, are minimally disturbed by ungulates. Substantial areas of disturbed limestone forest are also present. Some of these disturbed areas, particularly to the east of the racetrack, include small remnant “islands” of original limestone forest that have not been recently cleared, but are surrounded by cleared land allowing invasive, non-native species to encroach.

Wildlife – Native Species

The yellow bittern has been reported as occurring in the area by GDAWR (2000a). Also, the blue-tailed skink and mourning gecko were observed in forested areas during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation).

Wildlife – Non-Native Species

Sign of ungulates, both feral pig and Philippine deer, was observed in the area during recent surveys although soil and vegetation damage in the area was not severe as in other areas such as parts of nearby Andersen South (NR Survey Report in preparation). Wildlife species that currently occur in the area are non-native species that are common elsewhere on Guam such as Eurasian tree sparrow, island collared dove, black francolin, curious skink, house gecko, greenhouse frog, and cane toads as observed during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation).

ESA-Listed Species

Nine ESA-listed or candidate species have been observed or habitat is present within the Route 15 lands (Table 10.1-14, Figure 10.1-19). Limestone forests are an important habitat for these species.

**Table 10.1-14. Known or Potential Occurrence of ESA-listed, Candidate, and Guam-listed Species at the Route 15 Lands**

Common Name	Status*		Habitat	Occurrence at Route 15 Lands
	ESA	Guam		
<b>MAMMALS</b>				
Mariana fruit bat	T	E	Limestone forest, coastal forest, and coconut plantations	Present historically but not observed within the last several years; essential habitat is present
<b>BIRDS</b>				
Mariana crow	E	E	All forests with a preference for native limestone forest	Not currently present, but recovery zones designated
Guam Micronesian kingfisher	E	E	Forest and scrub with preference for native limestone forest	Extirpated but essential habitat present
Mariana swiftlet	E	E	Nests in caves; feeds in savannah and ravine forest	One possible colony in the area historically; not reported since 1998
<b>REPTILES</b>				
Pacific slender-toed gecko	-	E	Forests	Not observed in recent surveys
Moth skink	-	E	Forest areas with large tree trunks	Not observed in recent surveys
<b>INVERTEBRATES</b>				
Marianas eight-spot butterfly	C	-	Intact limestone forest with host species	Reported occurrence at Pagat Point and observed during recent surveys
Guam tree snail	C	T	Intact limestone forest	Not observed in recent surveys
Humped tree snail	C	E	Intact limestone forest	Not observed in recent surveys
Fragile tree snail	C	E	Intact limestone forest	Not observed in recent surveys
<b>PLANTS</b>				
Fire Tree	E	E	Limestone and ravine forests.	Habitat present
<i>Heritiera longipetiolata</i>	-	E	Limestone forest	Present








Legend: \*T = threatened, E = endangered, C = candidate.

Sources: Wiles et al. 1995; GDAWR 2006.

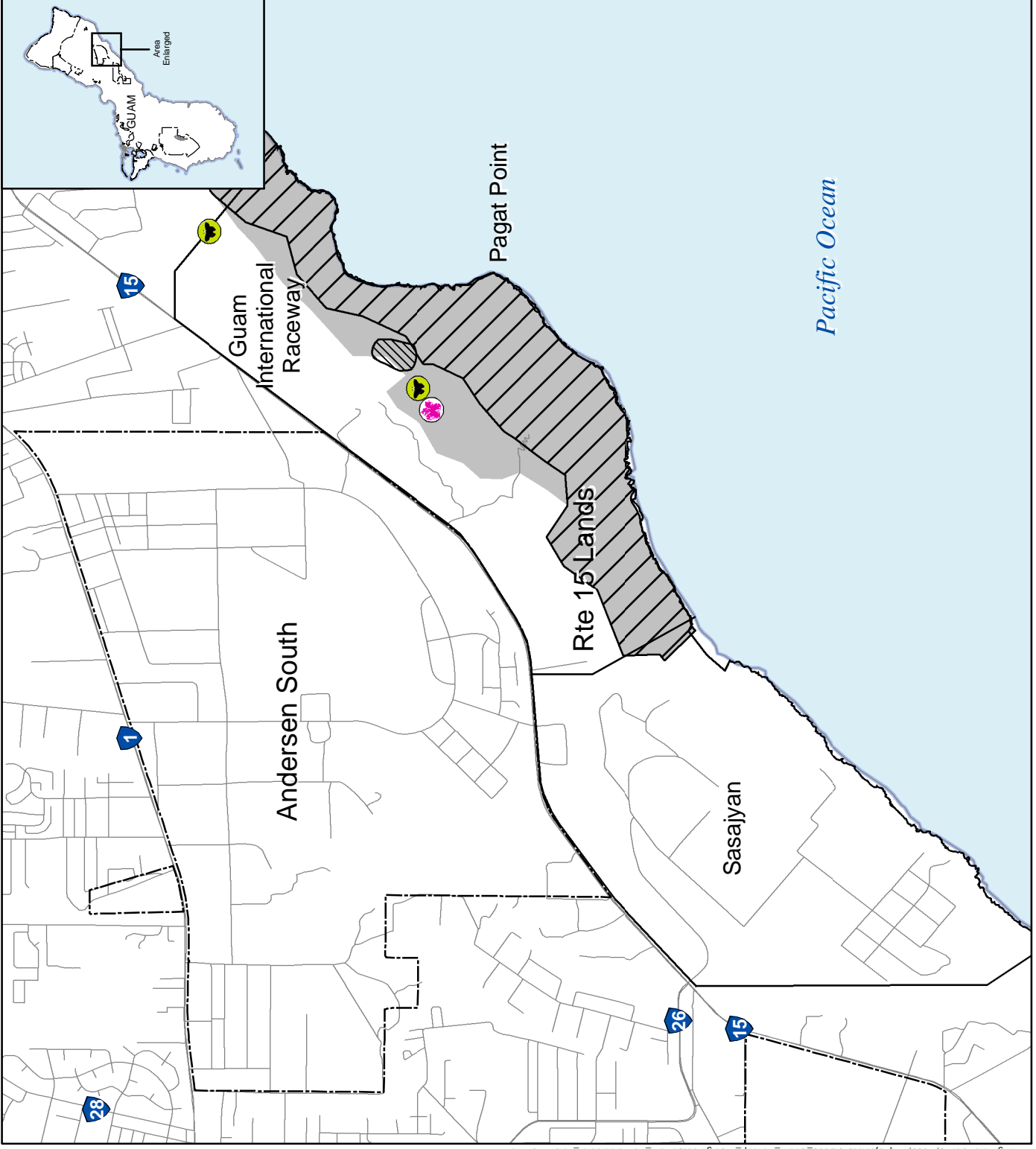
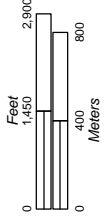
**Figure 10.1-19**

Occurrences of Special-Status Species and Essential Habitat and Recovery Zones for ESA-listed Species on or in Vicinity of Andersen South and Rte 15 Lands

**Legend**

-  Military Installation
-  Route Number
-  Mariana Fruit Bat and Guam Micronesian Kingfisher Essential Habitat
-  Mariana Crow Recovery Zones
-  *Heritiera longipetiolata* Clusters
-  Mariana Eight-Spot Butterfly Location
-  *Heritiera longipetiolata* Location

Sources: USFWS 2002, 2004, 2005b; Campora and Lee 2009; NR Survey Report, in preparation



### *Mariana Fruit Bat*

An estimated 40-60 fruit bats were believed to live in solitary or in small groups in northern Guam, primarily along the cliffline extending from Bija Point to Iates Point east of Route 15 (GDAWR 2009). A single incidental fruit bat sighting was reported in 1999 during biological surveys in the Route 15 north parcel (Duenas & Associates 2000). There are no other recent records of Mariana fruit bats from Andersen South or the Route 15 lands. Based on the proposed critical habitat areas (USFWS 2002), essential habitat for the species occurs on Route 15 lands (refer to Figure 10.1-19).

### *Mariana Swiftlet*

One swiftlet colony is known from the Lumuna district of Yigo in the area of the parcel. In November 1992 there were infrequent sightings of 1-6 birds, suggesting a possible colony size of 15-30 individuals (Wiles et al. 1995). Although the cave harboring these birds was not found, it was thought to be between Pagat Point and Lujuna Point. A search for swiftlets in this area in January 1998 recorded three birds at one site, but attempts to find the colony's cave were not successful (GDAWR 1998).

### *Mariana Crow*

The crow does not currently occur on the Route 15 lands; however, a recovery zone has been designated along the coastal portion of the parcels (USFWS 2005b).

### *Guam Micronesian Kingfisher*

Kingfishers once utilized a wide variety of habitats on Guam, including limestone forest, strand forest, agricultural forest, secondary forest, edge habitats, and forest openings; however, mature forests with suitable cavity trees to provide nest sites may be the single most important requirement for kingfisher reproduction (USFWS 2008a). These habitat requirements are all present within the Route 15 lands. Furthermore, based on the proposed critical habitat areas (USFWS 2002), the coastal portion of the parcel within the limestone forest is considered essential habitat for the kingfisher.

### *Mariana Eight-Spot Butterfly*

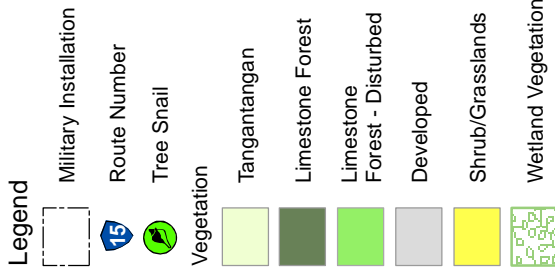
Two populations have been reported in the Pagat area of the Route 15 lands; however, the specific location was not given (Scheiner and Nafus 1996 as cited in USFWS 2007b). During December 2008 surveys at the site, one individual was observed at the southern location shown in Figure 10.1-20 (NR Survey Report in preparation). In July 2009, surveys were conducted for all life stages of the Mariana eight-spot butterfly and its two documented host plant species (*Elatostema calcareum* and *Procris pedunculata*) along three transects within the Route 15 Lands (Campora and Lee 2009). Host plants were generally sparsely distributed except for two areas which contain large groups of both plant species. One adult eight-spot butterfly was seen within one of the large host plant areas at the northern location shown in Figure 10.1-20. The previous adult eight-spot sighting in December 2008 at the southern location was within the other large host plant area. Other life stages (e.g. egg, larvae, pupae) were found on host plants in all three transects; however, without rearing these stages to the adult form they cannot be identified with complete certainty as Mariana eight-spot butterflies (Campora and Lee 2009).

### Guam-Listed Species

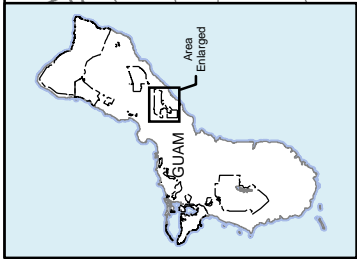
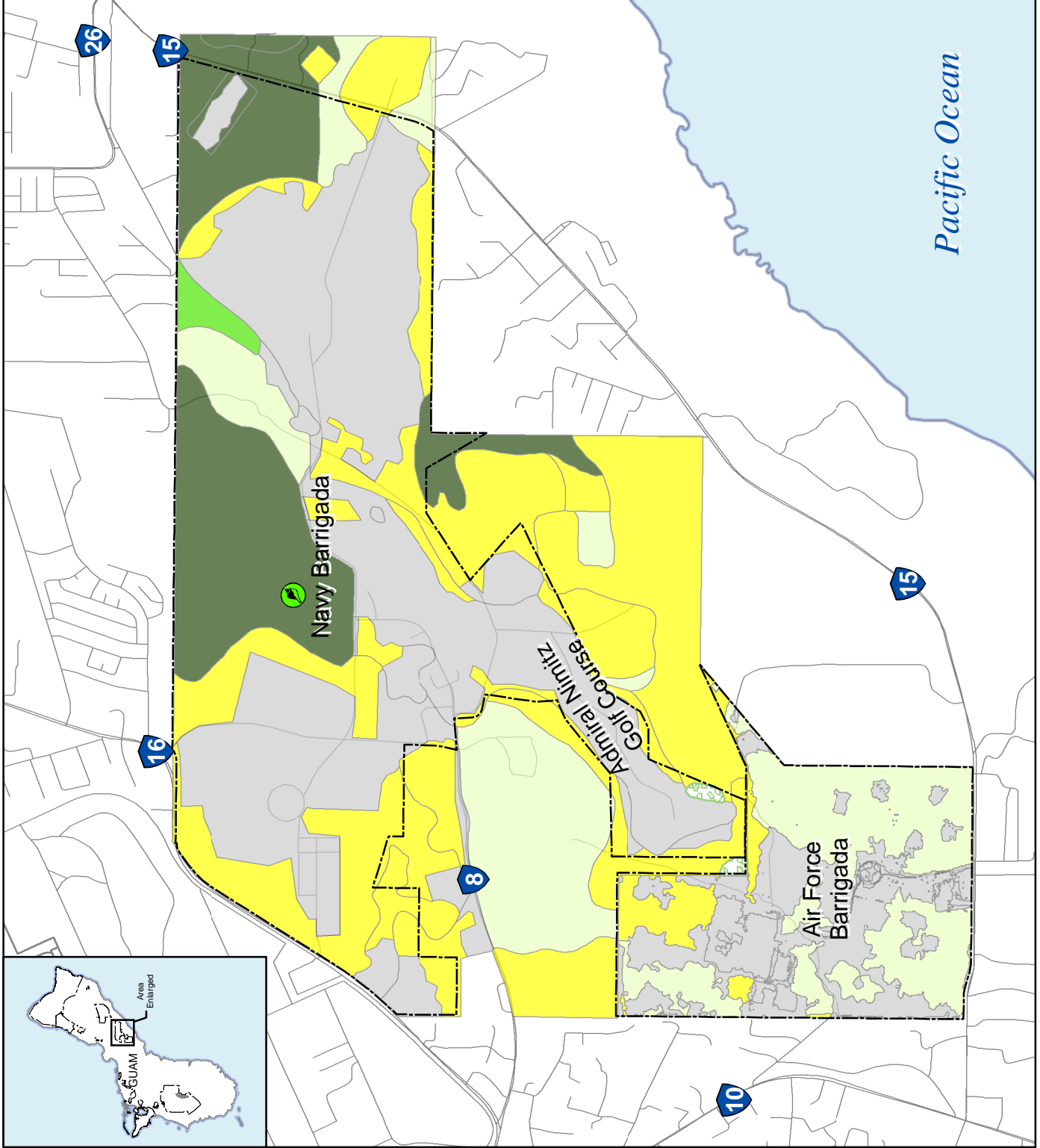
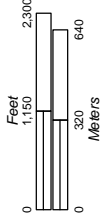
Eleven Guam-listed species have been observed or potential habitat is present on the Route 15 lands (Table 10.1-14). Those species that are also listed under the ESA are discussed above.



**Figure 10.1-20**  
Vegetation  
Communities and  
Special-Status  
Species -  
Navy Barrigada  
and Air Force  
Barrigada



Sources: COMNAV Marianas 2001  
(modified by TEC Inc.) ; USFS 2006



*Heritiera Longipetiolata*

The Guam-listed endangered tree *Heritiera longipetiolata* has been identified on the Route 15 lands in previous surveys for the Guam International Raceway (Duenas & Associates 2000). A total of 22 mature trees and 184 seedlings of this species were found in the southeastern sector of the property (see Figure 10.1-19). One individual tree of this species was also recently observed along a transect on Route 15 lands.

## 10.1.3.3 Navy Barrigada and Air Force Barrigada

Vegetation Communities

Vegetation communities at Navy Barrigada have been mapped in the 2001 INRMP (COMNAV Marianas 2001). The vegetation of Air Force Barrigada was not mapped in any INRMP; however, the vegetation mapping for the entire island of Guam by the USFS (2006a) was used and categorized to match the vegetation community types in the Navy INRMP. Figure 10.1-20 depicts the cover types within the boundaries of Navy and Air Force Barrigada and acreages are listed in Table 10.1-15.

**Table 10.1-15. Vegetation Communities at Navy Barrigada and Air Force Barrigada (ac [ha])**

<i>Vegetation Type</i>	<i>Navy Barrigada</i>	<i>Air Force Barrigada</i>
Limestone forest	296 (120)	0
Limestone forest, disturbed	16 (6.5)	0
Tangantangan	68 (28)	198 (80)
Wetlands	2.8 (1.1)	0.9 (0.4)
Shrub/Grasslands	295 (119)	42 (17)
Developed	739 (299)	192 (78)

Limestone forest is present on Navy Barrigada in the northern portion of the site. A total of 290 ac (117 ha) of this forest was classified as limestone forest, and 16 ac (6 ha) was classified as degraded limestone forest in 2001 (COMNAV Marianas 2001). Based on transect data collected in 2008, the limestone forest has been degraded to some extent, particularly along its edges (NR Survey Report in preparation).

Wildlife – Native Species

The open grasslands and constructed wetlands within Navy and Air Force Barrigada are occasionally used as resting and foraging areas for migrating species (COMNAV Marianas 2001). Recent bird surveys documented the Pacific golden plover and yellow bittern. Other species likely use ponds on the adjacent golf course. Reptiles observed in recent studies were the blue-tailed skink and mourning gecko.

Wildlife – Non-Native Species

Signs of ungulate use, both feral pig and Philippine deer, were observed at Navy Barrigada during recent surveys (NR Survey Report in preparation). Soil and vegetation damage ranged from light to moderate. Eurasian tree sparrow, island collared dove, black francolin, curious skink, and house gecko were also observed in forested areas during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation).

ESA-Listed Species and Critical Habitat

Three ESA-listed or candidate species have been observed, or habitat is present, at Navy Barrigada (Table 10.1-16 and Figure 10.1-20). No listed species occur at Air Force Barrigada.

**Table 10.1-16. Known or Potential Occurrence of ESA-listed, Candidate, and Guam-Listed Species at Navy Barrigada**

Common Name	Status*		Habitat	Occurrence at Navy Barrigada
	ESA	Guam		
MAMMALS				
Mariana fruit bat	T	E	Limestone and coastal forests, coconut plantations	Historical reports of flyovers and a colony on Mt. Barrigada
BIRDS				
Mariana common moorhen	E	E	Freshwater wetlands	Observed in golf course ponds
INVERTEBRATES				
Guam tree snail	C	T	Intact limestone forest	Observed in recent surveys

Legend: \*T = threatened; E = endangered; C = candidate.

Sources: Wiles 1987; Wiles et al. 1995; COMNAV Marianas 2001; GDAWR 2006; NR Survey Report in preparation.

There are small areas of habitat marginally suitable for the Marianas fruit bat at Navy Barrigada and it has been observed flying there in the recent past. Daytime sightings of bats (in solitary and in small groups) were made during 1980-1999 in the Barrigada Area at Mt. Barrigada and near the Navy Golf Course (GDAWR 2009). From observations in 1983 and 1984, the population of fruit bats in the Mt Barrigada area was estimated as less than 5 individuals (Wiles 1987). The few constructed wetlands within Navy Barrigada are also suitable for the Marianas common moorhen (COMNAV Marianas 2001). The ESA candidate Guam tree snail was found in recent vegetation surveys on Navy Barrigada in the north-central portion of the installation (NR Survey Report in preparation).

#### Guam-Listed Species

Three Guam-listed species have been observed, or habitat is present, at Navy Barrigada and their occurrence is discussed above.

##### 10.1.3.4 Off Base Roadways

The proposed action include on base roadway construction projects that would be implemented by the DoD. An affected environment description for on base roadway construction projects is included beneath the appropriate subheadings in other sections of this chapter. The following section describes the affected environment for off base roadway construction projects that would be implemented by the FHWA.

Figures 10.1-21 and 10.1-22 show the location of Central Region proposed GRN projects and vegetation communities within the BRSA.

#### Vegetation Communities

For Central Region road projects, the BRSA includes maintained vegetated road shoulders (i.e., areas periodically mowed), herbaceous scrub community type along the fringe of the road shoulder, and developed areas. In some areas the BRSA extends into scrub forests and disturbed limestone forests (Table 10.1-17) that contain important foraging trees for some special-status species, but that have been heavily impacted by feral pigs. In relatively more intact areas in the BRSA of the Route 15 relocation, this community type is dominated by native breadfruit, screw pine, or in some instances native fig trees. The canopy is mostly closed in the disturbed limestone forest areas, allowing mesic conditions to persist on the forest floor and lower canopy layers.

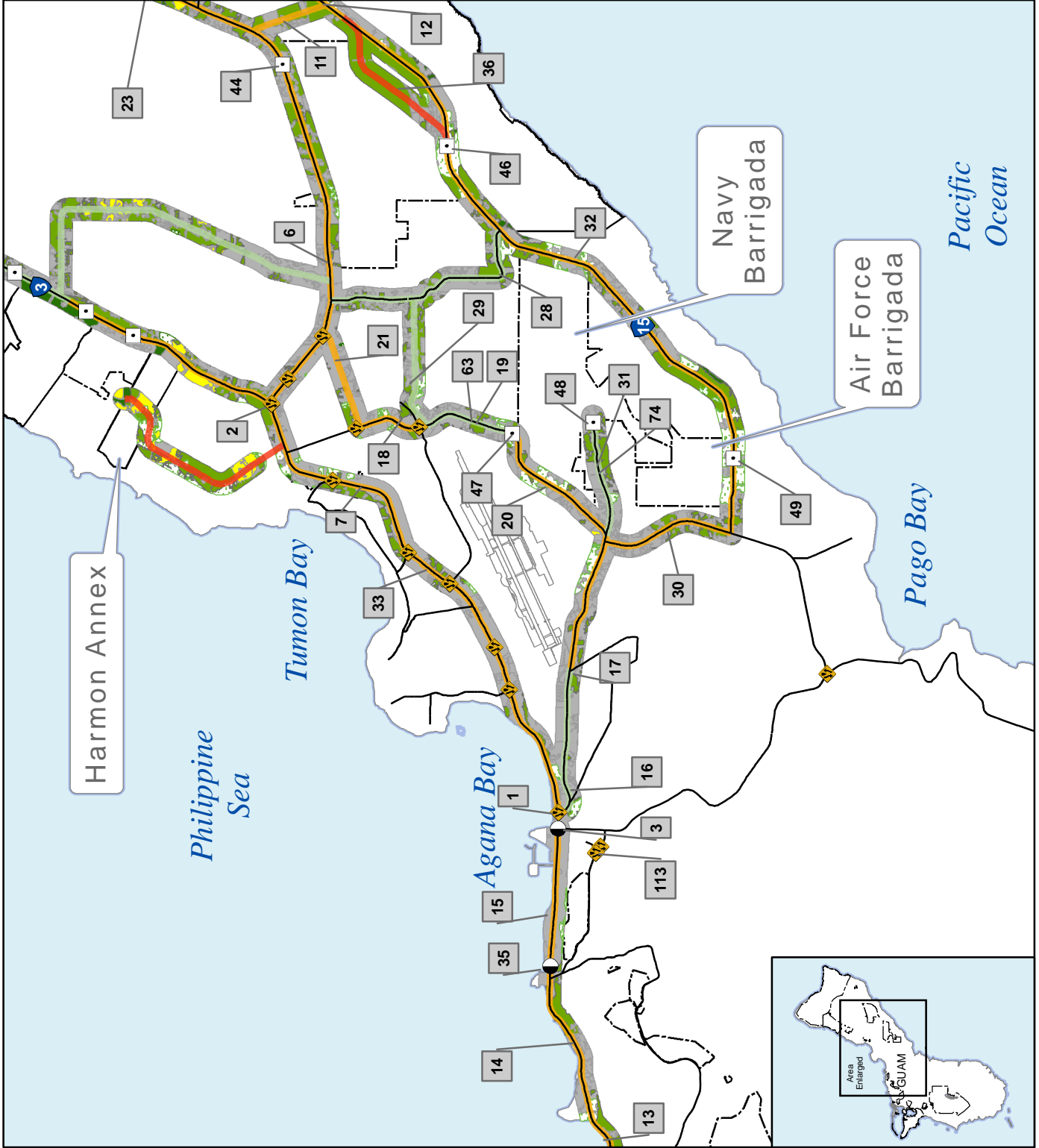
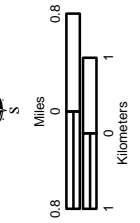
**Figure 10.1-21**

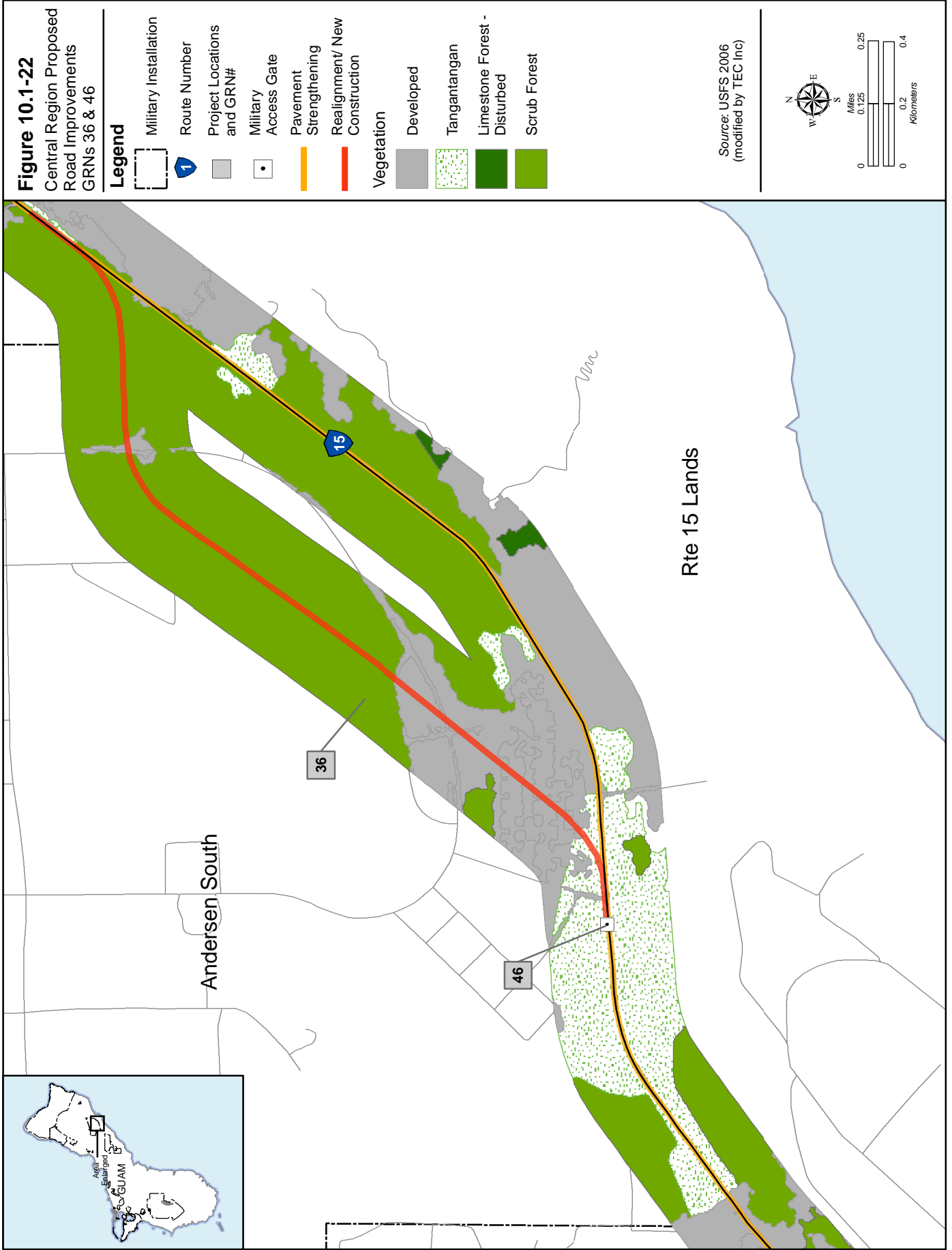
Central Region Proposed Road Improvements

**Legend**

- Military Installation
- Route Number
- Project Locations and GRN#
- Bridge Replacement
- Intersection Improvement
- Military Access Gate
- Pavement Strengthening
- Widening/Pavement Strengthening
- Realignment/ New Construction
- Vegetation
- Agricultural Field
- Developed
- Tangantangan
- Limestone Forest - Disturbed
- Scrub Forest
- Shrub/Grassland

Sources: COMNAV Marianas 2001 (modified by TEC Inc); USFS 2006





**Table 10.1-17. Vegetation Communities within the Central Region for the Proposed GRN Projects (ac [ha])**

GRN #	Route	Limestone Forest Disturbed	Scrub Forest	Tangantangan	Savanna	Mixed Herbaceous Scrub	Agricultural Field	Developed
6	1	108 (43)	113 (45)	34 (13)	0	77 (31)	0	702 (284)
7	1	2.8 (1.1)	52 (21)	28 (11)	0	-	0	237 (95)
11	Chalan Lujan	1.9 (0.8)	77 (31)	7.5 (3)	0	5.0 (2)	0	75 (30)
12	15	6.5 (2.6)	97 (39)	15 (6)	0	7 (2.8)	0	56 (22)
13	1	0	71 (28)	17 (6.9)	0	0	0	134 (54)
14	1	0	47 (19)	0	0.4 (1.6)	0	0	94 (38)
15	1	0	7 (2.8)	7.6 (3.1)	0	0	0	221 (89)
16	8	0	15 (6)	16 (6)	0	0	0	253 (102)
17	8	0	19 (7)	24 (9)	0	0.4 (0.2)	0	224 (90)
18	16	0	10 (4)	8.8 (3.6)	0	-	0	123 (49)
19	16	0	23(9)	10 (4)	0	2.6 (1.1)	0	167 (67)
20	16	0	8.4 (3.4)	23 (9)	0	55 (22)	0	211 (85)
21	27	0	18 (7.3)	3.5 (1.4)	0	0	0.7 (0.3)	186 (75)
28	27	5.2 (2.1)	90 (36)	10 (4)	0	4.2 (1.7)	0	317 (128)
29	25	0	72 (29)	15 (6)	0	0	0	177 (71)
30	10	0	53 (21)	1.1 (0.4)	0	0.4 (0.2)	0	212 (85)
31	8a	0	0.3 (0.1)	55 (22)	0	56 (23)	0	133 (53)
32	15	232 (93)	182 (73)	278 (112)	0	79 (32)	0	527 (213)
33	1	2.8 (1.1)	112 (45)	38 (15)	0	0	0	748 (302)
36	15	111 (44)	84 (34)	41 (16)	0	10 (4)	0	90 (36)
63	16	0	23 (9)	10 (4)	0	2.6 (1.1)	0	167 (67)
74	8a	0	0.3 (0.1)	55 (22)	0	56 (23)	0	133 (53)
<b>Total</b>		<b>470 (190)</b>	<b>1,386 (475)</b>	<b>697 (282)</b>	<b>0.4 (1.6)</b>	<b>397 (143)</b>	<b>2.3 (0.3)</b>	<b>5,187 (2,099)</b>

Wildlife – Native Species

Because of the presence of non-native species (e.g., predators, ungulates, and plants), the disturbed limestone forested areas within the BRSA do not currently support resident native bird species. These areas, however, do contain potential forage for future recovery of native forest birds.

Based on project-specific surveys in areas of the Route 15 realignment BRSA, and the generally degraded habitat throughout the entire BRSA, reptiles present would include the blue-tailed skink and the mourning gecko. Predation by BTS is a limiting factor for native reptiles. These species are described earlier in this chapter for discussions of wildlife within the Central Region of this EIS/OEIS.

Although numerous native butterflies potentially occur within the BRSA, the blue-banded king crow has been observed most frequently. Other butterflies may be limited by herbivory on nurse plants by Philippine deer and other habitat degradation associated with feral pigs.

Wildlife – Non-Native Species

Non-native bird species within the BRSA of the proposed road projects for the Central Region may include the black francolin, island collared dove, black drongo, Eurasian tree sparrow, and feral chickens associated with residences to the west of the Andersen South parcel.

Feral and domesticated cats and dogs, rats, Philippine deer, and feral pigs are known to inhabit the Central Region for the proposed GRN projects. Ungulate impacts are well evidenced within the area for the proposed relocation of Route 15. Extensive pig wallows and rooting of vegetation directly impact native vegetation and cause secondary impacts such as facilitating invasive weed encroachment, reducing or

eliminating recruitment of emergent tree species, and erosion of top soil. Non-native ungulates also facilitate the spread of invasive species through ingestion and subsequent defecation of seed material.

Curious skink, house gecko, greenhouse frog, and cane toads were observed within the Andersen South parcel during recent surveys in support of this EIS/OEIS. These species are likely to occur within the BRSA for the proposed Route 15 relocation site, as well as BTS.

The most common and easily observed invertebrates include a snail and the blue-banded king crow butterfly. Traps for the coconut rhinoceros beetle are seen occasionally along the existing road corridors. A recent outbreak of this non-native beetle that destroys coconut trees has occurred on Guam.

#### ESA- and Guam-Listed Species

The only Special-status Species associated with the Central Region BRSA for the proposed road improvements include the Mariana fruit bat, Mariana crow, and Pacific slender-toed gecko (Table 10.1-18). These species are not expected to occur within the BRSA; however, some elements of the vegetation communities (i.e., foraging, nesting, roosting tree species) may be important to ongoing and future recovery efforts for this species. There are no designated habitat areas such as essential habitats (i.e., formerly proposed critical habitat designations), recovery zones, or Overlay Refuge identified within the BRSA for proposed roads within the Central Region.

**Table 10.1-18. Known or Potential Occurrence of ESA-listed, Candidate, and Guam-listed Species within the Central Region for the Proposed GRN Projects**

Common Name	Status*		Occurrence in the BRSA
	ESA	Guam	
<b>MAMMALS</b>			
Mariana fruit bat	T	E	Not known to occur although may occasionally fly through the area or forage in individual trees; no essential habitat designated
<b>BIRDS</b>			
Mariana crow	E	E	Does not occur; no essential habitat
Guam Micronesian kingfisher	E	E	Does not occur; no essential habitat
<b>REPTILES</b>			
Moth skink	-	E	Not found in central Guam in recent surveys; last reported occurrence is at Haputo Beach area.
Pacific slender-toed gecko	-	E	Not documented and not likely to be present due to degraded habitat.
<b>INVERTEBRATES</b>			
Mariana eight-spot butterfly	C	-	Not known to be present; forested habitat with host plants that typically occur on karst are absent.
Guam tree snail	C	T	Not known to be present and unlikely because of degraded habitat and limited current distribution of these species.
<b>PLANTS</b>			
<i>Heritiera longipetiolata</i>	-	E	Unlikely to be present because of disturbance and degraded condition of the vegetation; small populations of <i>H. longipetiolata</i> are found in karst areas of Pati Point and in the non-DoD lands south of Route 15 area near Andersen South.

Legend: \*C = candidate, E = endangered, T = threatened.

Sources: COMNAV Marianas 2001, GDAWR 2006, Andersen AFB 2008a.

## 10.1.4 Apra Harbor

### 10.1.4.1 Naval Base Guam

#### Vegetation Communities

Acres are listed in Table 10.1-19 while Figure 10.1-23 depicts the cover types within the boundaries of Naval Base Guam as mapped in the 2001 Navy INRMP (COMNAV Marianas 2001).

**Table 10.1-19. Vegetation Communities at Naval Base Guam**

<i>Vegetation Type</i>	<i>ac (ha)</i>
Developed	2,106 (852)
Tangantangan	620 (251)
Scrub forest	353 (143)
Limestone forest	86 (35)
Mangrove	53 (21)
Strand	12 (4.9)
Coconut forest	3.8 (1.5)
Wetlands	3.8 (1.5)
Badland/barren	2.1 (0.8)

The Navy established the Orote Peninsula ERA in 1984 as a mitigation measure for the construction of Kilo Wharf. The Orote ERA includes submerged lands from the shoreline to a depth of 120 ft (36.6 m), and it extends inland from the mean lower low water line to the upper edge of the cliff along the southwestern edge of Orote Peninsula. The terrestrial unit of this ERA totals about 30 ac (12 ha), and the submerged lands total about 133 ac (54 ha) (COMNAV Marianas 2001).

There are numerous non-native species commonly found in the forests of the Orote Peninsula. They are common because the forest is short and open, and therefore more susceptible to invasion by non-natives. An alternative explanation could be that Orote, being highly disturbed, has a high store of non-natives to invade the cliff forests. Other factors may also influence the number of non-native species on Orote peninsula. Notable among the non-native species are *Carica papaya*, *Chromolaena odorata*, *Leucaena leucocephala*, *Passiflora foetida*, and *Antigonon leptopus* (USFWS 1986b).

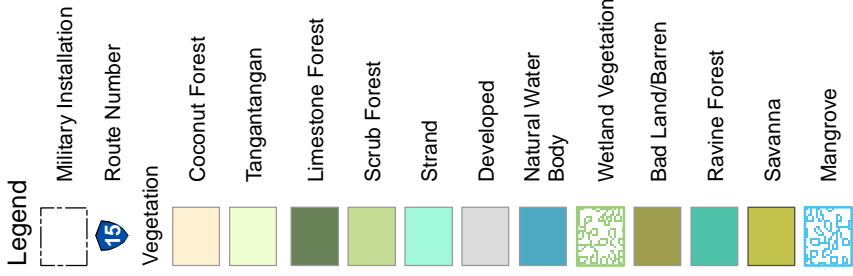
Much of the terrestrial area of Naval Base Guam is vegetated with communities that have undergone previous disturbance (e.g., disturbed limestone forest, disturbed ravine forest, and urban/maintained). Limestone communities are limited to the cliff area on Orote Peninsula. A narrow band of halophytic/xerophytic scrub communities exists on cliff faces on Orote Peninsula (COMNAV Marianas 2001).

Mangroves are present along the east side of Apra Harbor. These mangroves and associated wetlands include the following plant species: *Rhizophora mucronata*, *Bruguiera gymnorrhiza*, *Avicennia* spp., *Lumnitzera coccinea*, *Heritiera littoralis*, *hibiscus*, and *giant swamp fern* (COMNAV Marianas 2001).

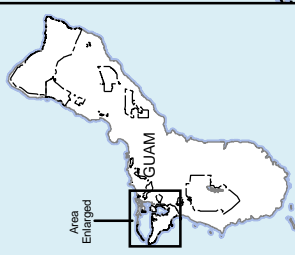
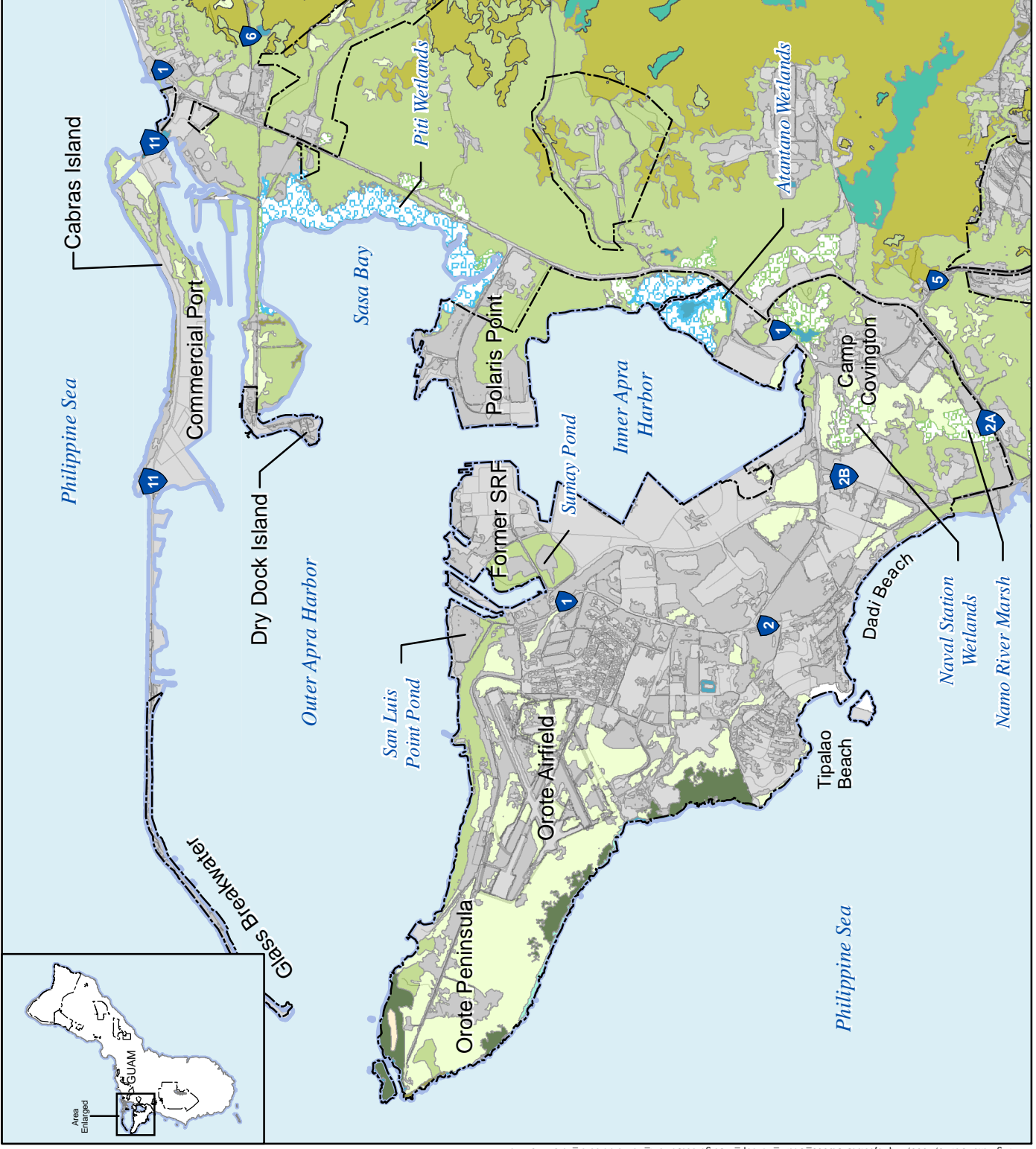
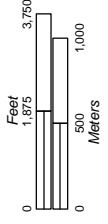


**Figure 10.1-23**

**Vegetation Communities - Naval Base Guam**



Sources:  
COMNAV Marianas 2001;  
USFS 2006



## Wildlife – Native Species

### *Birds*

Common migratory seabird species seen on or in the vicinity of Naval Base Guam include brown noddy, white tern, and brown booby. Brown noddies nest and roost on steep cliffs and on rocky offshore islets. There is a nesting colony of brown noddies located on Orote Island just off the end of Orote Peninsula. This species also nests on Adotgan Rock north of Orote Peninsula (COMNAV Marianas 2008a). Numerous other migratory birds also use the wetland and mangrove areas of Apra Harbor for resting and feeding including Pacific reef heron, little egret, intermediate egret, and great egret. The indigenous yellow bittern and Pacific reef heron utilize food resources within the Apra Harbor shoreline areas. Historically, a breeding population of the Pacific reef heron occurred on Orote Peninsula (GDAWR 2006). The Pacific reef heron, along with the brown booby and white-tailed tropicbird are listed as SOGCN (GDAWR 2006). Exposed tidal mudflats and estuarine banks provide seasonal foraging and loafing habitat to any number of migratory avian species. Annual migrants to Guam that occur at Naval Base Guam are Pacific golden plover, common greenshank, Mongolian plover, gray-tailed tattler, whimbrel, ruddy turnstone, and cattle egret (COMNAV Marianas 2008, Eggleston 2009, NR Survey Report in preparation).

### *Reptiles*

During recent surveys conducted in support of this EIS/OEIS, three native reptile species were found within the forested areas of the Orote Peninsula, in the vicinity of Dadi and Tupalao beaches, and at Polaris Point: Pacific blue-tailed skink, mourning gecko, and mutilating gecko (NR Survey Report in preparation).

### *Invertebrates*

Native land hermit crabs and coconut crabs are present on Orote Peninsula and in coastal and estuarine areas (COMNAV Marianas 2008).

## Wildlife – Non-Native Species

### *Birds*

Eurasian tree sparrow, island collared dove, and black francolin were observed at Naval Base Guam in forested areas during recent surveys in support of this EIS/OEIS (NR Survey Report in preparation).

### *Reptiles and Amphibians*

During recent surveys conducted in support of this EIS/OEIS, four non-native reptile and one amphibian species were found within the forested areas of the Orote Peninsula, in the vicinity of Dadi and Tupalao beaches, and at Polaris Point: curious skink, house gecko, monitor lizard, BTS, and marine toad (NR Survey Report in preparation).

USDA Wildlife Services conducts trapping and removal of the BTS on Navy property. These efforts include the placement of BTS traps within the interior of the main base and around ports of exit and cargo facilities on Navy proper to reduce the local population of BTS that might be available as possible stowaways within outbound cargo.

## ESA-Listed Species and Critical Habitat

There are seven ESA-listed or candidate species, that have either been observed, or suitable habitat is present on Naval Base Guam (Table 10.1-20 and Figure 10.1-24).

**Table 10.1-20. Known or Potential Occurrence of ESA- and Guam-Listed and Candidate Species at Naval Base Guam**

Common Name	Status*		Habitat	Occurrence on Naval Base Guam
	ESA	Guam		
<b>MAMMALS</b>				
Mariana fruit bat	T	E	Limestone and coastal forests, coconut plantations	Possible observation at Orote Peninsula in 2007.
<b>BIRDS</b>				
Mariana common moorhen	E	E	Freshwater wetlands	Wetlands in various locations.
Guam rail	E	E	Secondary habitats, also savanna and limestone forests	Extirpated but habitat present throughout.
<b>REPTILES</b>				
Green sea turtle	T	T	Suitable beaches and strand for basking or nesting	Successful nesting has been recorded from 2007 - 2009 at Orote Point.
Hawksbill sea turtle	E	E	Historical reference of suitable nesting beach	Possible historic nesting at Sumay Cove.
<b>INVERTEBRATES</b>				
Marianas eight-spot butterfly	C	-	Limestone forest with host plants	Documented on Orote Peninsula
Guam tree snail	C	T	Intact limestone forest	Not documented on Naval Base Guam. Forested areas are not suitable for this species because of habitat degradation
<b>PLANTS</b>				
<i>Heritiera longipetiolata</i>	-	E	Limestone forest	Present along north and south coast of Orote Peninsula

Legend: T = threatened; E = endangered; C = candidate.

Sources: COMNAV Marianas 2001, 2008; GDAWR 2006; Brooke 2008.

#### *Mariana Fruit Bat*

The Mariana fruit bat is not typically observed at Naval Base Guam. However, a possible observation of a fruit bat was made in 2007 (Brooke 2008).

#### *Mariana Common Moorhen*

The moorhen utilizes a number of wetland habitats on Naval Base Guam, including wetlands associated with Camp Covington, Sumay Pond, and San Luis Point Pond. The Camp Covington wetlands are one of the main habitat areas for the moorhen, in addition to Agana Marsh and Fena Valley Reservoir.

Primary moorhen habitat is also present at the Camp Covington (Navy) wetlands located south of Apra Harbor, and secondary moorhen habitat is located at wetlands northwest and southeast of the Sumay inlet and in the Atantano wetland (non-Navy) east of the inner harbor (refer to Figure 10.1-24) (USFWS 1991b).








#### *Guam Rail*

This species is extirpated but habitat exists in some areas of the Overlay Refuge into which the species could be reintroduced.

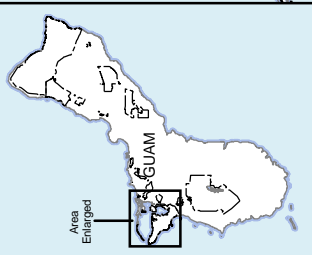
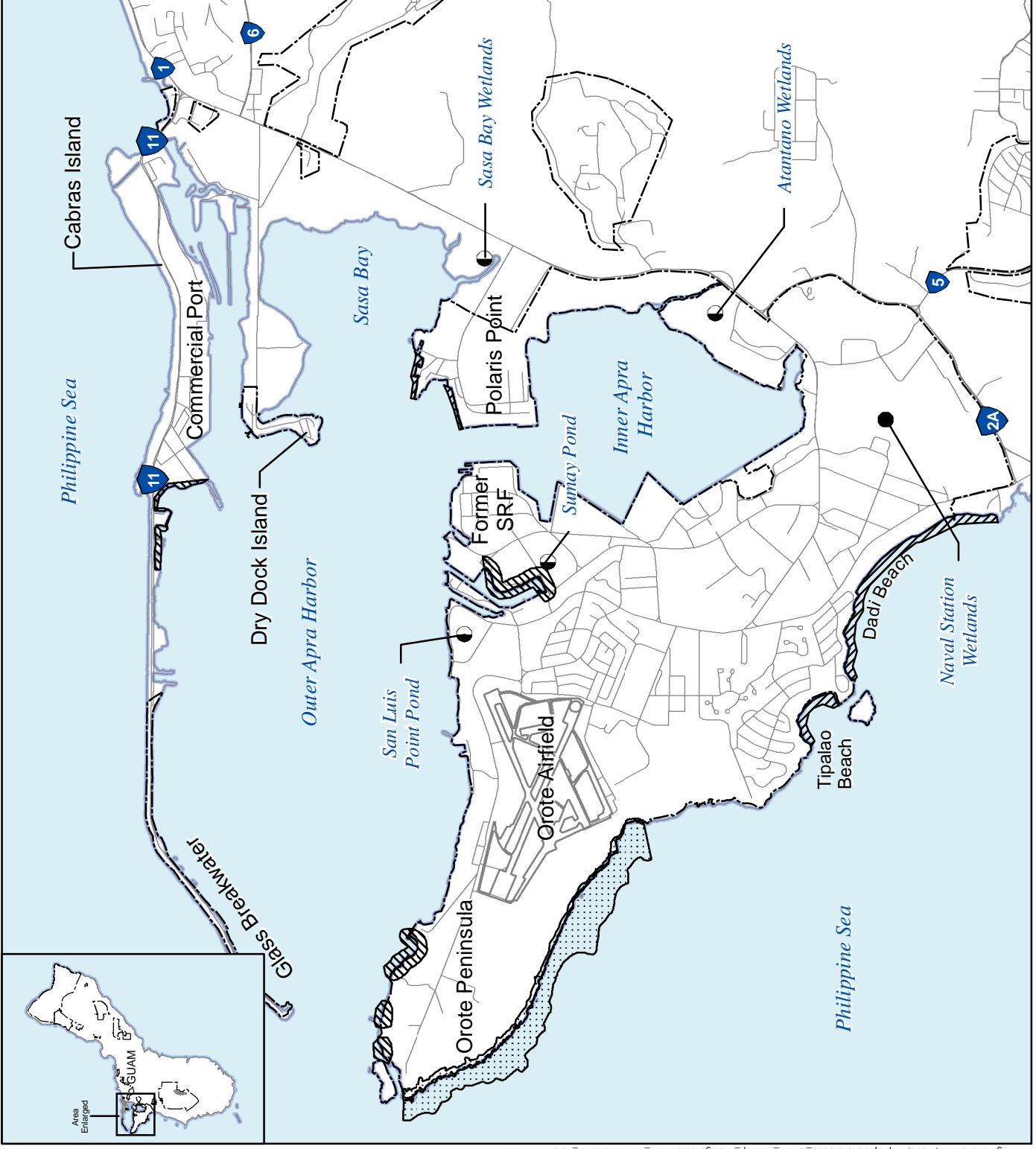
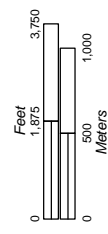
**Figure 10.1-24**

Occurrence of  
Special-Status  
Species - Naval  
Base Guam

**Legend**

-  Military Installation
-  Route Number
-  Orote ERA
-  Sea Turtle Nesting
-  Potential Sea Turtle Nesting
-  Mariana Common Moorhen Habitat - Primary
-  Mariana Common Moorhen Habitat - Secondary

Sources: USFWS 1991b;  
NOAA 2005; GDAWR 2007;  
Grimm and Farley 2008



### Green and Hawksbill Sea Turtles

The Navy, in cooperation with the USFWS and GDAWR, monitors sea turtle nesting on Navy lands throughout the sea turtle nesting season. In June 2007, GDAWR and Navy Natural Resources staff confirmed five sea turtle nests on Orote Peninsula. Four nests were excavated for nest contents (counting unhatched eggs and shells). There was an estimated range of 73-97 eggs hatched with an estimated hatch success of 95%. Nesting activity continued at this beach in 2008 (Grimm and Farley 2008) and 2009 (A. Brooke, pers comm.). A reported nesting occurrence by a hawksbill sea turtle was documented on a small cobble and sand beach near the mangroves within the Sumay inlet; nesting has not been confirmed since 1995 (COMNAV Marianas 2001).

### Mariana Eight-Spot Butterfly

One population of the Mariana eight-spot butterfly has been reported on Orote; the specific location was not given (Scheiner and Nafus 1996, as cited in USFWS 2007b).

### Guam-Listed Species

Six Guam-listed threatened or endangered species have been observed, or habitat is present for them, on Naval Base Guam (see Table 10.1-20 and Figure 10.1-24). Those species that are also dually listed under the ESA are discussed above. *Heritiera longipetiolata* is widespread on Orote Peninsula along the north and south coasts, and a total of 142 trees were counted in 2000 (Wiles 2005 as cited in COMNAV Marianas 2007).

#### 10.1.4.2 Off Base Roadways

The proposed action includes on base roadway construction projects that would be implemented by the DoD. An affected environment description for on base roadway construction projects is included beneath the appropriate subheadings in other sections of this chapter. The following section describes the affected environment for off base roadway construction projects that would be implemented by the FHWA.

Roadway projects in the Apra Harbor Region of Guam include pavement strengthening, intersection improvements, and bridge replacements (on Route 1). The BRSA for the proposed roadway projects at Apra Harbor Region is shown in Figure 10.1-25.

### Vegetation Communities

Vegetation communities identified within the Apra Harbor Region BRSA for proposed GRN projects are listed in Table 10.1-21. These communities are characterized by prior disturbance and monoculture or near monocultures of tangantangan, with some hibiscus. Wetland vegetation on consists of freshwater wetlands and mangrove areas.















**Table 10.1-21. Vegetation Communities within the Proposed GRN Projects Boundaries in the Apra Harbor Region (ac [ha])**

GRN #	Route	Barren	Savanna	Tangantangan	Scrub Forest	Wetlands	Mangrove	Open Water	Developed
4	11	5.0 (2.0)	0	14 (5.7)	43 (17)	0	0	1.7 (0.7)	183 (74)
24	1	0	0	0.7 (0.3)	269 (108)	40 (16)	62 (25)	3.2 (1.3)	141 (57)
26	2A	0	1.8 (0.7)	4.0 (1.6)	65 (26)	27 (11)	0	0	69 (27)
<b>Totals</b>		<b>5.0 (2.0)</b>	<b>1.8 (0.7)</b>	<b>19 (7.6)</b>	<b>377 (153)</b>	<b>67 (27)</b>	<b>62 (25)</b>	<b>4.9 (2.0)</b>	<b>393 (159)</b>

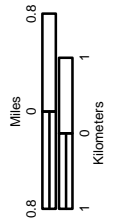
**Figure 10.1-25**

Apra Harbor Region  
Proposed Road  
Improvements  
GRNs 4, 5,  
24, 26, 35, 50, & 51

**Legend**

-  Military Installation
-  Route Number
-  Project Locations and GRN#
-  Bridge Replacement
-  Intersection Improvement
-  Military Access Gate
-  Pavement Strengthening
-  Vegetation
-  Barren
-  Developed
-  Tangantangan
-  Savanna Complex
-  Scrub Forest
-  Wetland Vegetation

Source: USFS 2006



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## Wildlife

Wildlife present within the BRSA would be expected to be similar to that described previously for Navy Base Guam in Section 10.1.4.1.

### ESA-Listed, Candidate and Guam-Listed Species

The only listed species (ESA and Guam) with habitat present in the Apra Harbor Region BRSA is the Mariana common moorhen, as indicated in Table 10.1-22. This bird species can be found in a variety of wetland habitats on Guam. No critical habitat has been proposed or designated for the Mariana common moorhen.

**Table 10.1-22. Known or Potential Occurrence of ESA-listed, Candidate, and Guam-listed Species within the Apra Harbor Region BRSA for the Proposed GRN Projects**

Common Name	Status*		Occurrence in the BRSA
	ESA	Guam	
<b>MAMMALS</b>			
Mariana fruit bat	T	E	Not known to occur although may occasionally fly through the area or forage in individual trees; no essential habitat designated
<b>BIRDS</b>			
Mariana common moorhen	E	E	Wetland habitats present that may be utilized by this species
<b>REPTILES</b>			
Green sea turtle	T	T	Suitable nesting beaches not present
Hawksbill sea turtle	E	E	Suitable nesting beaches not present
<b>INVERTEBRATES</b>			
Guam Snail	C	T	Not known to be present and unlikely because of degraded habitat and limited current distribution of these species

Legend: \*E = endangered, T = threatened, C = candidate.

Sources: GDAWR 2006, COMNAV Marianas 2001.

## 10.1.5 South

### 10.1.5.1 Naval Munitions Site

#### Vegetation Communities

The NMS contains some of Guam's most remote, inaccessible terrestrial habitat. Figure 10.1-26 depicts the vegetation communities within the boundaries of the NMS as mapped by the USFS (2006a) and acreages are listed in Table 10.1-23. Based on mapping in the 2001 INRMP (COMNAV Marianas 2001) and from recent field surveys (NR Survey Report in preparation), *Merrilliodendron*-dominated limestone forest communities were overlaid on USFS mapping.

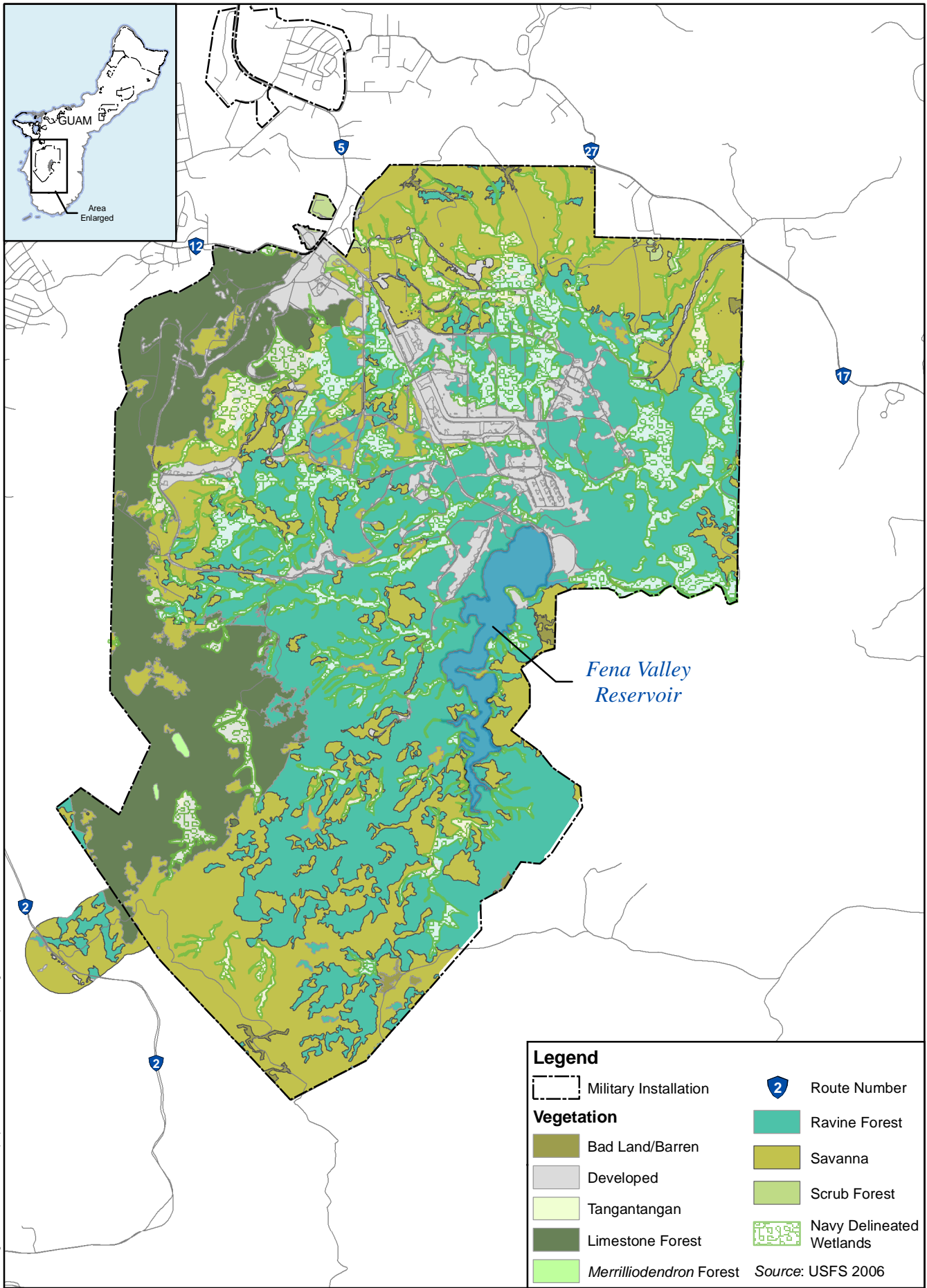
**Table 10.1-23. Vegetation Communities at NMS**

Vegetation Type	ac (ha)
Ravine forest	3,673 (1486)
Savanna	2,677 (1083)
Limestone forest	1,390 (563)
Developed	648 (262)
Badland/barren lands	24 (9.7)
Scrub forest	19 (7.7)
<i>Merrilliodendron</i> forest	6.4 (2.6)

The NMS has diverse vegetative communities that include ravine forest, disturbed ravine forest, limestone forest, *Merrilliodendron* forest, savanna, wetland, coconut grove, and urban/developed. Fosberg (1960) classified the forest vegetation in valleys and ravines in southern Guam as ravine forests.



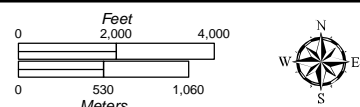
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**Legend**

Military Installation	Route Number
<b>Vegetation</b>	
Bad Land/Barren	Ravine Forest
Developed	Savanna
Tangantangan	Scrub Forest
Limestone Forest	Navy Delineated Wetlands
Merrilliodendron Forest	Source: USFS 2006

**Figure 10.1-26**  
**Vegetation Communities - Naval Munitions Site**





Although the floristic composition of the ravine communities can be similar to limestone communities, these forests are generally quite variable in floristic composition. They are located on volcanic soils or on argillaceous limestone soils. The ravine forest communities are abundant, occupying much of the south central portion of the NMS. Savannas, which are defined as grasslands with scattered trees or clumps of trees, cover extensive areas in southern Guam. Savannas are predominately found on volcanic soils (COMNAV Marianas 2001).

The Sadog Gago River valley was previously reported to be relatively pristine and may comprise the least disturbed ravine forest ecosystem left on Guam, to be valued as a botanical refuge and water resource (M&E Pacific 1998). However, a recent transect survey within the Sadog Gago River valley found a highly degraded ravine forest community dominated by the invasive *Vitex* in the canopy (NR Survey Report in preparation). Many other ravine forests are dominated by non-native woody species with a more open canopy. The floristic composition represents subclimax seral stages following human-induced disturbance, such as agriculture or clearing. *Vitex*, *Calophyllum inophyllum*, ilangilang, and allspice are common components of disturbed ravine forest on Navy lands (COMNAV Marianas 2001).

The fern *Ophioglossum pendulum* was found in the area of the Almagosa River mouth at Fena Reservoir and the uncommon fern *Asplenium unilateral* was reported as abundant on wet cliff faces here (M&E Pacific 1998).

NMS also has the largest extent of interior limestone communities on Navy lands. These limestone communities persist on the ridge tops and upper slopes from Mount Lamlam northward to Mount Alifan. The moist forests in limestone areas such as Mt. Almagosa contain wetter *Merrilliodendron*-dominated sites, rare trees such as *Psychotria hombroniana*, *Pisonia umbellifera*, *Fagraea berteriana* and the shrub, *Maesa walker*, as well as an undescribed species of *Rhaphidophora* in the Araceae family (M&E Pacific 1998).

According to surveys conducted in 1987 (NAVFAC Pacific 1989) and 1997 (M&E Pacific 1998), many rare, but unlisted species occur on NMS. The fern *Thelypteris warburgii* occurred along the Bonya, Maemong, Tolaeyuus and Maagas rivers and is found in few other locations. *Histiopters incisa* is a very rare fern found only where the Imong River joins the Sadog Gago River. Orchids such as *Eria rostriflora*, *Coelogyne guamensis*, and *Nervilia platychila* have been found on Guam only on NMS. Species such as *Fagraea berteriana* and *Pisonia umbellifera* occur only on the high limestone slopes of the NMS (NAVFAC Pacific 1989).

### Wildlife – Native Species

#### *Birds*

Migratory birds observed in project-specific studies include the yellow bittern, white tern, grey-tailed tattler, and Pacific golden plover (NR Survey Report in preparation). A total of 34 species were noted in a summary of incidental observations of migratory shorebirds and waterbirds at Fena Lake and the rest of the NMS by GDAWR biologists from March 1987 to March 1996 (USFWS 1996). These included yellow bittern, Pacific golden plover, and a number of sandpiper, duck, egret, and heron species. Other information on migratory birds for the NMS area is found in the National Audubon Society's Christmas Bird Counts for southern Guam (National Audubon Society 2008). From 1999 through 2005, a total of 54 species of birds have been reported, of which 35 species are protected under the MBTA. Ospreys have also been observed at Fena Reservoir (GDAWR 2000a).

### Reptiles

During surveys conducted in support of this EIS/OEIS, four native reptile species were found within the forested areas of the NMS: Pacific blue-tailed skink, mourning gecko, mutilating gecko, and moth skink (a Guam-listed species discussed below) (NR Survey Report in preparation).

### Freshwater Invertebrates and Fish

The NMS contains large areas of freshwater habitats. Nine streams traverse portions of the site: Talisay, Maemong, Bonya, Mahlac, Maagas, Maulup, Almagosa, Sadog gago, and Imong rivers. Guam's freshwater ecosystems have not been studied in detail. Indigenous freshwater fish found on Guam are amphidromous, moving between saltwater and freshwater during their life cycles. Guam stream fauna recorded during surveys on NMS include the species listed in Table 10.1-24. All the fish are amphidromous (i.e., fish which move between fresh and salt water during some part of life cycle, but not for breeding). The Tahitian prawn, marbled eel, flagtail and one goby species are designated as SOGCN (GDAWR 2006). Native eels have also been observed in Fena Reservoir (COMNAV Marianas 2001).

**Table 10.1-24. Native and Non-native Aquatic Species Distribution in NMS Streams Based on Visual Surveys**

Species or Group	River			
	Alamagosa	Maulup	Sadog	Lost/Maagas (outside Fena watershed)
<b>Native Fish</b>				
Marbled eel*	✓			
Guam goby	✓		✓	✓
Flagtail*				✓
Yellow tail rock-climbing goby				✓
Stiphodon spp. (goby)*	✓			✓
<b>Non-native Fish</b>				
Peacock bass				✓
Walking catfish				✓
Bighead catfish				✓
Mosquito fish				✓
Snappers				✓
Tilapia	✓		✓	✓
<b>Native Invertebrates</b>				
Freshwater prawn*	✓	✓	✓	✓
<i>Neritina pulligera</i> (nerite snail)*				✓
<i>Stenomelania plicaria</i> (thiarid snail)*				✓
<i>Atyoida</i> sp. and <i>Caridina</i> sp. (shrimp)*				✓
Varunid crabs*				✓

Notes: \*SOGCN.

Sources: GDAWR 2000b; NR Survey Report in preparation.

### Wildlife – Non-Native Species

#### Birds

Non-native bird species observed at NMS during recent surveys in support of this EIS/OEIS include, island collared dove, black francolin, and black drongo (NR Survey Report in preparation).

#### Mammals

Asiatic water buffalo, locally called carabao, are large ungulates introduced to Guam in the 1600s by European settlers. The population of feral carabao on the NMS was estimated at approximately 300

animals as of 2001 (COMNAV Marianas 2001). The feeding and wallowing habits of the carabao have resulted in extensive accelerated soil erosion. These animals also produce large amounts of fecal material in and around the shores of Fena Reservoir, which raises water quality concerns. Between 1999 and 2003 the Navy, in cooperation with USFWS and GDAWR, administered an immunocontraception drug (PZP) to female carabao with the intent of reducing their fertility on the NMS (COMNAV Marianas 2003). The immunocontraception program was supplemented with a calf adoption program, and the number of calves declined 58% between 2001 and 2003; however, the population continued to increase.

Philippine deer inhabit limestone, ravine, and savanna plant communities. Spotlight surveys on the NMS in 1998 and 1999 counted 41 deer/mile surveyed (COMNAV Marianas 2001). Feral pigs inhabit similar habitat as Philippine deer. No abundance estimates have been made for pigs on the NMS. Severe damage due to pig rooting was observed in one area, and lesser damage in other areas was observed during recent surveys on the NMS (NR Survey Report in preparation).

#### *Reptiles and Amphibians*

During recent surveys conducted in support of this EIS/OEIS, two non-native reptile and four amphibian species were found within the forested areas of the NMS: curious skink, house gecko, marine toad, eastern dwarf tree frog, crab-eating frog, and Gunther's Amoy frog (NR Survey Report in preparation).

USDA Wildlife Services conducts trapping and removal of the BTS on Navy property. These efforts include trapping for protection for the federally endangered Mariana swiftlet (*Aerodramus bartschi*) within NMS.

#### *Freshwater Invertebrates and Fish*

Non-native crustaceans in Fena Reservoir include the shrimp *Atyoida pilipes* and *Caridina* sp. Several fish species were introduced into Fena Reservoir between 1956 and 1968 by GDAWR (NAVFAC Pacific 1989). The introduction of various cichlid fishes, including the tilapia (see Table 10.1-24), the sport fish Peacock bass, and small mouth bass, into Fena Reservoir and indirectly into the connected rivers potentially poses a threat to indigenous and endemic species. Introduced turtles and frogs have also been observed in Fena Reservoir (COMNAV Marianas 2001). Documented non-native species in the Lost/Maagas River system are listed in Table 10.1-24.

#### ESA-listed and Candidate Species

Eleven ESA-listed or candidate species have either been observed at NMS, or suitable habitat is present (Table 10.1-25). The majority of the NMS is also included as Overlay Refuge lands (refer to Figure 10.1-3).

**Table 10.1-25. Known or Potential Occurrence of ESA-listed, Guam-listed, and Candidate Species at NMS**

Common Name	Status*		Habitat	Occurrence at NMS
	ESA	Guam		
<b>MAMMALS</b>				
Mariana fruit bat	T	E	Limestone forest, coastal forest, and coconut plantations	Known to be present; essential habitat present

Common Name	Status*		Habitat	Occurrence at NMS
	ESA	Guam		
<b>BIRDS</b>				
Mariana common moorhen	E	E	Freshwater wetlands	Fena Reservoir
Mariana swiftlet	E	E	Nests in caves; feeds in savannah and ravine forest	Three occupied caves with hundreds of birds
Mariana crow	E	E	All forests with a preference for native limestone forest	Recovery zones and essential habitat present
Guam Micronesian kingfisher	E	E	Forest and scrub, preference for native limestone forest	Essential habitat present
Guam rail	E	E	Secondary habitats, also savanna and limestone forests	Extirpated but habitat present
<b>REPTILES</b>				
Pacific slender-toed gecko	-	E	Forests	Observed during recent surveys
Moth skink	-	E	Forest areas with large tree trunks	Observed during recent surveys
<b>INVERTEBRATES</b>				
Marianas eight-spot butterfly	C	-	Limestone forest with host plants	Alamagosa sink
Guam tree snail	C	T	Intact limestone forest	One population known
Humped tree snail	C	E	Intact limestone forest	Not known from the area but habitat present
Fragile tree snail	C	E	Intact limestone forest	Not known from the area but habitat present
<b>PLANTS</b>				
Fire Tree	E	E	Limestone and ravine forests.	Not known from the area but habitat present
<i>Heritiera longipetiolata</i>	-	E	Limestone forest.	Not known from the area but habitat present
<i>Cyathea lunulata</i>	-	E	Wet ravines and drainage slopes of southern Guam	Present in ravine forest in 1989 and 1997 surveys

Legend: \*T = threatened, E = endangered, C = candidate.

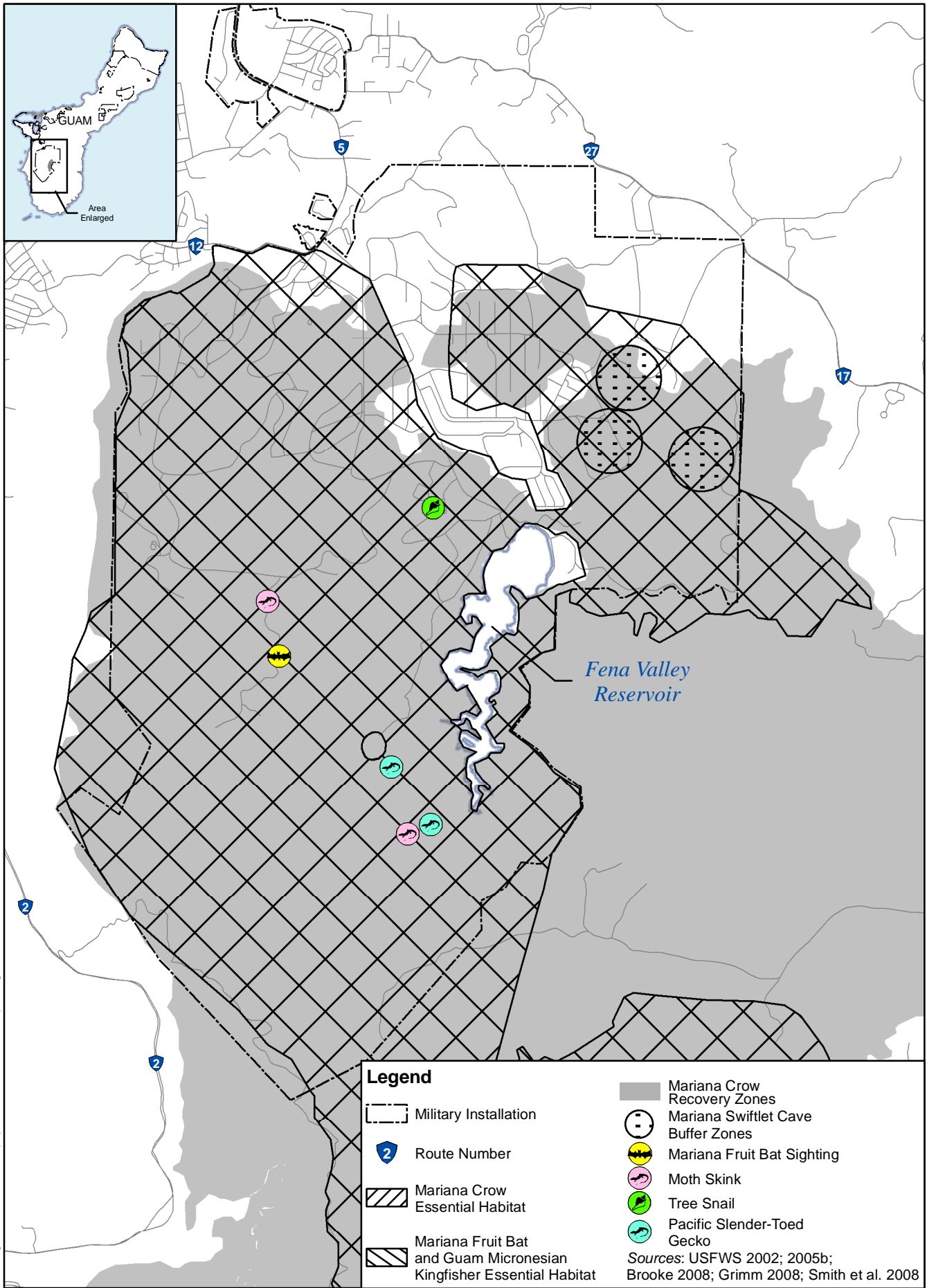
Sources: COMNAV Marianas 2001; GDAWR 2006; Brooke 2008; Smith et al. 2008; NR Survey Report in preparation.

Based on the 2002 proposed critical habitat, essential habitat for the Mariana fruit bat, Mariana crow, and Guam Micronesian kingfisher occurs throughout the NMS (Figure 10.1-28) (USFWS 2002). In addition, most of the NMS outside of the operations area is designated as a Mariana Crow Recovery Zone (Figure 10.1-27) (USFWS 2005b).

#### *Mariana Fruit Bat*

The USFWS recovery plan for the Mariana fruit bat identified the Fena watershed as the largest single parcel of suitable habitat in southern Guam (USFWS 1990a). There were 26 confirmed sightings of fruit bats between 1984 and 1996 with many distributed from Mount Almagosa to East Tower. More recently, an estimated 5 to 20 individual Mariana fruit bats were thought to occur within the NMS/Upper Talofofu Watershed, and were assumed to be full time residents of the area, rather than migrants from the main Pati Point Colony at Andersen AFB in northern Guam (Morton and Wiles 2002). The USFWS (1996a) speculated that disturbance associated with illegal hunting may be inhibiting the establishment of a communal roost. Currently, fruit bats are only occasionally observed at NMS. During dawn and dusk

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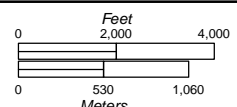
**Legend**

- Military Installation
- Route Number
- Mariana Crow Essential Habitat
- Mariana Fruit Bat and Guam Micronesian Kingfisher Essential Habitat

- Mariana Crow Recovery Zones
- Mariana Swiftlet Cave Buffer Zones
- Mariana Fruit Bat Sighting
- Moth Skink
- Tree Snail
- Pacific Slender-Toed Gecko

Sources: USFWS 2002; 2005b; Brooke 2008; Grimm 2008; Smith et al. 2008

**Figure 10.1-27**  
Occurrences of Special-Status Species and Essential Habitat and Recovery Zones of ESA-listed Species on or in the Vicinity of Naval Munitions Site



observations at 21 sites (NMS, Naval Base Guam, NCTS Finegayan, and Navy Barrigada) on 42 different days between February and July 2008, only one bat was sighted along Alamagosa Road (Brooke 2008).

#### *Mariana Swiftlet*

The NMS has a large population of the swiftlet within three occupied caves: Mahlac, Fachi, and Maemong (refer to Figure 10.1-27). Between 1984 and 1999, the estimated number of birds in Mahlac cave fluctuated between 150 and 500. Since 2002, the number of birds at Mahlac cave has increased to about 950 during the most recent count in 2008. Fachi cave has had no more than 100 birds present since the initial surveys in 1992. Birds using Maemong cave have increased from 4 individuals in 2004 to a breeding group of up to 100 (Grimm 2008). BTS predation is a frequent occurrence at the largest colony; only birds that nest and roost high on smooth walls and ceilings are difficult for the BTS to reach (Wiles et al. 2003).

#### *Mariana Common Moorhen*

The moorhen is a freshwater obligate species and inhabits emergent vegetation in freshwater marshes and ponds. On Guam, 90 birds are estimated to persist at three wetland sites (GDAWR 2006): Agana Marsh, Fena Valley Reservoir, and Camp Covington Wetlands. The largest concentration of this species was located on Fena Reservoir on the NMS (COMNAV Marianas 2001). During the dry season, most moorhens reside on Fena Reservoir because other wetland habitats are hydrologically intermittent (Takano and Haig 2004). Recently, conditions in the reservoir have changed causing the moorhen to find more suitable habitat elsewhere. Only a few birds have been recently sighted or heard, possibly because the submergent *Hydrilla* spp. is no longer found in the reservoir, and this provided forage and a base on which this species could walk. (Grimm 2008).

#### *Guam Rail*

This species is extirpated but habitat exists in some areas of the NMS into which the species could be reintroduced.

#### *Tree Snails*

Recent surveys of 15 sites on the NMS located two colonies of Guam tree snail at the Kitts Road Bonya River site (Smith et al. 2008); however, the previously reported fragile tree snail (USFWS 1996) was not found here again. Previous reports of Guam and humped tree snail colonies at Mt. Alifan in the late 1980s were not confirmed in the recent study, and are likely gone from Mt. Alifan (Smith et al. 2008). Shells of tree snails were found in abundance on the ground at all locations (USFWS 2007c).

#### *Marianas Eight-Spot Butterfly*

Marianas eight-spot butterflies were documented at the *Merrilliodendron* forest in Almagosa Basin, which was one of two sites identified in southern Guam (USFWS 1996).

#### Guam-Listed Species

Fourteen Guam-listed species have been observed or potential habitat is present on the NMS (refer to Table 10.1-25). Those species that are also listed under the ESA are discussed above.

#### *Plants*

The 1987 surveys (NAVFAC Pacific 1989) and the 1997 plant studies (M&E Pacific 1998) at the NMS noted the presence of the Guam endangered tree fern, or tsatsa (*Cyathea lunulata*), on the edge of or in ravine forests. Wildland fires were cited as potential threat because the species inhabits edges between

savanna and forest (M&E Pacific 1998). *Heritiera longipetiolata* was found on limestone near Mt. Lamlam and near the Almagosa Springs ridge (M&E Pacific 1998). Neither of these species was observed during recent plant surveys conducted in support of this EIS/OEIS (NR Survey Report in preparation).

#### *Skinks and Geckos*

Two Guam-listed species, the moth skink and the Pacific slender-toed gecko, were present in 1996 and both were reported in substantial numbers (202-810/ac [500-2,000/ha]). The gecko, detected in 1996 on Guam for the first time since WWII, was found only in the southern part of the NMS, whereas the skink was found throughout (USFWS 1996). Recently, both the moth skink and Pacific slender-toed gecko were observed on transects within the limestone and ravine forests of the NMS during recent surveys conducted in support of this EIS/OEIS (NR Survey Report in preparation).

#### 10.1.5.2 Off Base Roadways

The proposed action includes on base roadway construction projects that would be implemented by the DoD. An affected environment description for on base roadway construction projects is included beneath the appropriate subheadings in other sections of this chapter. The following section describes the affected environment for off base roadway construction projects that would be implemented by the FHWA. The South Region proposed GRN projects are shown in Figure 10.1-28.

#### Vegetation Communities

Vegetation communities identified within the BRSA for the South Region proposed GRN projects are listed in Table 10.1-26. Mapped wetlands within the BRSA consist of palustrine and estuarine marshes and mangroves (USFS 2006).

**Table 10.1-26. Vegetation Communities within the Proposed South Region GRN Projects (ac [ha])**

GRN #	Route	Savanna	Scrub Forest	Tangantangan	Wetlands	Developed
25	5	28 (11)	93 (38)	3.4 (1.4)	0	106 (42)
27	5	59 (24)	33 (13)	0	0	8.4 (3.4)
110	2	0	22 (9)	0	10 (4)	77 (31)

#### Wildlife

The BRSA for the proposed GRN projects within the South Region contain heavily disturbed scrub areas and areas of developed land and savanna. Based on comparison with other similar habitat on Guam, these habitats are not likely to support native wildlife vertebrate species other than common species such as the yellow bittern. The wetland area may also contain additional native migratory species. Surveys have not been conducted in this area but it is likely to be typical of other small wetlands in the area and any bird species present are likely to be common species. Other wildlife present would be typical of disturbed areas and may contain several species of native reptiles including the Pacific blue-tailed skink, mourning gecko, and mutilating gecko.

#### ESA- and Guam-Listed Species

The only listed species potentially found within the South Region BRSA is the Mariana common moorhen, as indicated in Table 10.1-27. This species is a wetland bird that can be found in a variety of wetland habitats on Guam. No critical habitat has been proposed or designated for the Mariana common moorhen.

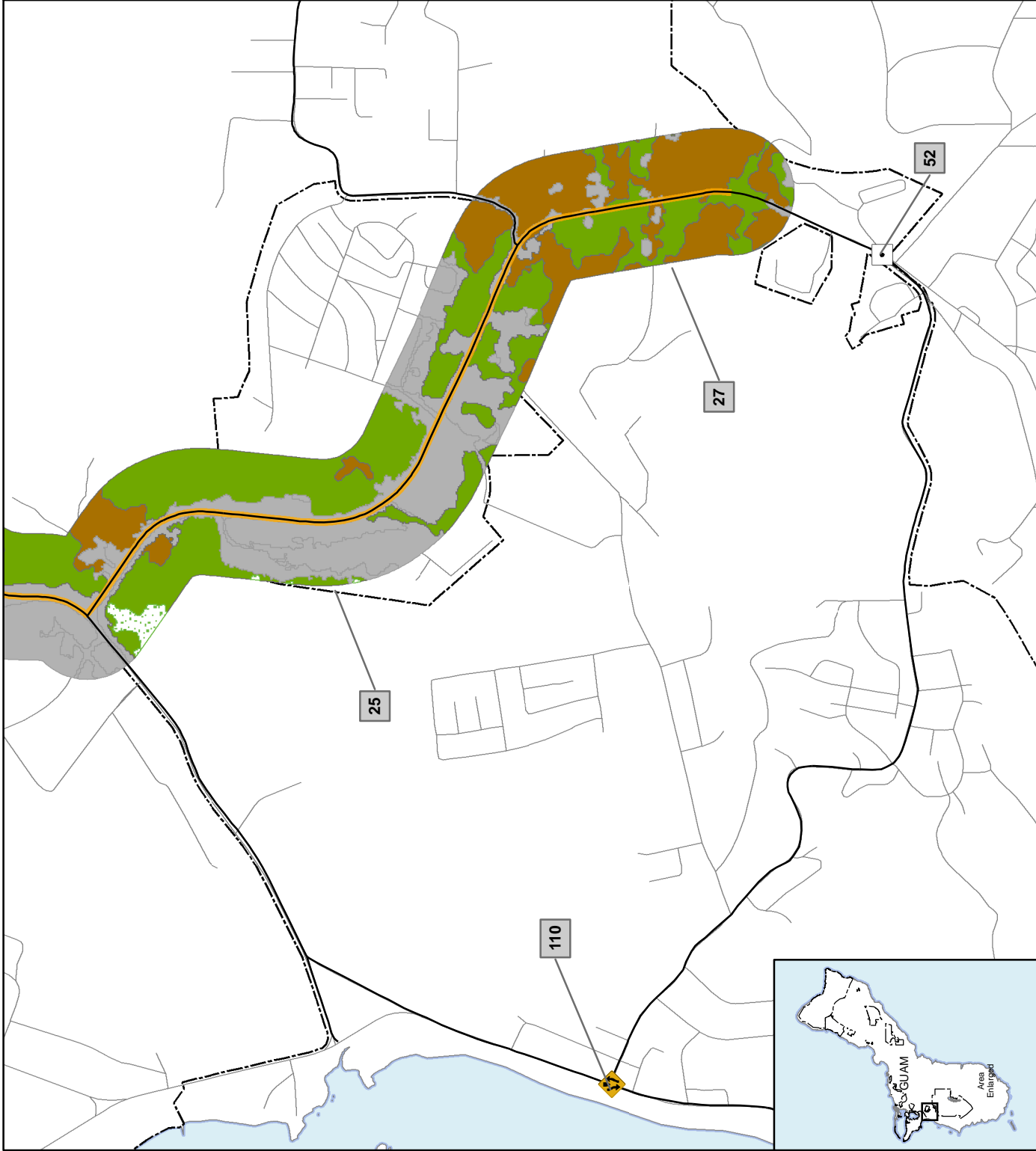
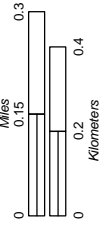
**Figure 10.1-28**

South Region Proposed Road Improvements GRNs 25 & 27

**Legend**

-  Military Installation
-  Route Number
-  Project Locations and GRN#
-  Intersection Improvement
-  Military Access Gate
-  Pavement Strengthening
- Vegetation**
-  Developed
-  Tangantangan
-  Scrub Forest
-  Savanna Complex

Source: USFS 2006





**Table 10.1-27. Known or Potential Occurrence of ESA-listed, Guam-listed, and Candidate Species within the Proposed South Region GRN Projects**

Common Name	Status		Occurrence in the BRSA
	ESA	Guam	
<b>Birds</b>			
Mariana common moorhen	E	E	Presence of wetlands present that may be used by this species.
<b>Invertebrates</b>			
Guam tree snail	C	T	Not known to be present and unlikely because of degraded habitat and limited current distribution of these species.

Legend: E = endangered, T = threatened, C = candidate.

Sources: COMNAV Marianas 2001; GDAWR 2006.

## 10.2 ENVIRONMENTAL CONSEQUENCES

This description of environmental consequences addresses all components of the proposed action for the Marine Corps on Guam. The components addressed include: Main Cantonment, Training, Airfield, and Waterfront. There are multiple alternatives for the Main Cantonment, Training-Firing Range, Training-Ammunition Storage, and Training-NMS Access Road. Airfield and Waterfront do not have alternatives. Although organized by the Main Cantonment alternatives, a full analysis of each alternative, Airfield, and Waterfront is presented beneath the respective headings. A summary of impacts specific to each alternative, Airfield, and Waterfront is presented at the end of this chapter. An analysis of the impacts associated with the off base roadways is discussed in Volume 6.

### 10.2.1 Approach to Analysis

#### 10.2.1.1 Methodology

Biological resource issues and concerns include the potential direct, indirect, and cumulative impacts of the proposed action and alternatives during the construction and operation phases. Impacts may be either temporary (reversible) or permanent (irreversible). Direct and indirect impacts are distinguished as follows.

*Direct impacts* are associated with proposed construction activities (e.g., ground-disturbing activities) and operations (e.g., aircraft overflights and range use). Potential types of direct impacts include, but are not limited to:

- Loss of habitat due to vegetation removal during construction and potential wildfires from training activities.
- Temporary loss of habitat during construction from noise, lighting, and human activity.
- Potential loss of habitat due to increased noise from operations, including proposed aircraft activities, or training range usage. Injury or mortality to wildlife or special-status species caused by the action that occur at the same time and place as the action.

*Indirect impacts* are caused by or result from project-related activities, are usually later in time, and are reasonably foreseeable (e.g., increased likelihood of invasive species moving into the area after disturbance). Potential indirect impacts include, but are not limited to:

- All disturbances from human activity, noise, and lighting that would potentially impact unoccupied suitable habitat for special-status species.
- Introduction of new non-native species or increased dispersal of existing non-native species on Guam.

- Dispersal of existing non-native species from Guam to the CNMI, Hawaii, or other destinations.
- Increased threats from feral animals.
- Adverse effects from pollutants that are released from construction, military operations, or training.
- Adverse effects from wildfires.

Potential direct impacts of noise from aircraft operations and small arms ranges and munitions detonations were determined based on sound levels estimated from noise models. Potential direct and indirect impacts to species present and indirect impacts to unoccupied habitat (e.g., aircraft takeoff and landings, aircraft operations at maintenance or operations facilities, daily operations at facilities, and lighting disturbance) were determined based on the distances used by the USFWS in previous ESA formal consultations (e.g., ISR Strike BO) that were expected to cause disturbance to ESA-listed species (USFWS 2006). Within these distances or buffers, only undeveloped land was considered as suitable habitat. These buffers are as follows:

- Mariana fruit bat: roosting habitat within 492 ft (150 m) of aircraft ground operations; foraging habitat within 328 ft (100 m) from the activity. As the potential disturbance of roosting habitat is the greater of the two, the area within 492 ft (150 m) was used to determine the potential indirect impacts of the proposed construction and operation activities.
- Guam Micronesian kingfisher: foraging and nesting habitat within 328 ft (100 m) of proposed construction and ground and aircraft operations.
- Mariana crow: foraging and nesting habitat 984 ft (300 m) of aircraft ground operations and within 197 ft (60 m) of construction and general ground operations.
- Guam rail – unknown (no distances determined) (USFWS 2006).

General principles used to evaluate impacts are:

- The extent, if any, that the action would permanently lessen ecological habitat qualities that ESA-listed species depend upon, and which partly determines the species' prospects for conservation and recovery.
- The extent, if any, that the action would diminish population sizes, distribution, or habitat of regionally important native plant or animal species.
- The extent, if any, that the action would be likely to jeopardize the continued existence of any ESA-listed species.
- The extent, if any, that the action would be inconsistent with the goals of USFWS recovery plans, Navy and Air Force INRMPs, or the Guam CWCS.

#### 10.2.1.2 Determination of Significance

Significance of impacts to vegetation, wildlife, and special-status species were determined using guidelines in the previous section. Special-status species are defined as ESA- and Guam-listed species and species that are designated candidates for ESA listing. Specific significance criteria are discussed below. If significant impacts are determined, then mitigation may be proposed to offset the impacts. For this EIS/OEIS, a major consideration for BMPs is biosecurity. This issue is discussed in detail with the evaluation of impacts (see Section 10.2.2.6).

#### Vegetation

Impacts would be determined significant if any primary limestone forest (mature forest dominated by

native species) would be cleared, unless determined to be very minor in the context of the surrounding forest areas. Any loss of this forest vegetation community would be considered significant because of the large historical and continuing losses of this forest type on Guam. Loss of wetland or mangrove vegetation would also be considered potentially significant.

### Wildlife

Impacts would be determined significant if native wildlife species are present and the proposed project results in diminished population sizes or distributions of regionally important native animal species. These wildlife species include those designated as SOGCN in the Guam CWCS. Invasive species impacts that exceed the criteria specified above are evaluated. Historical impacts from non-native species have been severe, particularly from the BTS (see discussion in Section 10.1.1.2). Although the proposed action would not result in additional impacts from BTS on Guam, the concern is that the BTS would be inadvertently introduced to other islands throughout the Pacific. This concern is addressed comprehensively for all actions proposed in this EIS/OEIS with mitigation measures described in Section 10.2.2.6.

### *Migratory Birds*

For migratory birds, the MBTA prohibits the taking, killing, or possession of migratory birds, with an exemption for military readiness activities (as defined in federal regulations) provided they do not result in a significant adverse effect on a population of a migratory bird species. Congress defined military readiness activities as all training and operations of the Armed forces that relate to combat and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. Military readiness activities do not include: (A) routine operation of installation support functions such as administrative offices, military exchanges, water treatment facilities, schools, housing, storage facilities, and morale, welfare, and recreation activities; (B) the operation of industrial activities; and (C) the construction or demolition of facilities used for a purpose described in A or B (50 CFR Part 21).

The DoD must consult with the USFWS if it is determined that a military readiness activity would have a significant adverse effect on a population of a migratory bird species. An activity has a significant adverse effect if, over a reasonable period of time, it diminishes the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem.

Migratory bird conservation relative to non-military readiness activities is addressed separately in a Memorandum of Understanding developed in accordance with EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*. The Memorandum of Understanding between the DoD and USFWS was signed in July 2006 and DoD responsibilities included, but are not limited to: (1) incorporating conservation measures addressed in regional or state bird conservation plans and INRMPs; (2) managing military lands and activities other than military readiness in a manner that supports migratory bird conservation; and (3) avoiding or minimizing impacts to migratory birds, including incidental take and the pollution or detrimental alteration of the environments used by migratory birds.

The following species that occur on Guam are considered non-migratory birds and are not covered under the MBTA: black francolin, black drongo, Eurasian tree sparrow, island-collared dove (previously known as Philippine turtle dove), common pigeon, and king quail.

### Special-Status Species

The presence of Special-Status species in the project areas was described in Section 10.1. Background information is presented in the species profiles in Appendix G. Impacts would be determined significant if special-status species are present in the project area and any project action is likely to result in harassment or harm of an individual, population or species. Impacts to ESA-listed species would include vegetation clearing of designated undeveloped Overlay Refuge habitat, or recognized essential habitat or recovery zones, unless it is determined that the removal of habitat or other affect is minor when considering all the remaining habitat and quality of habitat available to that species and considering USFWS recovery plan goals. Significant impacts would also include disturbing ESA- and Guam-listed species due to noise, lighting, or human activity. If species are currently present in a proposed project area, noise, lighting, and general human activity are considered direct impacts for the purposes of this analysis, even though it is recognized that some of the impacts from the proposed action may be indirect, rather than direct. If unoccupied but recognized habitat is affected by noise, lighting, or human activity, impacts would be considered indirect and would be determined significant unless the area affected is considered minor when considering all the remaining habitat and quality of habitat available to that species.

The baseline area for Overlay Refuge on Guam is 21,690 ac (8,778 ha) according to USFWS (2008d) with slight modifications made to correspond to the present NCTS-former FAA boundary (see Figure 10.1-2). The area of essential habitat, as directed by USFWS (USFWS 2009) is identical to the area proposed for critical habitat on Guam by the USFWS (2002), which is 24,802 ac (10,040 ha) for the Mariana fruit bat and Guam Micronesian kingfisher and 23,004 ac (9,309 ha) for the Mariana crow. The baseline Mariana crow recovery zone habitat on Guam based on the recovery plan is 35,360 ac (14,310 ha) (USFWS 2005b).

For ESA-listed species, federal agencies are required to ensure that their actions do not jeopardize the continued existence of an endangered or threatened species or its critical habitat. Analyses of potential impacts are based on review of plans for the proposed action and the available current and historical distributional data for each species. In accordance with section 7 of the ESA, a BA is being prepared by the Navy to analyze the potential impacts on ESA-listed and candidate species and critical habitat under the jurisdiction of the USFWS.

The BA and the subsequent BO issued by the USFWS after their review of the BA, would be the final determination of impacts to ESA-listed species that are being evaluated in this EIS/OEIS. Candidate species must also be evaluated in the BA, however if they are not formally listed by the time the BO is issued and the proposed action would not result in their listing, no determination for these species would be made in the BO. The BO would provide an Incidental Take Statement that would list the amount or extent of take anticipated. Based on that take it would specify Terms and Conditions that the action proponent must comply with to be exempt from the prohibitions of Section 9 of the ESA. These are non-discretionary requirements. The BO would also specify Conservation Recommendations that are discretionary proponent activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The USFWS effects determinations from the BO would be incorporated into the Final EIS/OEIS.

#### 10.2.1.3 Issues Identified during Public Scoping Process

The terrestrial biological resource issues that were identified during the public scoping process include:

- Activities associated with the military expansion (i.e., construction, expansion, renovation projects, and military training activities) may result in habitat loss and physical disturbance of federally listed endangered species and other federally protected species.
- Potential for harm to fragile ecosystems on Guam and in the Marianas from the introduction of invasive species due to increased traffic among the islands from the movement of personnel and materials. Such species include the BTS, flatworms, various insects, and some plants. The EIS/OEIS should outline inspection and sanitary procedures to prevent this movement.
- Existing control and containment activities at air and sea ports for BTS are insufficient to deal with the risk associated with the increased cargo and personnel movement from Guam to other vulnerable destinations. The issue “of utmost concern” is BTS interdiction and an effective, enforceable, and fail-proof procedure for inspecting all military cargo, personnel, and equipment entering the CNMI must be instituted. The Navy must assure funding to sustain a 100% inspection rate of all cargo, vehicles, munitions, and household goods. Guam regulation protocols 505 and 506 should be incorporated into a BTS control plan to be included as part of the EIS/OEIS.
- Potential impact of placement of facilities on flora and fauna at Navy Barrigada.

## 10.2.2 Alternative 1

### 10.2.2.1 North

#### Andersen AFB

##### *Construction*



*Vegetation.* A total of 7.5 ac (3 ha) of primary limestone forest and 78 ac (32 ha) of disturbed limestone forest would be removed during proposed construction activities (Table 10.2-1 and Figures 10.2-1 and 10.2-2). The limestone forest that would be removed is classified by Andersen AFB as plateau/primary. The disturbed limestone forest that would be removed is classified as mixed limestone forest-plateau/secondary, including: *Ochrosia* edge (*Ochrosia mariannensis*; langiti), *Vitex*-closed canopy (*Vitex parviflora*), or *Vitex*-sparse canopy (see Figure 10.2-1). Because of historical and continued loss of primary limestone forest on Guam and the continued degradation of forest from invasive plant encroachment, the removal of this forest would be a significant impact. The vegetation to be removed serves as potential habitat for Special-status Species and is addressed below.


**Table 10.2-1. Potential Impacts to Vegetation Communities at Andersen AFB with Implementation of Alternative 1 (ac [ha])**

<i>Parcel and Activity</i>	<i>Limestone Forest, Primary</i>	<i>Limestone Forest, Disturbed</i>	<i>Scrub</i>	<i>Developed</i>
Construction Areas (vegetation removed)				
North Ramp – ACE	7.1 (2.8)	16 (6.3)	15 (6.0)	177 (72)
South Ramp – Embarkation	0.4 (0.2)	4 (1.6)	4.5 (1.8)	24 (9.7)
Access Gate and Road	0	47 (19)	5.1 (2.1)	16 (6.4)
NWF – LZs	0	0	0	6.7 (2.7)
MSA – New Magazines	0	11 (4.5)	0	6.3 (2.5)
<b>Total Area Removed</b>	<b>7.5 (3.0)</b>	<b>78 (32)</b>	<b>25 (10)</b>	<b>230 (93)</b>

















The limestone forest in the North Ramp ACE area contains individuals of *Tabernaemontana rotensis*, a species not listed as threatened or endangered, but considered a SOGCN (GDAWR 2006). Surveys in the ACE area identified two locations of *T. rotensis* with a total of several hundred saplings and one larger tree (UoG 2007; Figures 10.2-3 and 10.2-4). Surveys in the proposed new magazine area also identified *T.*

**Legend**

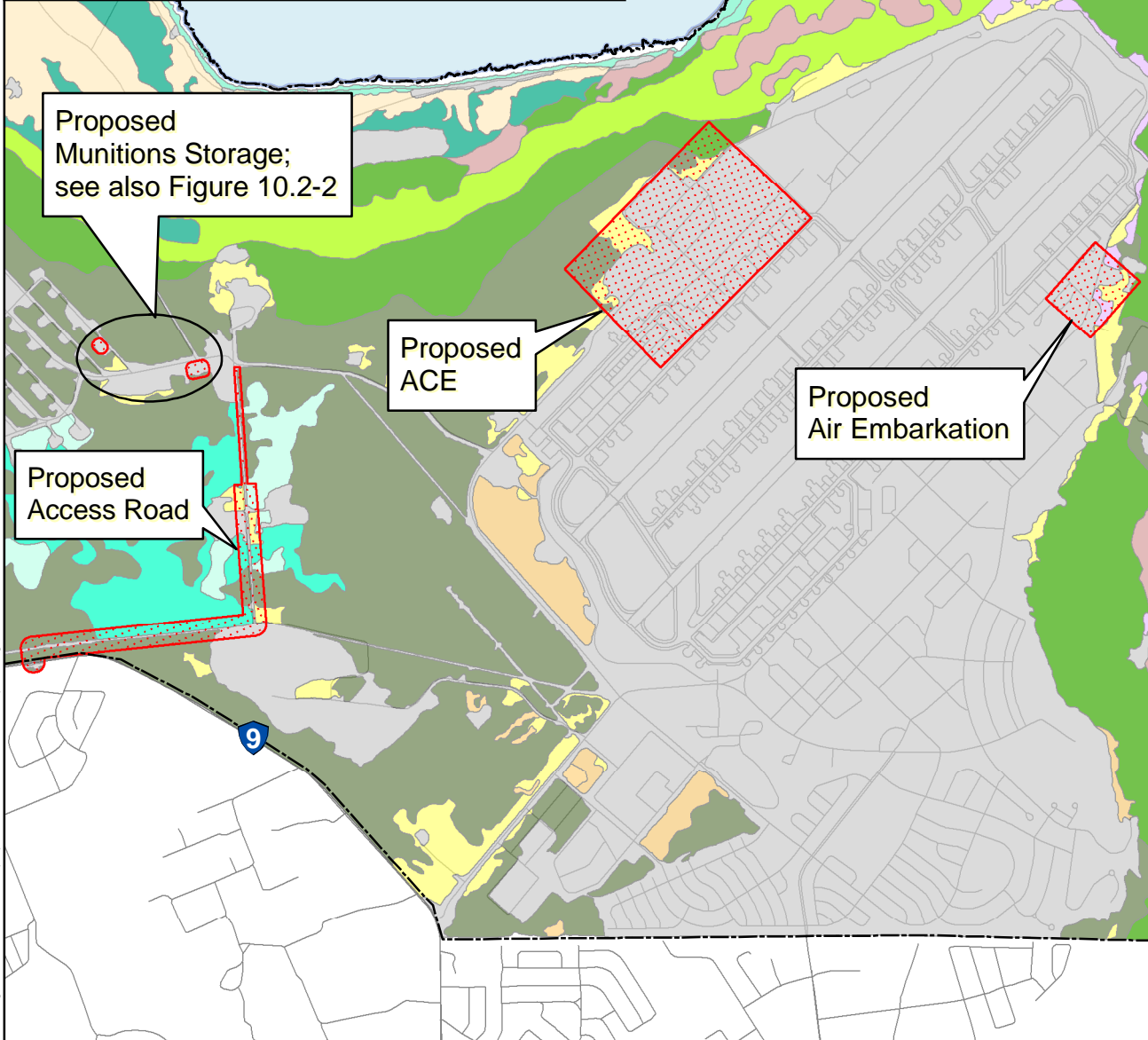
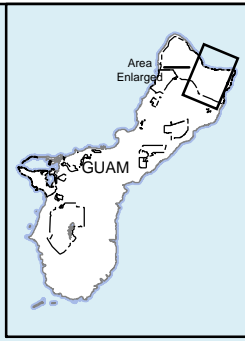
 Andersen AFB Boundary
  Route Number

 Proposed Project Footprint

**Vegetation**

 <i>Casuarina</i> Forest	 Limestone Forest - Primary
 Coconut Forest	 Mixed Herbaceous Scrub
 Developed	 Mixed Limestone Forest - Foreslope
 <i>Hibiscus - Ochrosia</i> Scrub	 Mixed limestone Forest - Secondary
 <i>Hibiscus</i> Scrub	 Mixed Shrub
 <i>Hibiscus - Leucaena</i>	 <i>Ochrosia</i> Edge
 <i>Vitex</i> - Closed Canopy	 Strand
 <i>Vitex</i> - Sparse Canopy	 <i>Neisosperma</i> Forest

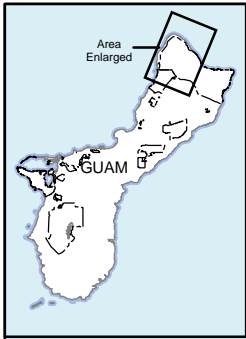
Source: Andersen AFB 2008c



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**Figure 10.2-1  
Potential Vegetation Impacts - Andersen AFB East**





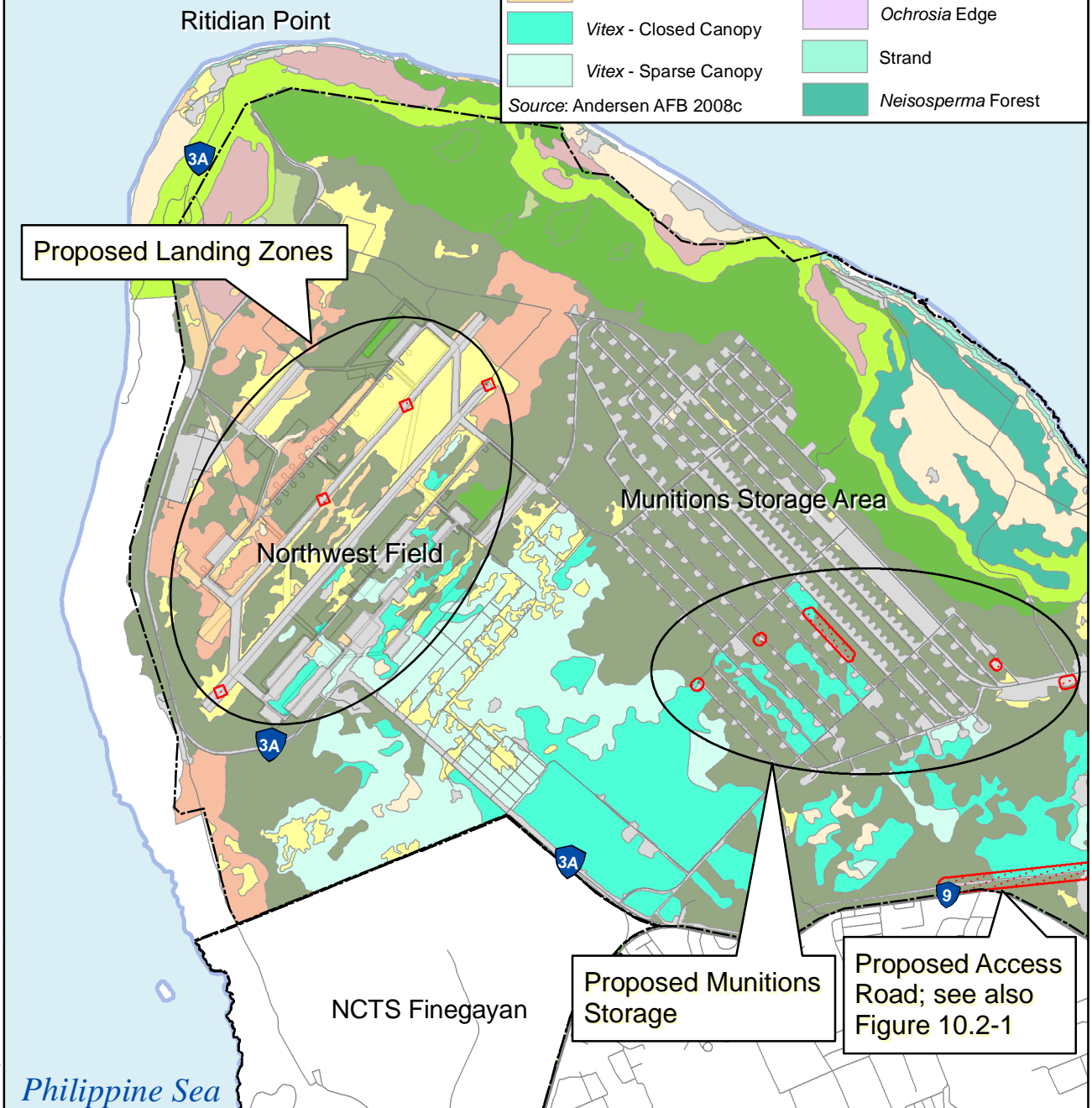
**Legend**

- Andersen AFB Boundary
- Proposed Project Footprint
- Route Number

**Vegetation**

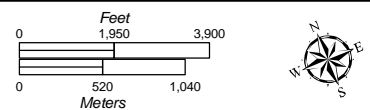
- |                           |                                    |
|---------------------------|------------------------------------|
| Casuarina Forest          | Limestone Forest - Primary         |
| Coconut Forest            | Mixed Herbaceous Scrub             |
| Developed                 | Mixed Limestone Forest - Foreslope |
| Hibiscus - Ochrosia Scrub | Mixed limestone Forest - Secondary |
| Hibiscus Scrub            | Mixed Shrub                        |
| Hibiscus - Leucaena       | Ochrosia Edge                      |
| Vitex - Closed Canopy     | Strand                             |
| Vitex - Sparse Canopy     | Neisosperma Forest                 |

Source: Andersen AFB 2008c





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**Figure 10.2-2  
Potential Vegetation Impacts - Andersen AFB West**










**Legend**




 Andersen AFB Boundary
  Route Number

 Proposed Project Footprint

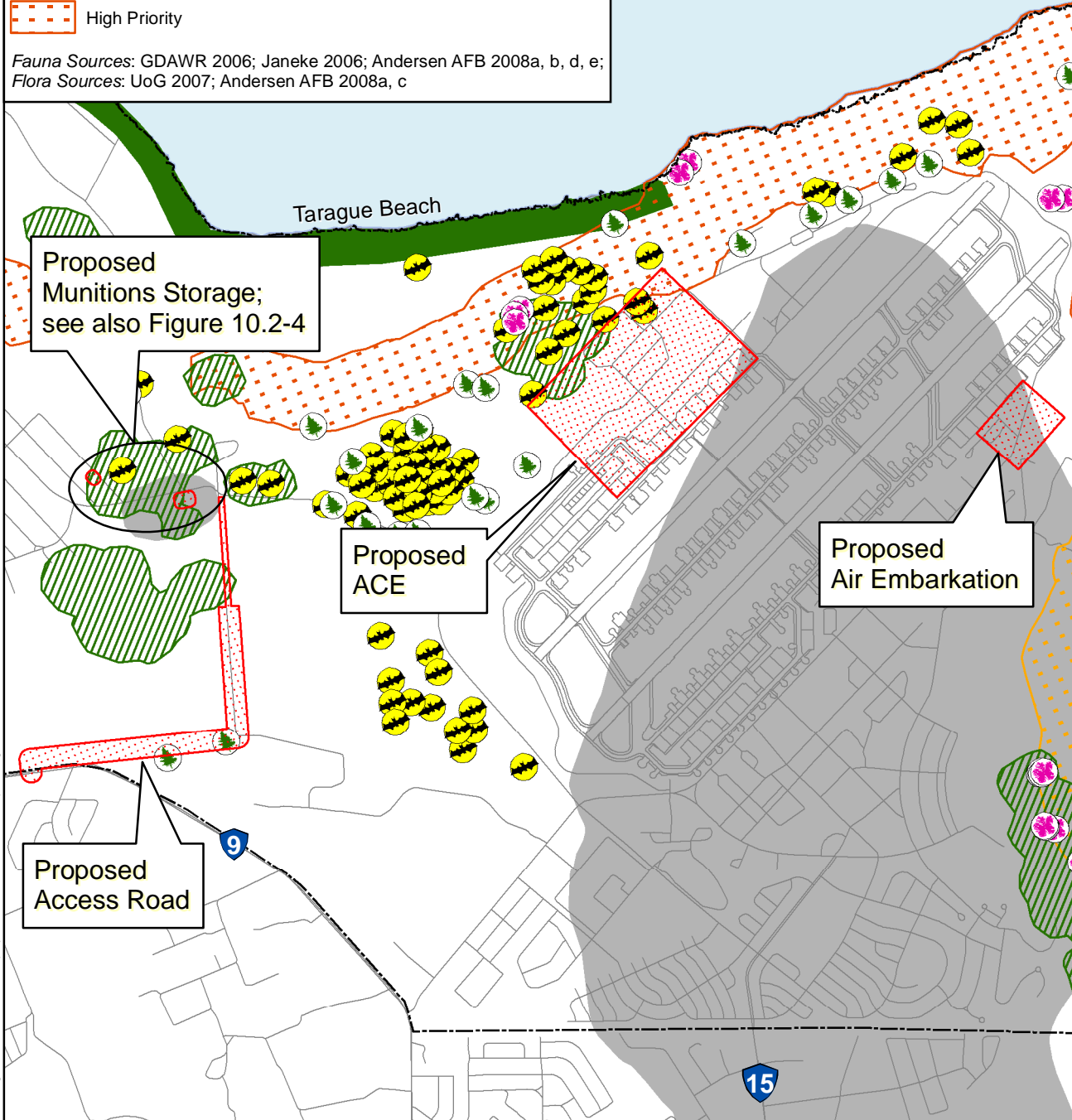
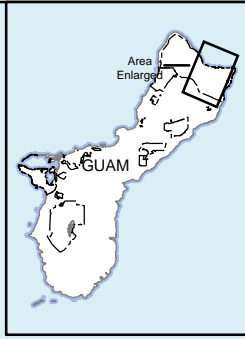
**Fauna**

 Mariana Fruit Bat Locations  
 Micronesian Starling Habitat  
 Green Sea Turtle Nesting Area  
 Fruit Bat Roosting Habitat - Medium Priority  
 Fruit Bat Roosting Habitat - High Priority

**Flora**

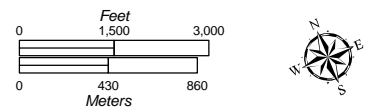
 *Heritiera longipetiolata*  
 *Tabernaemontana rotensis*  
 *Tabernaemontana rotensis* Clusters

*Fauna Sources:* GDAWR 2006; Janeke 2006; Andersen AFB 2008a, b, d, e;  
*Flora Sources:* UoG 2007; Andersen AFB 2008a, c

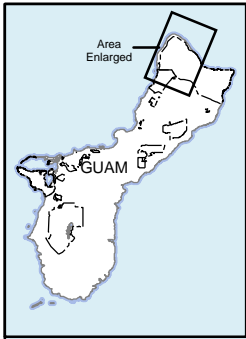


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**Figure 10.2-3**  
**Potential Special-Status Species Impacts - Andersen AFB East**



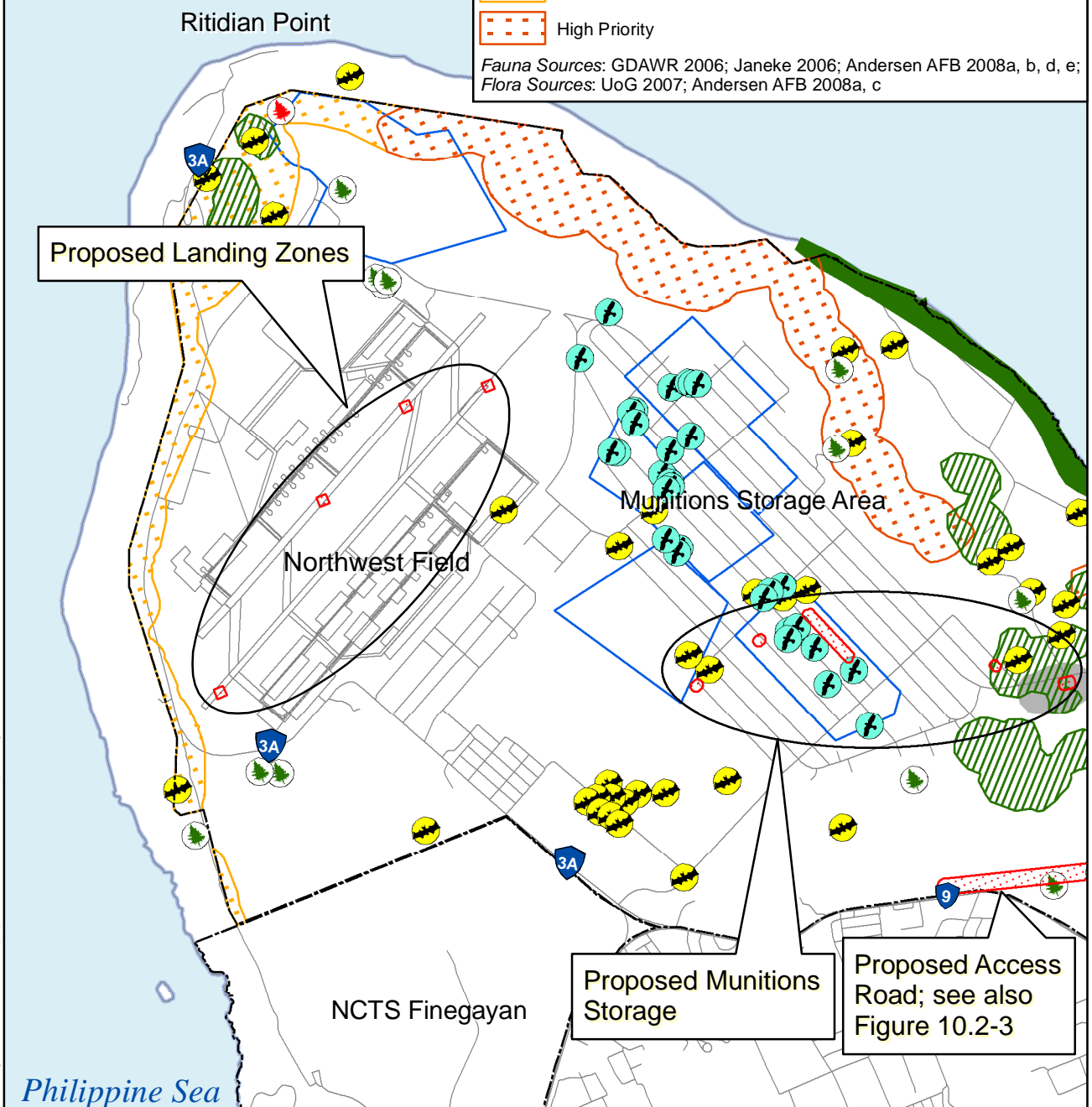




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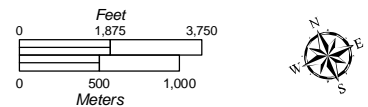
- Andersen AFB Boundary
- Mariana Crow Locations (Sept 2006)
- f Mariana Fruit Bat Locations
- f Mariana Crow Locations
- Micnesian Starling Habitat
- Green Sea Turtle Nesting Area
- Fruit Bat Roosting Habitat
- Medium Priority
- High Priority
- 9 Route Number
- Proposed Project Footprint
- Flora**
- f Fire Tree
- f *Heritiera longipetiolata*
- f *Tabernaemontana rotensis*
- Tabernaemontana rotensis* Clusters

Fauna Sources: GDAWR 2006; Janeke 2006; Andersen AFB 2008a, b, d, e; Flora Sources: UoG 2007; Andersen AFB 2008a, c



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**Figure 10.2-4**  
**Potential Special-Status Species Impacts - Andersen AFB West**



*rotensis*. Because over 21,000 *T. rotensis* individuals were found throughout Andersen AFB at 265 separate locations in a recent survey (UoG 2007; see Figure 10.2-1), the potential loss from the proposed construction of the ACE and magazine would be small compared to the total population on Andersen AFB. Therefore, impacts would be a less than significant.

*Wildlife*. Few migratory birds are present in the project areas. The only native migratory bird species likely to be present in the project construction area, based on surveys conducted in support of this EIS/OEIS and other studies, are the yellow bittern and possibly the Pacific golden plover in open areas; both species are located throughout Guam. The loss of woody vegetation would result in the loss of nesting areas for the bittern, but this loss would not result in significant adverse effects on its population because it is very common throughout the island.








Proposed construction activities would displace the species and other wildlife from suitable habitat in the proposed project areas. Smaller, less mobile species, and those seeking refuge in burrows, could inadvertently be killed during construction activities. However, long-term, permanent impacts to populations of such species would not result because the species known to be present are abundant in surrounding areas, and would rapidly repopulate suitable portions of the affected area. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Therefore, impacts to wildlife due to proposed construction activities at Andersen AFB would be less than significant under Alternative 1.

Construction activities for the various facilities, the new gate, and access road construction or improvements would generate noise. Construction would take place during daylight hours. Only a few widespread migratory bird species are present that would be affected. They would move away from the construction areas, but there are other areas of suitable habitat nearby and they could return during evenings and to some of the area when construction is complete. Effects would be short-term. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Therefore, indirect impacts to wildlife from construction would be less than significant.

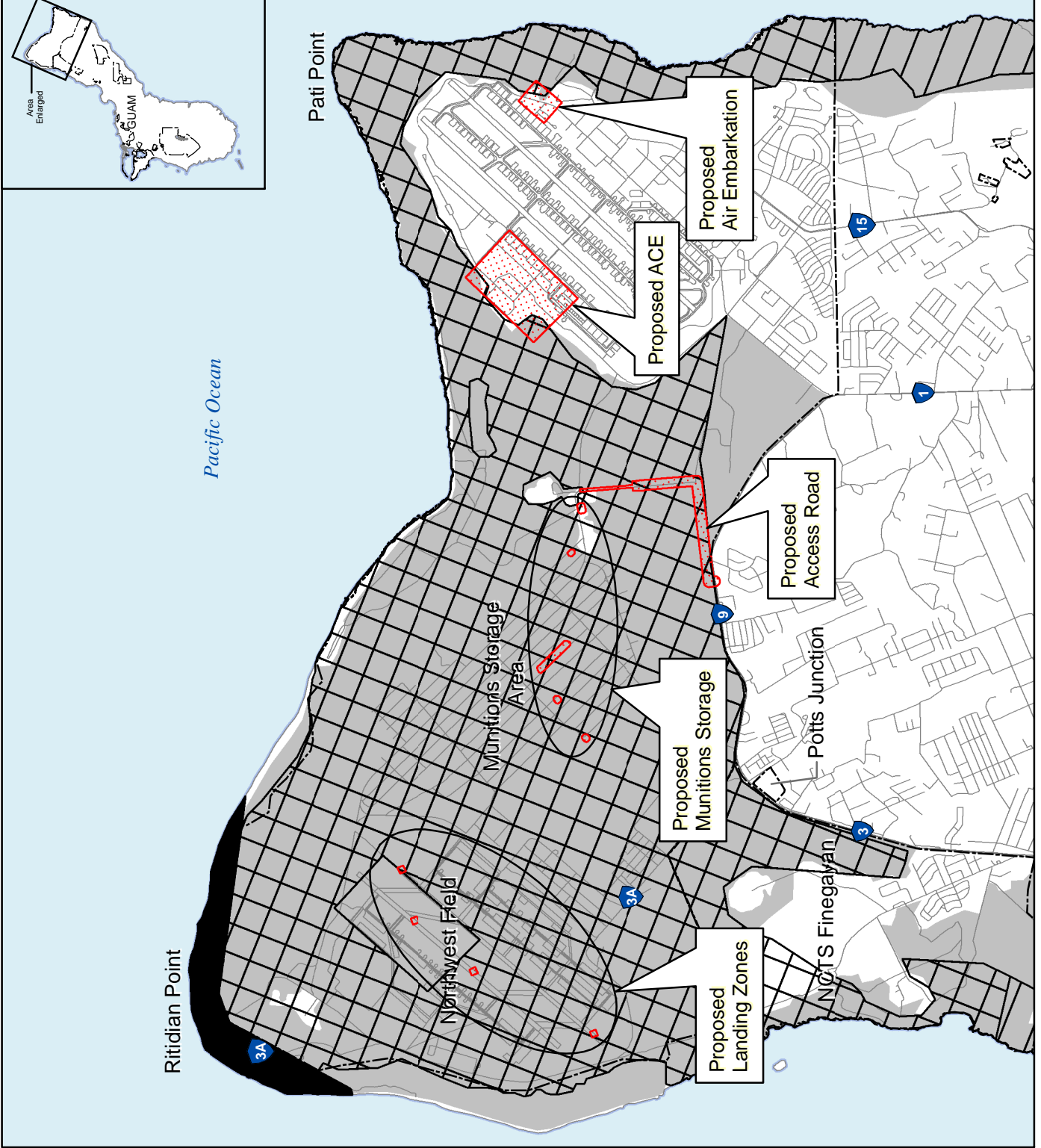
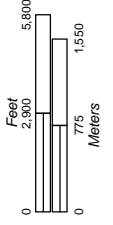
*Special-Status Species*. Proposed construction activities could directly impact habitat for several ESA-listed species that currently occur on Guam. Construction activities would impact essential habitat that could serve as potential reintroduction areas for ESA-listed species that are currently extirpated from Guam. MARIANA FRUIT BAT. In 2005, the USFWS determined that movement of fruit bats between all islands in the Mariana archipelago occur that results in an exchange of genetic material between individuals in the region. Therefore, the Mariana fruit bat was considered one subspecies and was down-listed to threatened status throughout the region (USFWS 2005). Proposed construction activities would include the loss of limestone forest that is potential foraging and roosting habitat for the Mariana fruit bats on the base (refer to Figures 10.2-3 and 10.2-4). It is well documented from scientific studies and observations that fruit bats are found in the proposed project areas (see Section 10.1). However, the number of bats using the area at any time cannot be estimated because they are active at night. Bats that roost in Northwest Field during the day are solitary and difficult to locate in the forest. A total of 116 ac (47 ha) of essential habitat would be removed for construction of the various project components on the base. This essential habitat is also designated Overlay Refuge (Figure 10.2-5). Removal of these areas due to construction would have a significant impact on fruit bat individuals because of the removal of habitat areas designated as essential habitat for the conservation of the species. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6. The proposed actions would have a minimal affect on the population or the subspecies with up to several thousand individuals present throughout the Mariana Archipelago.

**Figure 10.2-5**  
 Potential Impacts to  
 Essential Habitat,  
 Recovery Zones,  
 and Critical Habitat  
 for ESA-listed  
 Species on or  
 in the Vicinity of  
 Andersen AFB

Legend

-  Military Installation
-  Route Number
-  Proposed Project Footprint
-  Mariana Crow Essential Habitat
-  Mariana Fruit Bat and Guam Micronesian Kingfisher Essential Habitat
-  Mariana Crow, Mariana Fruit Bat, and Guam Micronesian Kingfisher Critical Habitat
-  Mariana Crow Recovery Zones

Sources: USFWS 2002, 2004, 2005b



Construction activities for the various facilities, LZs, the new gate, and access road construction or improvements would temporarily generate noise and human activity. Fruit bats are rarely observed during the day in the proposed construction areas. Construction would occur during daylight hours, avoiding the nighttime activity of individual Mariana fruit bats. Therefore, direct impacts from noise and activity associated with construction would result in less than significant impacts to fruit bats.

**GUAM MICRONESIAN KINGFISHER.** Proposed construction activities would include the loss of limestone forest that is potential foraging and nesting habitat for a potential future introduction of the kingfisher. A total of 116 ac (47 ha) of essential habitat would be removed for construction of the various project components on the base (Special-Status Species). Proposed construction activities could directly impact habitat for several ESA-listed species that currently occur on Guam. Construction activities would significantly impact the species due to loss of essential habitat that could serve as potential reintroduction areas for ESA-listed species that are currently extirpated from Guam. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

**MARIANA CROW.** Proposed construction activities would include the loss of limestone forest that is potential foraging and nesting habitat for the crow. A total of 116 ac (47 ha) of essential habitat would be removed for construction of the various project components on the base (see Table 10.2-2). This essential habitat is also designated Overlay Refuge (refer to Figure 10.2-5). Removal of these areas due to construction would have a significant impact on the species. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

Construction activities for the magazines at the MSA would temporarily generate noise and human activity at or near the location where the remaining crows are known to occur. Crows have been rarely observed in recent times in the other proposed construction areas. Potential indirect impacts to the crow are shown in Table 10.2-2. Using a surrounding zone of 197 ft (60 m) for project areas at the MSA, a total of 25 ac (10 ha) would be indirectly affected. Indirect impacts from noise and activity associated with construction would result in significant impacts to individual crows, however only two crows are known to be currently present on Guam. The entire remaining population of this species is on Rota, with the most recent species count being in 2004 at 170 breeding pairs (USFWS 2005b). Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

**GUAM RAIL.** Except for an experimental non-essential population that has been introduced to Rota, the rail survives only in captivity at this time and does not occur in the wild on Guam. Proposed construction activities would include the loss of shrub/grassland habitat that is potential foraging and nesting habitat for the Guam rail. No specific areas of essential habitat have been designated for this species, but 25 ac (10 ha) of favorable shrub/grasslands habitat contained within Overlay Refuge lands would be removed (see Figure 10.2-5). However, because the Guam rail is currently extirpated in the wild and most of Guam has habitat that is potentially suitable for the recovery of the species, removal of these areas due to construction would result in a less than significant impact.

**MARIANA EIGHT-SPOT BUTTERFLY.** This species was observed in the Pati Point area (PACAF 2006a). The larval stage of this species has 2 specific host plants not reported in the vicinity of Alternative 1 project areas; these host plants are generally associated with primary limestone forest in areas of pinnacle karst (karren) which is not present in the project areas. Therefore, removal of these areas due to construction would have no impact on the eight-spot butterfly.

**Table 10.2-2. Potential Impacts to Special-Status Species Habitat at Andersen AFB with Implementation of Alternative 1 (ac [ha])**

<i>Parcel and Activity</i>	<i>Overlay Refuge*</i>	<i>Essential Habitat – Bat and Kingfisher*</i>	<i>Essential Habitat – Crow*</i>	<i>Crow Recovery Zone*</i>
<b>Direct Impacts from Construction - Habitat Removed</b>				
North Ramp – ACE	0	27 (11)	27 (11)	22 (8.9)
South Ramp – Embarkation	0	6.4 (2.6)	6.4 (2.6)	6.3 (2.5)
Access Gate and Road	53 (21)	65 (26)	65 (26)	66 (26.6)
MSA – New Magazines	18 (7.3)	18 (7.3)	18 (7.3)	15 (6.2)
<b>Total Habitat Removed</b>	<b>71 (29)</b>	<b>116 (47)</b>	<b>116 (47)</b>	<b>109 (44)</b>
Percentage of Habitat Type on Guam that is Removed	0.3 %	0.5 %	0.5 %	0.3 %
<b>Direct Impacts – Noise, Lighting, Human Activity</b>				
150 m buffer for FB (R*): Ground Ops				
North Ramp – ACE	21 (8.6)	63 (26)	NA	NA
South Ramp – Embarkation	0	18 (7.3)	NA	NA
Access Gate and Road	137 (55)	138 (56)	NA	NA
LZs	96 (39)	59 (24)	NA	NA
Totals	254 (103)	278 (113)	NA	NA
150 m buffer for FB (R/N*): Air Takeoff and Landings				
North Ramp – ACE	21 (8.6)	63 (26)	NA	NA
South Ramp – Embarkation	0	18 (7.3)	NA	NA
LZs	96 (39)	59 (24)	NA	NA
Totals	117 (47)	140 (57)	NA	NA
<b>Direct Temporary Impacts from Construction– Noise, Lighting, Human Activity</b>				
60 m buffer for MC (F,N)				
MSA – New Magazines	25 (10)	NA	25 (10)	25 (10)
<b>Indirect Impacts (unoccupied habitat) – Noise, Lighting, Human Activity</b>				
60 m buffer for MC (F,N): Ground Ops				
North Ramp – ACE	8.1 (3.3)	NA	21 (8.5)	16 (6.5)
South Ramp – Embarkation	0	NA	5.1 (2.0)	6.1 (2.5)
Access Gate and Road	57 (23)	NA	56 (23)	64 (26)
LZs	21 (8.5)	NA	13 (5.3)	21 (8.5)
Totals	86 (35)	NA	95 (38)	107 (43)
100 m buffer for KF (F,N): Air Takeoff and Landings and Ground Ops				
North Ramp – ACE	14 (5.7)	39 (16)	NA	NA
South Ramp – Embarkation	0	10 (4.1)	NA	NA
Access Gate and Road**	92 (37)	91 (37)	NA	NA
LZs	48 (19)	30 (12)	NA	NA
Totals	154(62)	170 (69)	NA	NA
300 m buffer for MC (F,N): Air Takeoff and Landings				
North Ramp – ACE	43 (17)	NA	146 (59)	144 (58)
South Ramp – Embarkation	1.1 (0.4)	NA	50 (19)	54 (30)
LZs	315 (127)	NA	191 (77)	315 (12)
Totals	359 (143)	NA	387 (156)	513 (207)

Notes: Each habitat category is considered independently of others and are not additive; Only species with specific, recognized habitat areas are included in the table; NA – Not applicable. \*For the fruit bat the smaller foraging buffer of 100 m is not included; \*\*Aircraft takeoff and landings are not applicable for this component. FB – Fruit Bat, MC - Mariana Crow, KF – kingfisher, F – Foraging, R – Roosting/Colony, N - Nesting.

MICRONESIAN STARLING. A small area of habitat that is identified for this species' future recovery in the proposed new munitions storage magazine area would be removed (see Figure 10.2-3). Because the amount of habitat lost is so small, compared to that which is otherwise available for the species, impacts would be less than significant.

ALL SPECIAL-STATUS SPECIES. Other indirect effects on all species would occur as a result of the proposed construction. Movement of construction personnel, equipment, and supplies could result in the movement and spread of invasive plant and animal species to Guam, within Guam, and to other locations from Guam. Invasive species would affect special-status species or degrade habitat, thus are potential indirect impacts resulting from actions proposed in Alternative 1. Invasive species impacts for construction would be similar to those for operations but shorter-term. Awareness training and inspection of gear, clothing, and equipment as part of existing control measures would occur. The impacts are discussed in detail under operations below. Special status species impacts would be significant but numerous mitigation and other BMP measures, as specified under mitigation in Section 10.2.2.6, would be implemented to reduce impacts to less than significant.

#### *Operation*

*Vegetation.* Invasive plant species are likely to expand ranges and new species are likely in some areas due to the increase in number of increased activities such as more training, more personnel, and more vehicles. However, this is unlikely to substantially impact primary limestone forest because most activities are well away from these primary forest areas. Therefore, impacts would be less than significant.

*Wildlife.* Aircraft operations would result in some migratory bird airstrikes however these would be few because of the lack of native bird species. A Bird/Wildlife Aircraft Strike Hazard (BASH) Plan is currently in place at Andersen AFB and has measures to decrease the likelihood of these strikes. With this plan in place, there would be no diminished population sizes or distributions of migratory birds or regionally important native animal species and impacts would be less than significant.

Operations at the facilities and LZs would generate noise. The few migratory birds present would be affected and would move away from these areas, but there are other large areas of habitat nearby where they could move to when disturbed. The magazine areas would be used infrequently and there would be no nighttime lighting or minimal lighting using hooded lights. Operations at the aviation and embarkation facilities would be continuous and could occur day or night. Lighting in these areas would be hooded or shielded to prevent unnecessary light beyond operational areas. LZs in the training area at Northwest Field would not be used at night. Indirect impacts from noise and activity associated with operations would result in less than significant impacts to wildlife.

*Special-Status Species.* Direct and indirect impacts from ground and aircraft operations are described for each species below.

MARIANA FRUIT BAT. Fruit bats are potentially present at all the proposed project areas at Andersen AFB and could be disturbed during foraging or roosting, primarily during nighttime activities. Activities at the facilities and LZs from ground and aircraft operations would generate noise and facilities would require night lighting. The magazine areas would be used infrequently and there would be no night lighting or minimal hooded lighting. Operations at the aviation and embarkation facilities would be continuous and could occur day or night. To reduce impacts, lighting at facilities would be hooded or shielded to prevent unnecessary light beyond operations areas. Under the proposed action, there would be an increase in Andersen AFB aircraft operations primarily associated with the basing of additional helicopters to support Marine Corps training on Guam and Tinian. Overall, annual and average daily aircraft operations would each increase by approximately 37% over baseline levels. This equates to an increase from an average of approximately ten daytime aircraft operations per hour to approximately 14/hour, and an increase in nighttime operations from approximately 1/hour to 1.5/hour.

To account for the new facilities and the increased aircraft takeoff and landings and ground operations, surrounding perimeter zones around the proposed facilities and LZs are assumed to be affected by human activity, noise, and lighting. Observations of roosting Mariana fruit bats near human activities reported by USFWS (2006) indicate that individuals were not disturbed by most activities greater than 492 ft (150 m) away from the roost site. Observations reported by USFWS (2006) indicate that foraging fruit bats would not be disturbed by most activities at distances greater than 328 ft (100 m). So conservatively, using 492 ft (150 m), the amount of fruit bat essential habitat that may be directly impacted by the operation of the proposed facilities on Andersen AFB is approximately 278 ac (113 ha) for ground operations and 140 ac (57 ha) for aircraft takeoff and landings (see Table 10.2-2). Impacts would be significant. The impacts would affect individual fruit bats, but impacts to the population or the subspecies would be minimal with up to several thousand individuals present throughout the Mariana Archipelago.

Aircraft operations could result in some airstrikes of the Mariana fruit bat. A BASH Plan is currently in place at Andersen AFB and has measures to reduce BASH potential. With this plan in place, the likelihood of strikes is minimal and direct impacts to special-status species would be less than significant (may affect but is unlikely to adversely affect).

Noise associated with baseline aircraft operations at Andersen AFB currently extends over areas that contain roosting and foraging habitat for the Mariana fruit bat (fruit bat). Specifically, areas that are considered essential habitat for the fruit bat on Andersen AFB currently experience noise levels ranging from 60 decibels (dB) to greater than 85 dB (Table 10.2-3 and Figure 10.2-6). Under the proposed action, the total acreage of essential habitat that would be subjected to an increase in noise levels would increase from 4,148 ac (1,679 ha) to 5,898 ac (2,387 ha), or an increase of 42%. However, the majority of this increase (89%) would occur within the 60-65 dB noise contour.

**Table 10.2-3. Baseline and Projected Noise Contour Acreages over Essential Habitat for Mariana Fruit Bat and Guam Micronesian Kingfisher from Andersen AFB Aircraft Operations (ac [ha])**

<i>Average Noise Level (DNL)</i>	<i>Baseline</i>	<i>Proposed</i>	<i>Change from Baseline</i>	<i>% Change from Baseline</i>
60-65 dBA	1,573 (637)	3,123 (1,264)	1,550 (627)	98.5%
65-70 dBA	797 (323)	579 (234)	-218 (-89)	-27.3%
70-75 dBA	933 (378)	1,251 (506)	318 (128)	34.1%
75-80 dBA	460 (186)	520 (210)	60 (24)	13.0%
80-85 dBA	307 (124)	329 (133)	22 (9)	7.2%
>85 dBA	78 (32)	96 (39)	18 (7)	23.1%
<b>Total</b>	<b>4,148 (1,679)</b>	<b>5,898 (2,387)</b>	<b>1,750 (708)</b>	<b>42.2%</b>

*Legend:* DNL= Day-Night Sound Level; dBA= A-weighted decibel.

*Note:* Acreages, including totals, may not correspond exactly due to rounding.

This increase in area is mainly associated with the proposed increased use of NWF by helicopters departing from Andersen AFB, as depicted in the finger-like contour extending north from south of Potts Junction over NCTS Finegayan to NWF. Based on past data and recent monitoring efforts (Morton 1996, GDAWR 2006, Janeke 2006, Andersen AFB 2008d), fruit bats have not been observed foraging or roosting in this area; this is possibly due to the lack of habitat (i.e., tree species with sufficient canopy structure and fruits). The increase in the acreages of the higher noise levels (>70 dB) in the vicinity of Andersen AFB is associated predominantly with the proposed transient basing of Marine Corps F/A-18D jet aircraft at Andersen AFB. As these jet aircraft arrive and depart Andersen AFB runways in a straight line and at a greater speed than the proposed helicopters, which stay within the Andersen AFB environment longer, the increase in noise associated with these jet aircraft is short term.



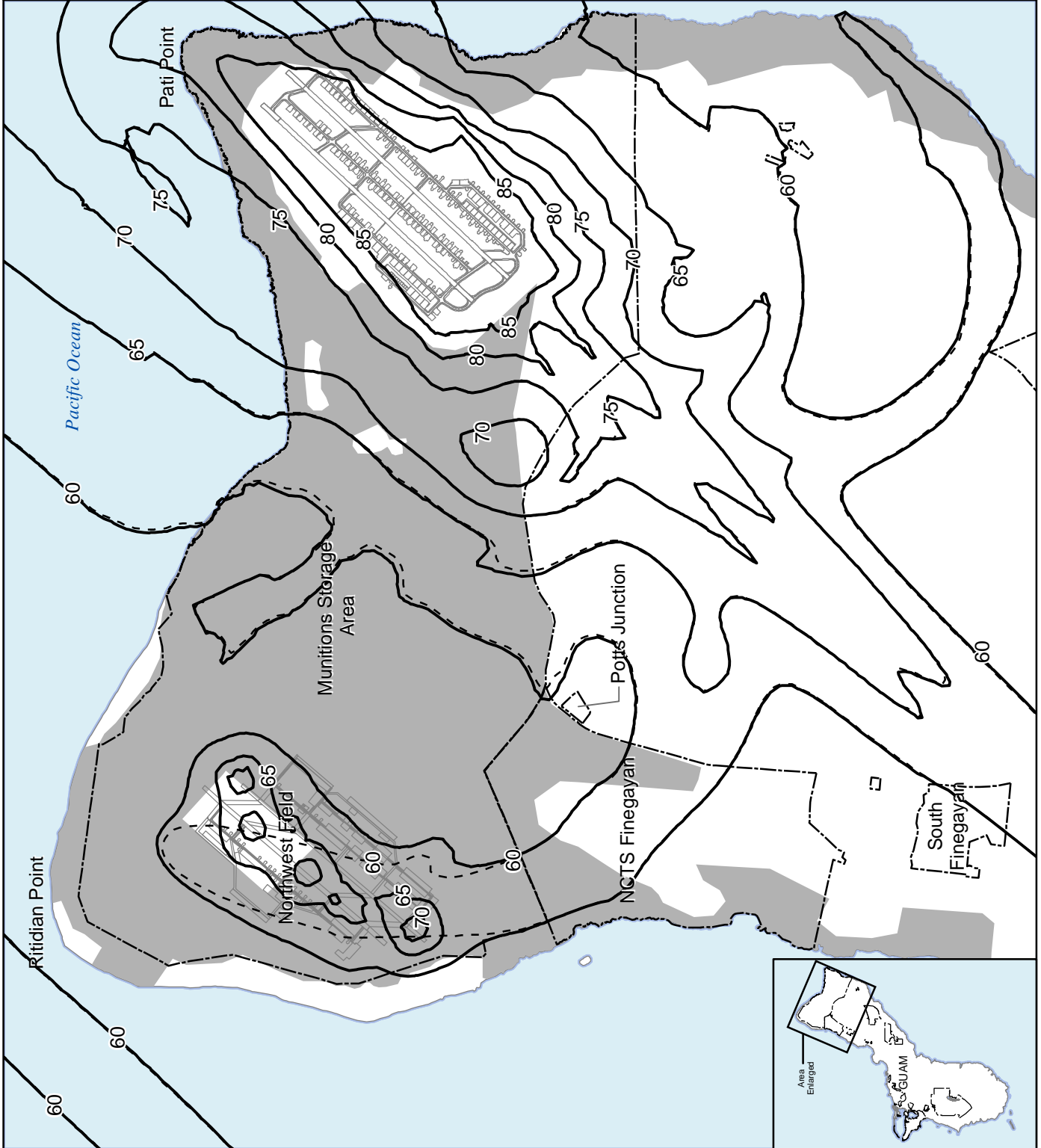
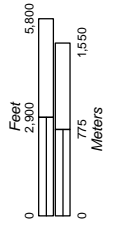
**Figure 10.2-6**

Guam Micronesian Kingfisher & Mariana Fruit Bat Essential Habitat and Noise Contours of Baseline and Proposed Aircraft Operations

**Legend**

- Baseline Noise -65 - Contours and dB (DNL) level
- Projected Noise -65 - Contours and dB (DNL) level
- Installation Boundary
- Kingfisher & Fruit Bat Essential Habitat

Sources: USFWS 2002; Czech and Kester 2008; Czech 2009





The proposed action for the previous 2006 ISR Strike EIS represents the current baseline conditions for this EIS/OEIS (PACAF 2006a). As part of the ESA Section 7 consultation process, the USFWS issued a Biological Opinion for the ISR Strike activities potentially impacting ESA-listed species on Guam, including the potential impacts of aircraft overflights and associated noise (USFWS 2006). Although it was recognized that noise from aircraft overflights would affect current populations of Mariana fruit bat, the USFWS concluded that implementation of the proposed aircraft operations of the ISR Strike action would not likely jeopardize the continued existence of the Mariana fruit bat. This conclusion was based on the implementation of conservation measures proposed by the Air Force as part of their proposed action, including conducting a multi-year monitoring program for the Mariana fruit bat and Mariana crow. This monitoring program would assess the current status of the Mariana fruit bat and evaluate any potential or known impacts of the ISR Strike project. Any adverse effects that become apparent due to aircraft operations would initiate modifications to aircraft ground tracks and profiles over sensitive areas through an adaptive management strategy. Although the results of the first year of monitoring (May 2007-May 2008) lacked overt evidence for panic, or colony flushing from aircraft noise the impact of increased aircraft noise was not measured. In addition, the full extent of increased aircraft noise was not evaluated because not all aircraft types were present for the study period. Therefore it was recommended that extensive monitoring of the effects of aircraft operations on fruit bat populations continue. To address the additional aircraft proposed under this study, the existing Andersen AFB monitoring data would be used and it would be augmented.

Aircraft disturbances have been found to impact native and non-native species at an individual and community level (e.g., Gladwin et al. 1987, National Park Service 1994). In terms of aircraft overflights, wild animals generally respond to low altitude aircraft, although the ways in which they respond varies depending on life-history, habitat, aircraft and flight activities, as well as previous exposure to aircraft (Burger 1981). Physiological and/or behavioral responses that can reduce an animal's fitness, ability to survive or increase its propensity to relocate. It is thought that low-altitude overflights can cause excessive stimulation, alertness, or stress (Fletcher, 1980, 1990; Mancini et al. 1988). In addition, chronic stress can compromise the general health of animals and behavioral responses by adults may interfere with offspring rearing, habitat use, and physiological energy budget (Owens 1977, Kushlan 1979, Burger 1981, Andersen et al., 1989, Belanger and Bedard 1989, Cook and Anderson 1990). According to the SWCA (2008) study, flushing episodes were infrequent at less than 5% for overflights louder than 75 dBC and 6% for overflights louder than 100 dBC. However, in a previous study, up to 42% of the Mariana fruit bat colony flushed in response to aircraft overflights (Morton 1996).

In addition, an increase in maintenance behaviors as a result of some overflights was recorded during the study (SWCA 2008). This behavior change during the day (when should be asleep) may result in increased stress on the animals.

Based on the above discussion, the primary increase in noise due to the proposed aircraft operations would be due to helicopter flights to NWF over areas potentially utilized by roosting or foraging fruit bats. The overall increase in noise experienced by Mariana fruit bats would not increase significantly on a daily or annual basis over baseline conditions, and there would be no significant impacts to the current fruit bat population or future recovery efforts due to proposed aircraft operations. As stated in the mitigation measures below, the Navy would provide additional support for the current monitoring effort of the effects of aircraft operations on Mariana fruit bats and adopt the Air Force's adaptive management strategy, which allows for modification of overflight patterns if adverse effects to fruit bats are documented. In addition, in support of recovery actions outlined in the recovery plan for the Mariana fruit bat (USFWS 1990a), the Navy would implement habitat restoration and control of BTS as provided

below in the mitigation measures. Therefore, noise resulting from aircraft operations of the proposed action would have a less than significant affect on the Mariana fruit bat.

Other noise increases would occur from the proposed action. Noise would be generated beyond current levels from increased use of the Northwest Field demolition facility. Its use is expected for one event per day up to 25 days per year. Noise studies have been conducted for this facility and a summary of the study and noise contours are shown in Chapter 6. Noise contours are based on the “busy day” C-weighted average sound day-night level (CDNL). The 70 dB CDNL contour within essential habitat for the fruit bat would be increased over a total of 1,385 acres under the proposed action. Given the limited amount of information available on the noise susceptibility of the fruit bat, noise from the demolition area may have a significant impact. To evaluate this potential, monitoring of the species in areas surrounding the demolition area would be conducted to determine potential noise impacts. If this monitoring determined that the fruit bat was being affected, techniques to reduce noise generation, such as noise barriers, would be employed. With this mitigation, impacts would be less than significant.

Impacts from noise and other activity may be exacerbated by effects from typhoons. Following typhoons, Mariana fruit bats are known to travel between Guam and Rota. Fruit bats would be under stress and food resources may be limited such that bats might forage during the day (USFWS 2006). In these situations, noise and other activity from operations would have a significant impact on the Mariana fruit bat and crow. Various conservation measures and mitigation actions would aid in the recovery of special-status species on Guam (see Section 10.2.2.5) and would reduce or compensate for these impacts.

**GUAM MICRONESIAN KINGFISHER.** The Guam Micronesian kingfisher has been extirpated from the wild and currently occurs only in captive breeding populations. When reintroduced in the future, it is expected that kingfishers are likely to avoid areas within 328 ft (100 m) of the proposed facilities and LZs due to operations and maintenance, perimeter and facility lighting at night, and aircraft takeoff and landing operations. Based on the essential habitat available within that distance, approximately 170 ac (69 ha) would be indirectly impacted by the operation of the proposed facilities on Andersen AFB (Table 10.2-2). Impacts would be significant.

Noise associated with baseline aircraft operations at Andersen AFB extends over areas that contain roosting and foraging habitat for kingfishers. Specifically, areas that are considered essential habitat for the Guam Micronesian kingfisher on Andersen AFB, NCTS Finegayan, and to the north of the Route 15 lands, currently experience noise levels ranging from 60 dB to greater than 85 dB (Table 10.2-3 and Figure 10.2-6). Under the proposed action, the total acreage of essential habitat that would be subjected to an increase in noise levels would increase from 4,148 ac (1,679 ha) to 5,898 ac (2,387 ha) or an increase of 42%. However, the majority of this increase (89%) would occur within the 60-65 dB noise contour. The immediate habitat areas that would potentially be affected by noise and impacts from ground and air operations are shown in Table 10.2-2.

Although the kingfisher does not presently occur in the wild, and no studies on the effects of aircraft overflights on this species or other kingfisher species have been conducted, the proposed aircraft operations over identified essential habitat for kingfishers are not expected to compromise the conservation and recovery process described in the revised recovery plan for the kingfisher (USFWS 2008a). With implementation of the mitigation measures described below including support for ungulate eradication and restoration of potential kingfisher foraging and nesting habitat and reintroducing kingfishers to Andersen AFB or other suitable areas on Guam, the proposed action aircraft operations would have a less than significant affect on kingfishers.

As described above for the fruit bat, noise would be generated beyond current levels from increased use of the Northwest Field demolition facility. The 70 dB CDNL contour within essential habitat for the kingfisher would be increased over a total of 1,385 acres under the proposed action. Given the limited amount of information available on the noise susceptibility of the kingfisher, noise from use of the demolition area may have a significant impact if it were to be reintroduced to the area. To evaluate this potential, if reintroduced to the area, monitoring of the species in areas surrounding the demolition area would be conducted to determine potential noise impacts. If this monitoring determined that the kingfisher was being affected, techniques to reduce noise generation, such as noise barriers, would be employed. With this mitigation, impacts would be less than significant.

**MARIANA CROW.** Crows are not currently present in proposed project areas other than at the magazines, where minimal operations occur. Therefore, impacts are assessed as indirect. Based on observations of foraging Mariana crows, it is expected that they are likely to avoid areas within 197 ft (60 m) of the proposed facilities due to operations and maintenance, and perimeter and facility lighting at night. Based on the essential habitat available within 197 ft (60 m), approximately 95 ac (38 ha) would be indirectly impacted by the operation of the proposed facilities on Andersen AFB (Table 10.2-2). Air takeoff and landing operations at the north and south ramp and LZs would affect unoccupied crow habitat. Based on the essential habitat available within 984 ft (300 m), approximately 387 ac (156 ha) would be indirectly impacted by aircraft takeoff and landings. Impacts from noise, lighting, and human activity would be significant.

Noise associated with baseline aircraft operations at Andersen AFB currently extends over areas that contain roosting and foraging habitat and identified recovery zones for Mariana crows. Specifically, areas that are considered essential habitat and recovery zones for the crow on Andersen AFB, NCTS Finegayan, and to the north of the Route 15 lands currently experience noise levels ranging from 60 dB to greater than 85 dB (Table 10.2-4 and Figure 10.2-7). Under the proposed action, the total acreage of essential habitat that would be subjected to an increase in noise levels from aircraft operations would increase from 3,937 ac (1,593 ha) to 5,667 ac (2,293 ha) or an increase of 44%. However, the majority of this increase (88%) would occur within the 60-65 dB noise contour. As the recovery zones are predominantly coincident with essential habitat, the total acreage of recovery zones subjected to an increase in noise levels would be similar to that for essential habitat.

**Table 10.2-4. Baseline and Projected Noise Contour Acreages over Mariana Crow Essential Habitat and Recovery Zones from Andersen AFB Aircraft Operations (ac [ha])**

Average Noise Level (DNL)	Baseline	Proposed	Change from Baseline	% Change from Baseline
<b>Essential Habitat</b>				
60-65 dBA	1,362 (551)	2,892 (1,170)	1,530 (619)	112.3%
65-70 dBA	797 (323)	579 (234)	-218 (-89)	-27.3%
70-75 dBA	933 (378)	1,251 (506)	318 (128)	34.1%
75-80 dBA	460 (186)	520 (210)	60 (24)	13.0%
80-85 dBA	307 (124)	329 (133)	22 (9)	7.2%
>85 dBA	78 (32)	96 (39)	18 (7)	23.1%
<b>Total</b>	<b>3,937 (1,593)</b>	<b>5,667 (2,293)</b>	<b>1,730 (700)</b>	<b>43.9%</b>
<b>Recovery Zone</b>				
60-65 dBA	1,526 (618)	3,164 (1,280)	1,638 (663)	107.3%
65-70 dBA	924 (374)	599 (242)	-325 (-131)	-35.2%
70-75 dBA	1,062 (430)	1,408 (570)	346 (140)	32.6%
75-80 dBA	671 (272)	742 (300)	71 (29)	10.6%
80-85 dBA	356 (144)	436 (176)	80 (32)	22.5%
>85 dBA	85 (34)	103 (42)	18 (7)	21.2%
<b>Total</b>	<b>4,624 (1,871)</b>	<b>6,452 (2,611)</b>	<b>1,828 (740)</b>	<b>39.5%</b>

Note: Acreages and hectares, including totals, may not correspond exactly due to rounding.

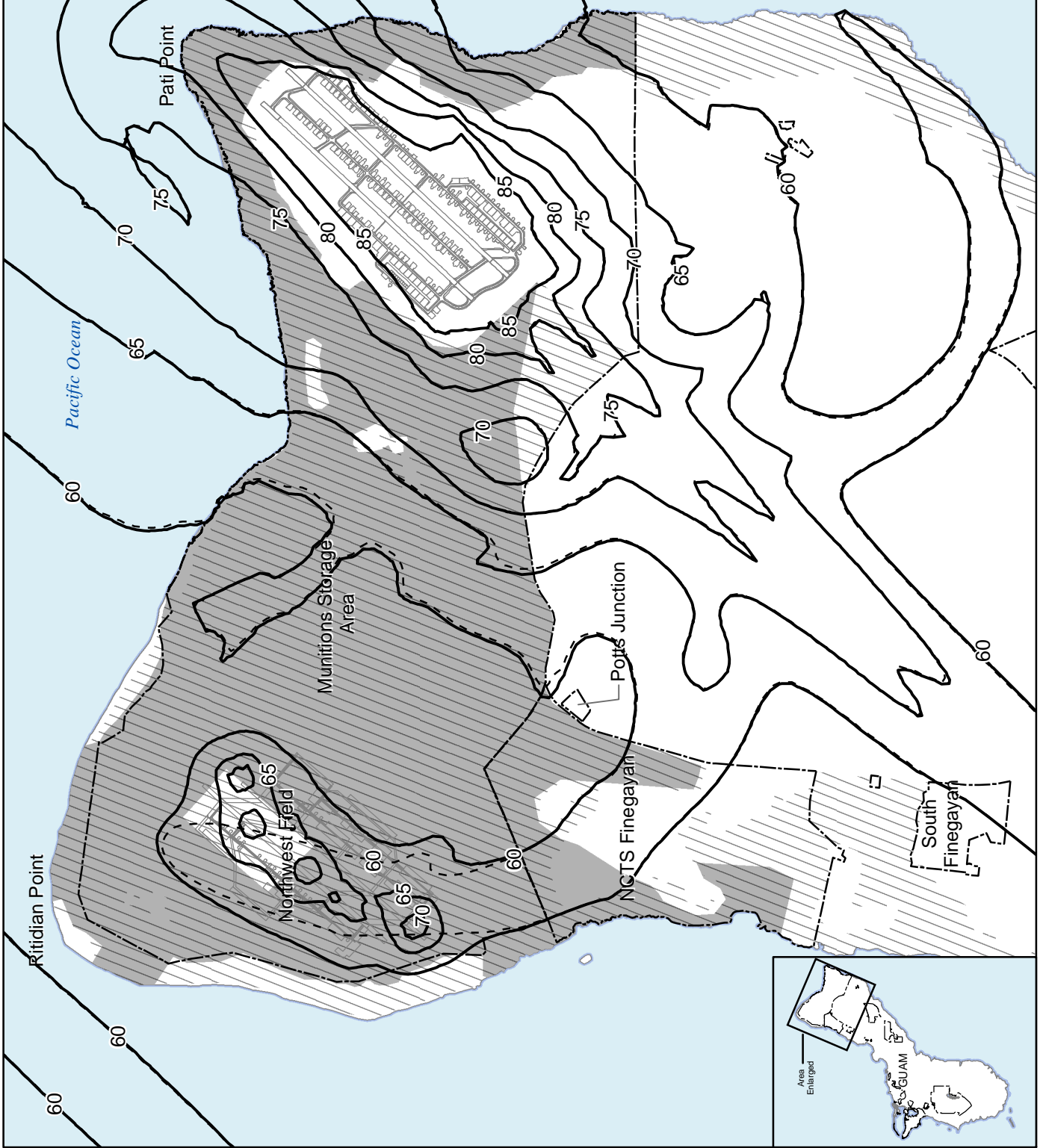
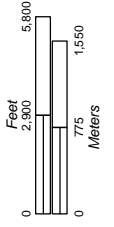
**Figure 10.2-7**

Mariana Crow  
Essential Habitat &  
Recovery Zones and  
Noise Contours of  
Baseline and  
Proposed Andersen  
AFB Aircraft  
Operations

**Legend**

- Baseline Noise  
Contours and  
dB (DNL) level
- Projected Noise  
Contours and  
dB (DNL) level
- Installation Boundary
- Recovery Zones
- Mariana Crow  
Essential Habitat

Sources: USFWS 2002, 2005b;  
Czech and Kester 2008;  
Czech 2009



Since the areas of crow and fruit bat essential habitat that would experience increased noise from proposed aircraft operations are virtually the same (with fruit bat essential habitat encompassing a slightly larger area within the area to the south of Andersen AFB along the eastern coast of Guam), the impacts to crows would be similar to those previously described for fruit bats. The primary increase in noise, due to the proposed aircraft operations, would be the result of helicopter flights to NWF over areas not known to be utilized by nesting or foraging crows (Morton 1996, GDAWR 2006, Andersen AFB 2008d). The overall increase in noise experienced by crows would not increase significantly on a daily or annual basis over baseline conditions, and there would be no significant impacts to the current crow population or future recovery efforts due to proposed aircraft operations. As stated in the mitigation measures below, the Navy would provide additional support for the current monitoring effort of the effects of aircraft operations on crows and adopt the Air Force's adaptive management strategy. In addition, in support of recovery actions outlined in the draft revised recovery plan for the Mariana crow (USFWS 2005b), the Navy would implement habitat restoration as a mitigation measure and control of BTS as a BMP. Therefore, the proposed action aircraft operations would have a less than significant effect on the Mariana crow.

As described above for the fruit bat, noise would be generated beyond current levels from increased use of the Northwest Field demolition facility. The 70 dB CDNL contour within essential habitat for the crow would be increased over a total of 1,385 acres under the proposed action. Given the limited amount of information available on the noise susceptibility of the crow, noise from use of the demolition area may have a significant impact. To evaluate this potential, monitoring of the species in areas surrounding the demolition area would be conducted to determine potential noise impacts. If this monitoring determined that the kingfisher was being affected, techniques to reduce noise generation, such as noise barriers, would be employed. With this mitigation, impacts would be less than significant.

Guam Rail. The Guam rail has been extirpated from the wild and currently occurs only as captive breeding populations. Ground and air operations are not expected to compromise the conservation and recovery process described in the rail recovery plan (USFWS 1990b). With implementation of the mitigation measures described in Section 10.2.2.6, including support for ungulate eradication and restoration of potential rail foraging and nesting habitat, the proposed action operations would have a less than significant impact.

**ALL SPECIAL-STATUS SPECIES.** Other indirect effects on all species would occur as a result of the proposed action. The movement and spread of invasive plant and animal species to Guam, within Guam, and to other locations from Guam would affect special-status species or degrade habitat, thus are potential indirect impacts resulting from actions proposed in Alternative 1. Invasive species might be accidentally introduced to Guam, spread on Guam, or transported to other islands through aircraft operations, shipment of supplies and equipment to the new facilities, movement of troops and supplies during training activities, or movement of household goods. Species that might be introduced or spread include plants such as *Vitex* that degrade habitat by displacing native species and ultimately reducing food or important nesting or roosting habitat, invertebrates such as coconut rhinoceros beetles or the flatworm predator of native snails, BTS and various frog and reptile species, rodents and cats. The introduction and spread of invasive species could result in predation, disease, and habitat alteration. These influences could have significant impacts on all special-status species potentially occurring in the project area (the same as those discussed under construction direct impacts). To prevent potentially invasive species from being moved or spreading, and in particular the BTS from being introduced in other areas from Guam, the project would fund and facilitate a 100% inspection effort for all cargo, vehicles, munitions, household goods, and other items leaving Guam. A Micronesian Biosecurity Plan would be developed as a

comprehensive plan to evaluate the risk of introducing species through various pathways (for example, air freight) and put in place measures to avoid, minimize and prevent further introductions of invasive species and to control invasive species already present. In addition, various other species specific plans and procedures would be developed or updated and implemented to address existing invasive species concerns such as ungulate damage that is affecting habitat quality of special-status species. These are described in Section 10.2.2.6, Potential Mitigation Measures. Once prepared and implemented, the objectives of the Micronesian Biosecurity Plan, along with other measures, would minimize the spread of invasive species to and from Guam and within Guam, and impacts would be less than significant.

The potential for wildfire to impact the fruit bat and crow currently present, or all special-status species if they returned or were reintroduced, would be low because proposed training exercises are non-firing, except for the demolition area which would be closely monitored. A wildfire plan would put into place policies and procedures that would prevent wildfires from occurring. A Marine Corps fire station with alert force facilities (manned by 51 staff) would be located at the Aircraft Fire and Rescue Station at Andersen AFB. That unit would help to ensure fire safety procedures and, along with the Andersen AFB fire department, would be responsible for controlling any fires that could be started during training exercises. There would be an Aircraft Fire and Rescue Station at the main cantonment at NCTS Finegayan which would respond to air-ground training incidents, and would be present during some training exercises as a precautionary measure. Based on a low fire potential and fire response capabilities, impacts to special-status species would be less than significant.

#### NCTS and South Finegayan

Under Alternative 1, approximately 1,181 ac (478 ha) of NCTS Finegayan and 283 ac (114 ha) of South Finegayan would be developed as part of the Main Cantonment.

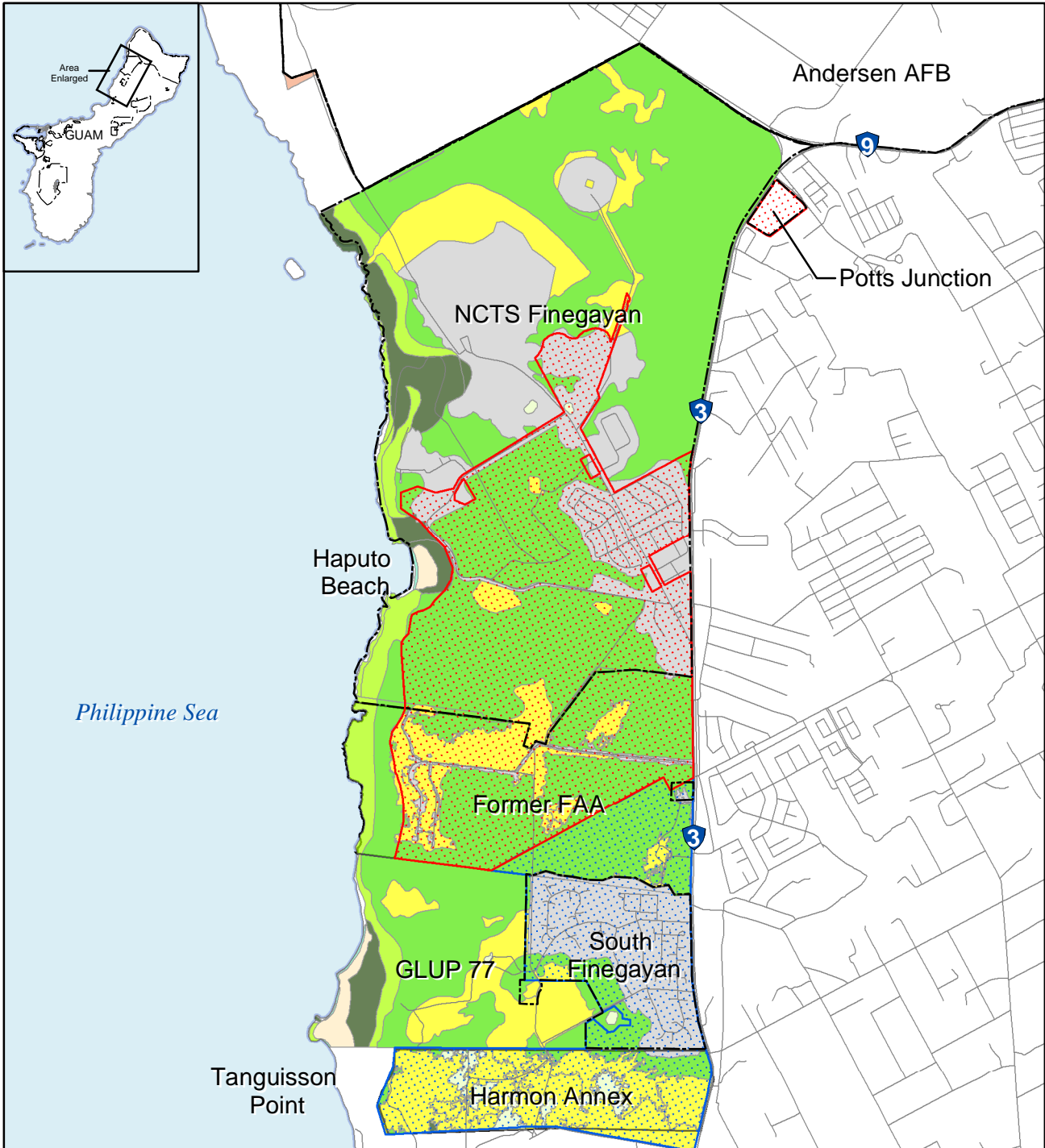
#### *Construction*

*Vegetation.* A total of 1.5 ac (0.6 ha) of primary limestone forest and 562 ac (227 ha) of disturbed limestone forest would be removed during proposed construction activities at NCTS and South Finegayan (Table 10.2-5 and Figure 10.2-8). The limestone forest is not known to harbor any sensitive plant species identified by government or conservation groups. Areas of remaining limestone forest habitat are shown in Figure 10.2.8. Approximately 49 ac (20 ha) of shrub/grassland and 1.0 ac (0.4 ha) of tangantangan would be removed from these same areas.

**Table 10.2-5. Potential Impacts to Vegetation Communities at Finegayan, Former FAA Parcel, and Harmon Annex with Implementation of Alternative 1 (ac [ha])**

<i>Parcel and Activity</i>	<i>Limestone Forest, Primary</i>	<i>Limestone Forest, Disturbed</i>	<i>Shrub/Grassland</i>	<i>Tangan-tangan</i>	<i>Developed</i>
<b>NCTS and South Finegayan Vegetation Removed</b>					
Main Cantonment	1.5 (0.6)	562 (227)	49 (20)	1.0 (0.4)	476 (193)
<b>Former FAA and Harmon Annex Vegetation Removed</b>					
Main Cantonment	1.0 (0.4)	480 (194)	387 (157)	32 (13)	31 (13)
<b>Total Vegetation Removed</b>	<b>2.5 (1.0)</b>	<b>1,042 (422)</b>	<b>436 (176)</b>	<b>33 (13)</b>	<b>507 (205)</b>

The most pristine vegetation and habitats are in the Haputo ERA, which would remain unchanged. Direct impacts to vegetation would be less than significant because only a very small amount of primary limestone forest would be removed in the upper plateau area. Removal of disturbed limestone forest, while not considered a significant impact for vegetation, is further evaluated for impacts wildlife and special-status species below.

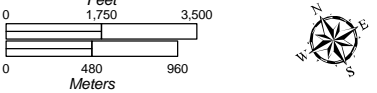


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**Legend**

Military Installation	Route Number
Main Cantonment	Limestone Forest - Disturbed
Family Housing	Shrub/Grasslands
Coconut Forest	Strand
Developed	Tangantangan
Halophytic/Xerophytic Scrub	<i>Source: COMNAV Marianas 2001 (modified by TEC Inc)</i>
Limestone Forest	

**Figure 10.2-8**  
**Potential Vegetation Impacts - Alternative 1**  
**(NCTS Finegayan, Former FAA Parcel, South Finegayan, and Harmon Annex)**





An indirect impact would occur from clearing large forested areas because of changes in evapotranspiration. Evapotranspiration would likely decrease from removal of the forest which would result in additional infiltration of rainwater and groundwater recharge and decreased moisture levels in the air. With respect to groundwater recharge, the construction of buildings and parking lots would have the opposite effect of reducing recharge. The overall effect on recharge is unclear but terrestrial biological resources in the remaining uncleared areas would be unlikely to be affected. With respect to moisture levels in the air, the impact is likely to be localized to the forested area removed and would not have a significant effect on the Haputo ERA, particularly since the area where vegetation would be removed is on the plateau and Haputo ERA primarily occupies the cliffs and lower bench along the coastline. Overall, the impacts from changed evapotranspiration would be less than significant.

*Wildlife.* Wildlife species that currently occur at Finegayan are native and non-native species that are common elsewhere on Guam, such as Pacific golden plover, yellow bittern, black francolin, Eurasian tree sparrow, blue-tailed skink, mutilating gecko, and mourning gecko. Feral pigs and deer are also present. No SOGCN species are known to occur in the area that would be developed. Construction activities would displace wildlife from habitat in the proposed project areas. The loss of woody vegetation would result in the reduction of nesting areas for the bittern, but this would not result in significant adverse effects on its population. Smaller, less mobile species, and those seeking refuge in burrows, could inadvertently be killed during construction activities; however, long-term, permanent impacts to populations of such species would not result because these species are abundant in surrounding areas and would rapidly repopulate portions of the affected area. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Therefore, impacts to wildlife would be less than significant with implementation of Alternative 1 at Finegayan.

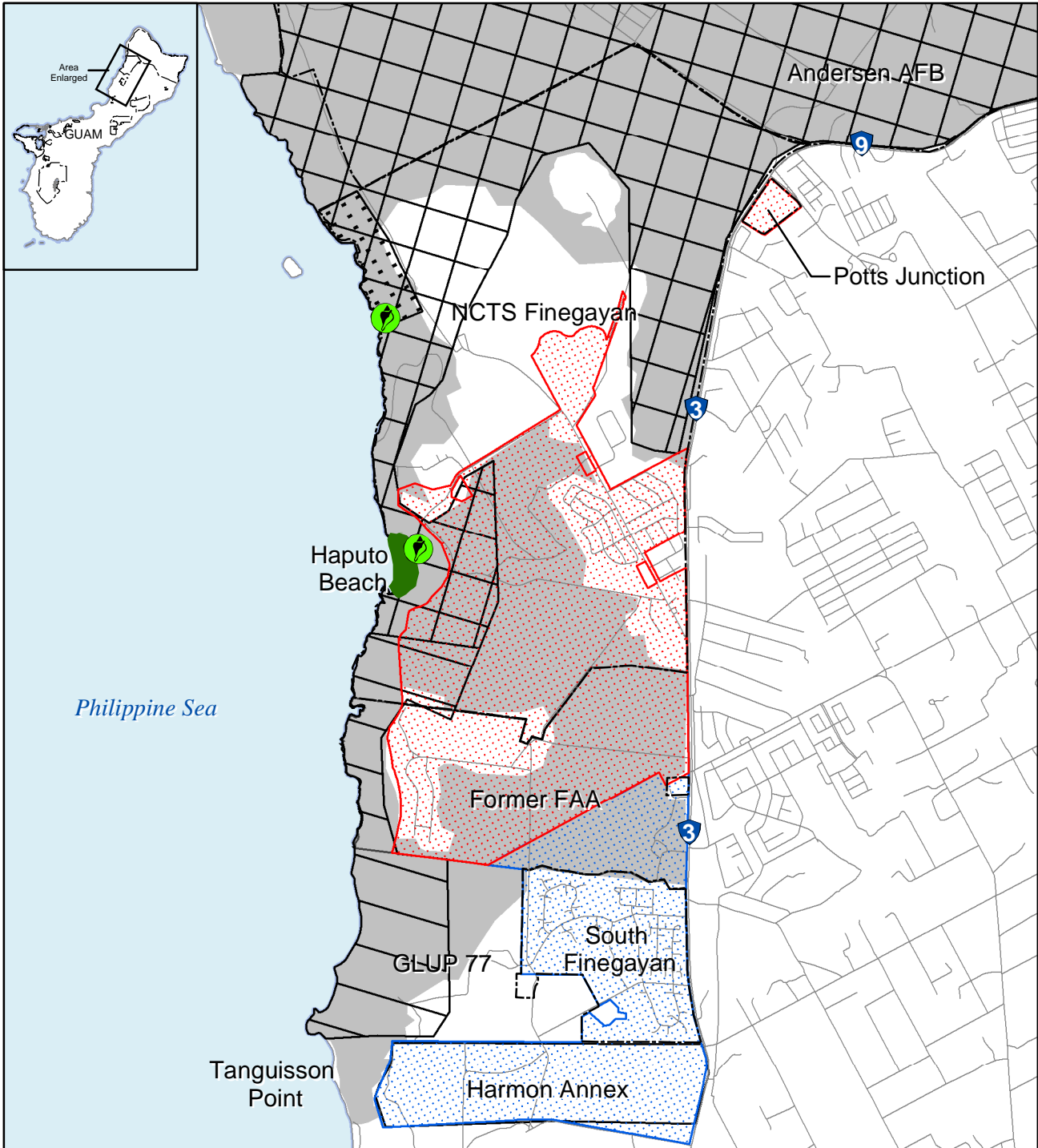
Noise from proposed construction activities would have an indirect effect on wildlife. Only a few widespread migratory bird species are present that would be affected. They would move away from the construction areas, but there are other areas of habitat nearby. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Therefore, indirect impacts to wildlife from construction would be less than significant.

*Special-Status Species.* All main cantonment components would be constructed on the upper plateau area. The Haputo ERA would remain as is and would be available to serve as a migration corridor for species moving or dispersing from Andersen AFB to potential habitat further south or from these areas to the north. Proposed construction activities could directly impact habitat for a number of ESA-listed species that currently occur on Guam and impact essential habitat and recovery zones that could serve as potential reintroduction areas for ESA-listed species that are currently extirpated or nearly extirpated from Guam.

**MARIANA FRUIT BAT.** Sightings of the fruit bat are uncommon at NCTS Finegayan (two sightings reported in 10 observation days) and occur in the Haputo ERA area or the very northern portion of the facility and there are no known colonial roost areas. Proposed construction activities would include the loss of disturbed limestone forest that is potential foraging and roosting habitat for the Mariana fruit bat. A total of 174 ac (70 ha) of essential habitat would be removed for construction of the various project components on the base (Table 10.2-6). This essential habitat is also designated Overlay Refuge (see Figure 10.2-9). Removal of these areas due to construction would have a significant direct impact due to the loss of habitat areas that would support the fruit bat in the future. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

Because the fruit bat is currently rarely observed south of Andersen AFB, indirect impacts from noise generated during construction would be less than significant.



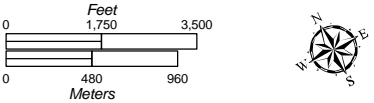


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**Legend**

- |   |                                   |
|---|-----------------------------------|
| Military Installation   | Main Cantonment                   |
| Route Number  | Family Housing                    |
| Mariana Crow Essential Habitat                                      | Mariana Crow Recovery Zones       |
| Mariana Fruit Bat and Guam Micronesian Kingfisher Essential Habitat | Tree Snail Locations              |
|   | Green Sea Turtle Nesting Area     |
|   | Mariana Eight-Spot Butterfly Area |
- Sources: USFWS 2002, 2004, 2005b; Grimm and Farley 2008; Smith et al. 2008

**Figure 10.2-9  
Potential Special-Status Species Impacts - Alternative 1  
(NCTS Finegayan, South Finegayan, Former FAA Parcel, and Harmon Annex)**



**GUAM MICRONESIAN KINGFISHER.** The kingfisher is not currently present in the wild. Proposed construction activities would include the loss of limestone forest that represents potential habitat that could be used by the species after future reintroduction. A total of 174 ac (70 ha) of essential habitat would be removed for construction of the various project components on the base (see Table 10.2-6). This essential habitat is also designated Overlay Refuge (see Figure 10.2-6). Removal of these areas, due to construction, would have a significant impact because they represent Overlay Refuge and essential habitat for the conservation and reintroduction of the species. Impacts would be significant. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

**MARIANA CROW.** Proposed construction activities would include the loss of 119 ac (48 ha) of limestone forest that is potential foraging and nesting habitat for the Mariana crow, and essential to the species' recovery. This essential habitat is also designated Overlay Refuge (see Figure 10.2-9). Removal of these areas, due to construction, would have a significant impact. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

**GUAM RAIL.** The rail survives only in captivity at this time. Proposed construction activities would include the loss of shrub/grassland habitat that is potential foraging and nesting habitat for the Guam rail. No specific areas of essential habitat have been described for this species, but 49 ac (20 ha) of favorable shrub/grasslands habitat and contained within the Refuge Overlay would be removed. However, because the Guam rail is currently extirpated in the wild and most of Guam has habitat that is potentially suitable for the recovery of the species, removal of these areas due to construction would result in a less than significant impact.

**Table 10.2-6. Potential Impacts to Special-Status Species Habitat at NCTS Finegayan, Former FAA Parcel, South Finegayan, and Harmon Annex with Implementation of Alternative 1 (ac [ha])**

<i>Parcel and Activity</i>	<i>Overlay Refuge<sup>1</sup></i>	<i>Essential Habitat – Bat and Kingfisher<sup>1</sup></i>	<i>Essential Habitat – Crow<sup>1</sup></i>	<i>Crow Recovery Zone<sup>1</sup></i>
<b>Direct Impacts from Construction – Habitat Removed</b>				
NCTS Finegayan	599 (242)	174 (70)	119 (48)	519 (210)
Former FAA Parcel and Harmon Annex	0	0	0	450 (182)
<b>Total Habitat Removed</b>	<b>599 (242)</b>	<b>174 (70)</b>	<b>119 (48)</b>	<b>969 (392)</b>
% of Habitat Type on Guam that is Affected	2.6 %	0.7 %	0.5 %	2.7 %
<b>Indirect Impacts (unoccupied habitat) – Noise, Lighting, Human Activity</b>				
<b>60-m buffer for MC (F, N) – Ground Ops</b>				
NCTS and South Finegayan	60 (24)	NA	23 (9.3)	38 (15)
Former FAA Parcel and Harmon Annex	0.6 (0.2)	NA	0	28 (11)
Totals	61 (25)	NA	23 (9.3)	66 (27)
<b>100-m buffer for KF (F, N) – Ground Ops</b>				
NCTS Finegayan	100 (40)	54(22)	NA	NA
Former FAA Parcel and Harmon Annex	1.7 (0.7)	32 (13)	NA	NA
Totals	102 (41)	86 (35)	NA	NA
<b>150-m buffer for FB (R) – Ground Ops</b>				
NCTS and South Finegayan	147 (59)	89 (36)	NA	NA
Former FAA Parcel and Harmon Annex	3.9 (1.6)	60 (24)	NA	NA
Totals	151 (61)	149 (60)	NA	NA

*Notes:* Each habitat category is considered independently of others and are not additive. NA – Not applicable, FB – Fruit Bat, MC - Mariana Crow, KF – kingfisher, F – Foraging, R – Roosting/Colony, N - Nesting.

ALL SPECIAL-STATUS SPECIES. Other indirect effects on all species would occur as a result of the proposed action. Damage from ungulate disturbance of forested areas is a serious concern in Guam. Damage from ungulates on NCTS Finegayan ranges is moderate to severe throughout the area proposed for the main cantonment. Removal of the large amounts of habitat under Alternative 1 would displace and concentrate feral pigs and Philippine deer into adjacent areas, resulting in even higher densities. Assuming a potential density of 0.07 deer/ac (0.17 deer/ha) (NAVFAC Marianas 2009) and 0.15 pigs/ac (0.38 pigs/ha) (Knutson and Vogt 2002) and the total of 612 ac (248 ha) of forest or shrubland to be removed, the number displaced would be approximately 43 deer and 92 pigs. This additional ungulate activity would result in significant impacts to all special-status species because of degradation of essential habitat and Overlay Refuge. As mitigation, an existing ungulate management plan that is currently being finalized would be updated to include specific management and control for the increase in ungulates resulting from this action and the plan would be implemented at NCTS Finegayan. Mitigation measures are further described in Section 10.2.2.6. With mitigation, impacts to habitat from ungulates would be less than significant.

Movement of construction personnel, equipment, and supplies could result in the movement and spread of invasive plant and animal species to Guam, within Guam, and to other locations from Guam. Invasive species would affect special-status species or degrade habitat, thus are potential indirect impacts resulting from actions proposed in Alternative 1. Invasive species impacts for construction would be similar to those for operations but shorter-term. The impacts are discussed in detail under operations below. Impacts would be significant but numerous mitigation measures, as specified under mitigation in Section 10.2.2.6, would be implemented to reduce impacts to less than significant.

#### *Operation*

*Vegetation.* Operations would not remove any limestone forest. Invasive plant species are likely to expand their ranges and new species are likely in some areas due to the increase in number of increased activities such as more training, more personnel, and more vehicles. However, this is unlikely to substantially impact primary limestone forest because most activities are away from primary forest areas that are located at Haputo ERA. Access to Haputo ERA would be limited. Therefore, impacts would be less than significant.

*Wildlife.* Indirect impacts include increased noise and human activity, increase and possible spread of feral and semi-feral animals, and increased recreational use of areas (especially those areas adjacent to the new housing and base). Operational activities would generate noise throughout the area. However, migratory bird species or other native wildlife that would otherwise use the area are common throughout Guam, and can utilize numerous habitats that are found throughout Guam. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Therefore, direct and indirect impact from noise and activity from operations associated with the proposed action would be less than significant.

Indirect impacts would occur from feral or unleashed animals. Housing is proposed for up to 3,520 families. The military typically allows two pets per family. Assuming that half of all families would have pets, the number of pets could be as high as 3,520. Cats and dogs that are not controlled, or that become feral due to escape or abandonment, are of concern due to their potential predation on native and non-native wildlife, particularly migratory birds. Shorebirds at Haputo beach and other beaches north and south along the shoreline would also be vulnerable. Skinks and geckos would also be preyed upon by cats. Impacts would be significant. Mitigation would be implemented through pet ownership policies and Base instructions or orders to ensure that pets are controlled and are not allowed in the Haputo ERA. With

mitigation there would be no diminished population sizes or distributions of migratory birds or regionally important native animal species and impacts would be less than significant.

*Special-Status Species.* There would be no direct impacts from operations. Indirect impacts are described below.

**MARIANA FRUIT BAT.** Based on observations of roosting Mariana fruit bats, it is expected that fruit bats are likely to avoid areas within 492 ft (150 m) of the proposed facilities due to human activity from housing and during operations and maintenance, and perimeter and facility lighting at night. Based on the essential habitat available within that distance, approximately 89 ac (36 ha) would be indirectly impacted by the operation of the proposed cantonment facilities at NCTS Finegayan (see Table 10.2-6). This significant impact would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

**GUAM MICRONESIAN KINGFISHER.** The Guam Micronesian kingfisher has been extirpated from the wild and currently occurs only in captive breeding populations. When reintroduced in the future, it is expected that kingfishers are likely to avoid areas within 328 ft (100 m) of the proposed facilities due to human activity from housing and during operations and maintenance, and perimeter and facility lighting at night. Based on the essential habitat available within that distance, approximately 54 ac (22 ha) would be indirectly impacted by the operation of the proposed facilities proposed cantonment facilities at NCTS Finegayan (see Table 10.2-2). This significant impact would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

**MARIANA CROW.** Based on observations of foraging Mariana crow, it is expected that crows are likely to avoid areas within 197 ft (60 m) of the proposed facilities due to human activity from housing and during operations and maintenance, and perimeter and facility lighting at night. Based on the essential habitat available within that distance, approximately 23 ac (9.3 ha) would be indirectly impacted by the operation of the proposed facilities proposed cantonment facilities at NCTS Finegayan (see Table 10.2-2). This significant impact would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

**GUAM RAIL.** The Guam rail has been extirpated from the wild and currently occurs only as captive breeding populations. Cats and dogs that are not controlled, or that become feral, are of concern due to their potential predation on the Guam rail should it be reintroduced. Controls to prevent stray or feral animals would be implemented, as described in Section 10.2.2.6. Other effects from housing and ground operations are not expected to compromise the conservation and recovery process described in the rail recovery plan (USFWS 1990b). With implementation of the mitigation measures described in Section 10.2.2.6, including support for ungulate eradication and restoration of potential rail foraging and nesting habitat, the proposed operation of the operations areas at Finegayan would have a less than significant impact.

**SEA TURTLES.** Cats and dogs that are not controlled, or that become feral, are of concern due to their potential predation on sea turtles. Mitigation measures would be implemented to control pets and feral animals and to prohibit them from being taken into Haputo ERA. With these mitigation measures, impacts would be less than significant. Increased potential recreational use of the beach by marines and their families, particularly at Haputo Beach, could adversely impact the green sea turtle through harassment. Mitigation measures would be implemented to restrict use of the area and minimize disturbance. Pets would not be allowed in the Haputo ERA to prevent potential turtle disturbance. With these controls, impacts to sea turtles would be less than significant. The Marine Corps presence would also provide a benefit because poachers would be less likely to frequent the area.

**TREE SNAILS.** Three species of tree snails, all candidates for federal listing are present along the coast at Haputo Beach and further north in Haputo ERA. Increased potential recreational use of these areas by Marines and their families, particularly at Haputo Beach, could adversely impact these species from disturbance of vegetation, collection of the shells, or handling of the individuals. Mitigation measures would be implemented to reduce the potential impact and to stop or minimize disturbance. Increased use of the beach would have a significant impact on these species. Mitigation would be implemented that would include restrictions on the use of this area. With implementation of this mitigation, impacts to the species would be less than significant.

**MARIANA EIGHT-SPOT BUTTERFLY.** Two colonies of this federal candidate species were reported from the Tweed's Cove area at Haputo ERA. Increased use of this area would result in significant impacts to the species. Because of their relatively remote locations and with mitigation measures to prevent excessive use of this area, impacts to the species would be less than significant.

**ALL SPECIAL-STATUS SPECIES.** Other indirect effects on all species would occur as a result of the proposed action. The movement and spread of invasive plant and animal species from operations was described above under Andersen AFB and these same concerns and mitigation measures to address them would also apply at Finegayan. Detailed descriptions of the mitigation measures are provided in Section 10.2.2.6, Potential Mitigation Measures. Once all mitigation measures and BMPs are applied, impacts from invasive species would be less than significant.

#### Non-DoD Land

##### *Construction*

*Vegetation.* A total of 1.0 ac (0.4 ha) of limestone forest and 480 ac (194 ha) of disturbed limestone forest would be removed during proposed construction activities on the former FAA parcel and Harmon Annex (see Table 10.2-5 and Figure 10.2-9). Approximately 387 ac (157 ha) of shrub/grassland and 32 ac (13 ha) of tangantangan would be removed from these same areas. The limestone forest is not known to harbor any sensitive plant species identified by government or conservation groups. Direct impacts to vegetation would be less than significant because only a very small amount of primary limestone forest would be removed in the upper plateau area. Removal of disturbed limestone forest, while not considered a significant impact for vegetation, is further evaluated for impacts wildlife and special-status species below.

*Wildlife.* Wildlife species that currently occur at the former FAA parcel are similar to those that occur at NCTS Finegayan. No SOGCN species are known to occur in the area that would be developed. Based on having similar vegetation, it is assumed that the Harmon parcel would support similar wildlife species. Based on the similar types of actions occurring here as at NCTS Finegayan, there would be no significant impacts to wildlife with implementation of Alternative 1.

Construction activities for the cantonment would generate noise. Only a few widespread migratory bird species are present that would be affected. They would move away from the construction areas and occupy other areas of suitable habitat nearby. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Therefore, indirect impacts to wildlife from construction would be less than significant.

*Special-Status Species.* All main cantonment components would be constructed on the upper plateau area. Proposed construction activities could directly impact habitat for two ESA-listed species that currently occur on Guam.

**MARIANA CROW.** Proposed construction activities would include the loss of wooded areas that are designated as recovery zone for the crow in the recovery plan. A total of 450 ac (182 ha) of this recovery zone would be removed for construction of the various project components on the base (see Table 10.2-6 and Figure 10.2.9). Large areas of recovery zone would remain on Andersen AFB as well as smaller areas remaining at NCTS Finegayan as shown in Figure 10.2-9. No Overlay Refuge is designated in this area. Removal of these areas due to construction would have a significant impact. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

**GUAM RAIL.** The rail survives only in captivity at this time. Proposed construction activities would include the loss of shrub/grassland habitat that is potential foraging and nesting habitat for the Guam rail. No Overlay Refuge is designated in this area. No specific areas of essential habitat or other habitat have been identified for this species but 387 ac (157 ha) of favorable shrub/grasslands habitat would be removed (see Figure 10.2-9). Because the rail is not currently present at this location and no specific habitat areas have been identified as essential habitat, construction would have a less than significant impact on the species.

**ALL SPECIAL-STATUS SPECIES.** Other indirect effects on both the Mariana crow and Guam rail from degradation of habitat would occur as a result of the proposed action. Existing ungulate damage on the former FAA parcel is generally moderate in the area proposed for the main cantonment based on field observations and this is also assumed to apply for Harmon Annex. Removal of the large amounts of habitat required for construction under Alternative 1 would displace feral pigs and Philippine deer into adjacent areas resulting in even greater density than currently exists. Assuming a potential density of 0.07 deer/ac (0.17 deer/ha) (NAVFAC Marianas 2009) and 0.15 pigs/ac (0.38 pigs/ha) (Knutson and Vogt 2002) and the total of 899 ac (364 ha) of forest or shrubland to be removed, the number displaced would be about 63 deer and 135 pigs. This additional ungulate activity would result in significant impacts to the Mariana crow because of degradation of recovery zones and to the Guam rail due to degradation of potential habitat. As mitigation, an existing ungulate management plan that is currently being finalized would be updated to include specific management and control for the increase in ungulates resulting from this action. With this mitigation, impacts would be less than significant.

Movement of construction personnel, equipment, and supplies could result in the movement and spread of invasive plant and animal species to Guam, within Guam, and to other locations from Guam. Invasive species would affect special-status species or degrade habitat, thus are potential indirect impacts resulting from actions proposed in Alternative 1. Invasive species impacts for construction would be similar to those for operations but shorter-term. The impacts are discussed in detail under operations below. Impacts would be significant but numerous mitigation measures, as specified under mitigation in Section 10.2.2.6, would be implemented to reduce impacts to less than significant.

### *Operation*

**Vegetation.** Operations would not remove any limestone forest. Invasive plant species are likely to expand their ranges and new species are likely in some areas due to the increase in number of increased activities such as more training, more personnel, and more vehicles. However, this is unlikely to substantially impact primary limestone forest because most activities are well away from these forested areas. Therefore, impacts would be less than significant.

**Wildlife.** Indirect impacts would include noise, human activity, and feral animals. Operational activities would generate noise throughout the area. However, migratory bird species or other native wildlife that would otherwise use the area are common throughout Guam and are generalists that can utilize numerous habitats that are abundant throughout Guam. There would be no diminished population sizes or

distributions of migratory birds or regionally important native animal species. Therefore, direct and indirect impacts from noise and activity from operations associated with the proposed action would be less than significant.

As discussed for Finegayan, the number of pets could be as high as 3,520. Cats and dogs that are not controlled, or that become feral due to escape or abandonment, are of concern due to their potential predation on native and non-native wildlife, particularly migratory birds. Cliff-line habitat that may be roosting areas for seabirds would be in close proximity to the family housing. Shorebirds at beaches in the Tanguisson and Hilaan areas would also be vulnerable. Skinks and geckos would also be preyed upon by cats. Impacts would be significant. Mitigation would be implemented through pet ownership policies and Base instructions or orders to ensure that pets are controlled and not allowed at Haputo Beach. Feral cats and dogs and rodents would be controlled by trapping or other techniques. With this mitigation, impacts would be less than significant.

*Special-Status Species.* There would be no direct impacts from housing and other operations. Indirect effects include impacts related to recreation, feral animals, and invasive species. The impacts from these proposed operations at the combined cantonment area (extending from NCTS Finegayan to Harmon) from these indirect effects have already been addressed above under NCTS and South Finegayan. Indirect impacts to special-status species would result from avoidance of essential habitat near human activity from housing and during operations and maintenance, and perimeter and facility lighting at night. The areas avoided, as specified in Table 10.2-6 are: fruit bat roosting activity - 60 ac (24 ha) and kingfisher activity - 32 ac (13 ha). Indirect impacts from these human activities and lighting would be significant. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

#### 10.2.2.2 Central

##### Andersen South and Non-DoD – Alternative A

###### *Construction*

*Vegetation.* Vegetation would be removed to construct various facilities at Andersen South and non-DoD lands. A total of 19 ac (7.7 ha) of primary (mature forest dominated by native species) limestone forest would be removed and 150 ac (61 ha) of disturbed limestone forest would be removed during proposed construction activities at Andersen South and the non-DoD lands (refer to Table 10.2-7 and Figure 10.2-10). The primary limestone forest that would be removed is mixed plateau forest, and it harbors a special-status plant species (see discussion below).

**Table 10.2-7. Potential Impacts to Vegetation Communities at Andersen South and Route 15 Lands with Implementation of Alternative 1 (ac [ha])**

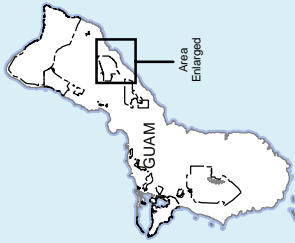
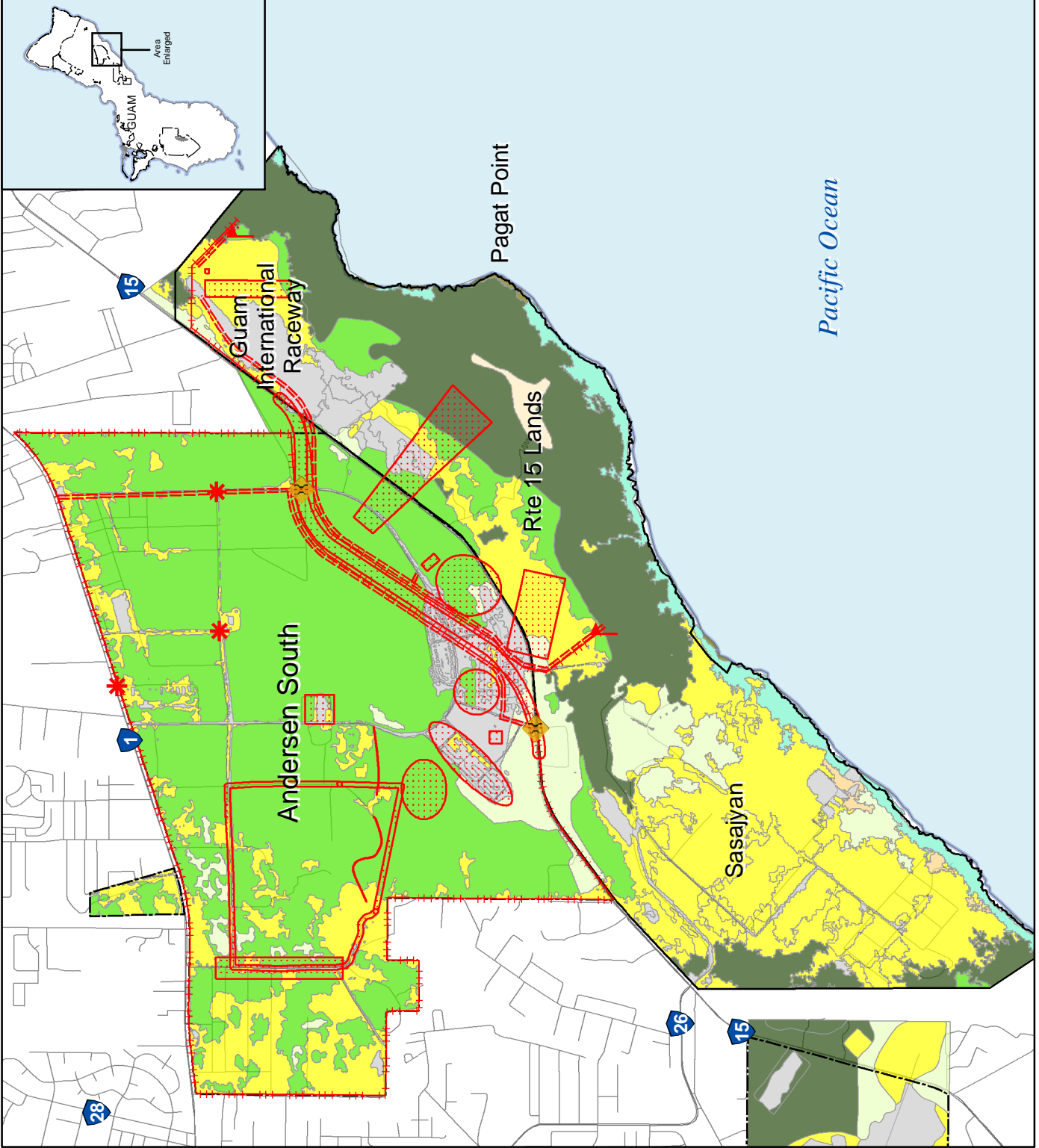
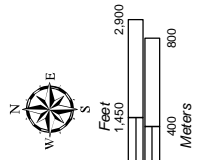
<i>Parcel and Activity</i>	<i>Limestone Forest, Primary</i>	<i>Limestone Forest, Disturbed</i>	<i>Shrub/Grasslands</i>	<i>Tangantangan</i>	<i>Developed</i>
<b>Andersen South and Non-DoD Alternative A Construction Areas (vegetation removed)</b>					
Firing Range Training Areas	18 (7.3)	28 (11)	40 (16)	4.0 (1.6)	14 (5.7)
Hand Grenade Training	0	18 (7.3)	0	0	6.0 (2.4)
AMVOC Training Areas	0	16 (6.5)	6.7 (2.7)	0.2 (0.1)	1.5 (0.6)
Pioneer Road	0	3.6 (1.5)	0.8 (0.3)	0	0
MOUT Areas	0	24 (9.7)	3.5 (1.4)	1.5 (0.6)	31 (13)
Convoy Course	0	17 (6.9)	9.4 (3.8)	0	4.0 (1.6)
Landing Zones	0	3.1 (1.3)	1.7 (0.7)	0	4.3 (1.7)
Firing Range Access Areas	0	1.8 (0.7)	1.9 (0.8)	0.1 (0.04)	3.1 (1.3)
Range Roads and Control Areas	0.6 (0.2)	15 (6.1)	5.0 (2.0)	0.5 (0.2)	9.0 (3.6)
Fencing	0.3 (0.1)	9.3 (3.8)	8.1 (3.3)	1.6 (0.6)	4.2 (1.7)
<b>Totals</b>	<b>19 (7.7)</b>	<b>136 (55)</b>	<b>77 (31)</b>	<b>8.0 (3.2)</b>	<b>77 (31)</b>
<b>Andersen South and Non-DoD Alternative B Construction Areas (vegetation removed)</b>					
Firing Range Training Areas	13 (5.3)	12 (4.9)	61 (25)	0	15 (6.1)
Hand Grenade Training	0	27 (11)	0	0	0
AMVOC Training Areas	0	16 (6.5)	6.7 (2.7)	0.2 (0.1)	1.5 (0.6)
Pioneer Road	0	3.6 (1.5)	0.8 (0.3)	0	0
MOUT Areas	0	8.3 (3.4)	4.1 (1.7)	2.0 (0.8)	46 (19)
Convoy Course	0	17 (6.9)	9.4 (3.8)	0	4.0 (1.6)
Landing Zones	0	3.1 (1.3)	1.7 (0.7)	0	4.3 (1.7)
Firing Range Access Areas	0.4 (0.2)	0.8 (0.3)	1.8 (0.7)	0	3.9 (1.6)
Range Roads and Control Areas	0.7 (0.3)	3.4 (1.4)	4.9 (2.0)	0.4 (0.2)	2.6 (1.1)
Fencing	1.5 (0.6)	6.4 (2.6)	9.5 (3.8)	3.9 (1.6)	4.8 (1.9)
<b>Totals</b>	<b>16 (6.5)</b>	<b>98 (40)</b>	<b>100 (40)</b>	<b>6.5 (2.6)</b>	<b>82 (33)</b>



**Figure 10.2-10**  
 Potential Vegetation  
 Impacts - Andersen  
 South and Rte 15  
 Lands (Range  
 Complex Alternative A)

- Legend**
- Military Installation
  - Route Number
  - Proposed Project Footprint
  - Proposed Features
  - Range Gate
  - Range Tower
  - Fence Line
  - Range Road
  - Bridge
  - Vegetation
  - Casuarina Forest
  - Coconut Forest
  - Tangantangan
  - Limestone Forest
  - Limestone Forest - Disturbed
  - Shrub/Grasslands
  - Strand
  - Developed

Source: USFS 2006  
 (modified by TEC Inc)



*Wildlife.* Wildlife species that currently occur at Andersen South and the non-DoD parcels are non-native species that are common elsewhere on Guam, such as Eurasian tree sparrow, island collared dove, black francolin, curious skink, Pacific blue-tailed skink, house gecko, greenhouse frog, and cane toads. All these species are common on Guam and most are not native. Indicators of ungulate use, both feral pig and Philippine deer, were observed in all areas, but at a much greater density at Andersen South than the non-DoD parcels. Soil and vegetation damage ranged from light to severe. In one area on the eastern side of Andersen South, feral pigs were very abundant and were readily heard and observed. Based on the species and existing conditions and no diminished population sizes or distributions of migratory birds or regionally important native animal species, impacts to wildlife would be less than significant.

Construction activities for ranges and training areas would generate noise. Only a few widespread migratory bird species are present that would be affected. They would move away from the construction areas, but there are other areas of habitat nearby. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Therefore, indirect impacts to wildlife from construction would be less than significant.

*Special-Status Species.* At Andersen South, no special-status species have been reported as occurring onsite, and none were observed in recent project-specific surveys. At the non-DoD parcels, proposed construction activities could directly impact habitat for a number of ESA-listed species that currently occur on Guam. Construction activities would generate noise throughout the area. However, no special-status species are known to currently use the area. Therefore, noise and activity from construction associated with the proposed action would be less than significant.

**MARIANA FRUIT BAT.** The fruit bat has not been documented in project-specific surveys conducted at Andersen South and Route 15 lands and there have been no reported observations since 1999. They may move through the area, or use the area occasionally. Essential habitat has been designated for the species in the non-DoD northern parcel below the cliff edge and in the lower bench area along the coast, but project areas do not extend into the essential habitat or any other designated critical habitat area. However, some primary limestone forest that is potential habitat would be removed. Because no designated habitat areas are removed there would be a less than significant impact on the fruit bat from construction activities.

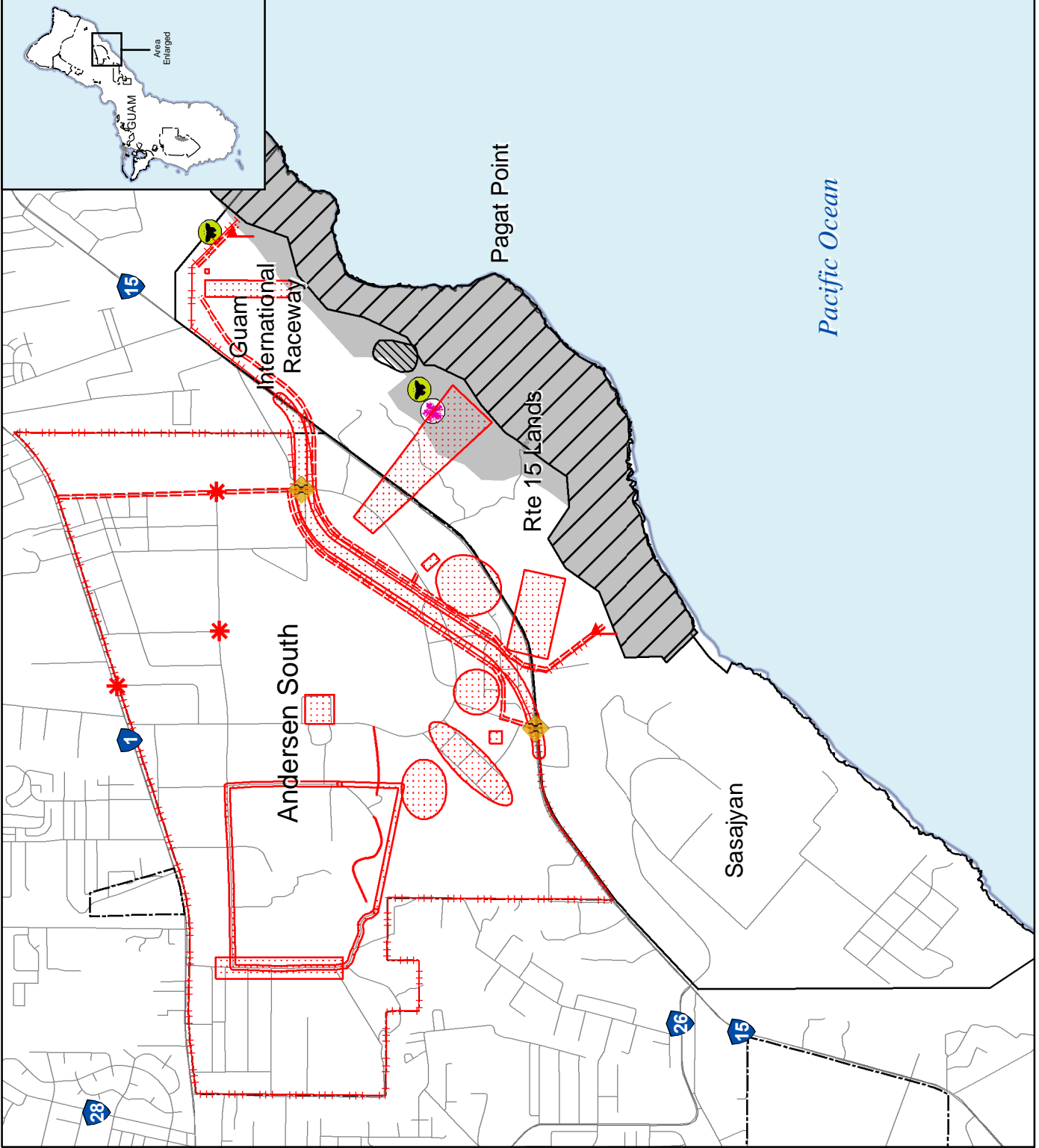
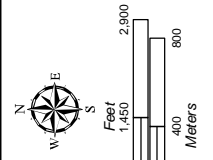
**MICRONESIAN KINGFISHER.** The kingfisher currently survives only in captivity. Essential habitat has been designated for the species in the northern parcel, beginning along the cliff and down into the lower bench area along the coast (Figure 10.2-11); however, no construction is proposed for this portion of the project area. However, some primary limestone forest that is potential habitat would be removed. Because no designated habitat areas are removed there would be a less than significant impact on the fruit bat from construction activities.

**MARIANA CROW.** The crow does not currently occur in the project area. Construction would not occur in essential habitat (see Figure 10.2-11). However, construction would remove 22 ac (8.9 ha) of recovery zone habitat specified in the recovery plan within limestone forest in the plateau area of the parcel (see Table 10.2-8). Removal of this currently unoccupied habitat would have a less than significant impact on the species because the amount removed would be minor in relation to the overall recovery zone about on Guam (0.06%), including large areas adjacent to the proposed construction (see Figure 10.2-11), and would not significantly affect the recovery of the species (the amount of habitat required to meet recovery plan goals for the species is estimated at 8,100 ac [3,278 ha] compared to the total currently available of 23,004 ac [9,309] in Section 10.1.1.3).

**Figure 10.2-11**  
 Potential Impacts to  
 Special-Status Species  
 and Essential Habitat  
 and Recovery Zones  
 for ESA-listed Species  
 at Andersen South  
 and Rte 15 Lands  
 (Range Complex  
 Alternative A)  
 Legend

- Military Installation
- Route Number
- Proposed Project Footprint
- Proposed Features**
- Range Gate
- Range Tower
- Fence Line
- Range Road
- Bridge
- Vegetation**
- Mariana Fruit Bat and Guam Micronesian Kingfisher Essential Habitat
- Mariana Crow Recovery Zones
- Heritiera longipetiolata* Clusters
- Mariana Eight-Spot Butterfly Location
- Heritiera longipetiolata* Location

Sources: USFWS 2002, 2004, 2005b; Campora and Lee 2009; NR Survey Report, in preparation



**GUAM RAIL.** The rail survives only in captivity at this time. Proposed construction activities would include the loss of shrub/grassland habitat that is potential foraging and nesting habitat for the Guam rail, should it be reintroduced. No specific areas of essential habitat have been designated for this species (refer to Figure 10.2-11). Based on the current absence of the species in the area and lack of designated habitat, there would be no impact on the species.

**MARIANAS EIGHT-SPOT BUTTERFLY.** This candidate species was observed in a mixed host plant area approximately 300 ft (91 m) from the Alternative A proposed machine gun range footprint during 2008 site-specific surveys (see Figure 10.2-11). Scattered individuals of its two host plants were also observed within the machine gun range footprint. An individual butterfly was also observed in a mixed host plant area approximately 50 ft (15 m) northeast of the proposed northern-most fenceline (see Figure 10.2-11). Scattered individuals of its two host plants were also observed within the proposed fenceline and access road footprints. Because only scattered host plants would be removed and the large mixed host plant areas would remain, impacts would be less than significant.

**HERITIERA LONGIPETIOLATA.** One specimen of this State-listed tree has been identified near or within the boundary of the Alternative A machine gun range near the southeastern corner. A complete survey of the range footprints and surrounding area has not been completed but would be completed prior to clearing. If any individuals are in areas to be cleared, they would be transplanted if possible, or attempts would be made to propagate the species for transplanting elsewhere. Additional information is provided under the mitigation discussion (Section 10.2.2.6). With implementation of this mitigation, impacts to the species would be less than significant.

**ALL SPECIAL-STATUS SPECIES.** Other indirect effects on all species would occur as a result of the proposed construction. Movement of construction personnel, equipment, and supplies could result in the movement and spread of invasive plant and animal species to Guam, within Guam, and to other locations from Guam. Invasive species would affect special-status species or degrade habitat, thus are potential indirect impacts resulting from actions proposed in Alternative 1. Invasive species impacts for construction would be similar to those for operations but shorter-term. Awareness training and inspection of gear, clothing, and equipment as part of existing control measures would occur. The impacts are discussed in detail under operations below. Impacts would be significant but numerous mitigation measures and BMPs, as specified under mitigation in Section 10.2.2.6, would be implemented to reduce impacts to less than significant.

### *Operation*

**Vegetation.** Trees and shrubs in the surface danger zones (SDZs) of firing ranges would be damaged from stray munitions. However, stray bullets would be minimal, and are unlikely to damage the vegetation enough to kill individual specimens. Invasive plant species are likely to expand ranges and new species are likely in some areas due to the increase in activities such as more training, more personnel, and more vehicles. However, this is unlikely to substantially impact primary limestone forest as long as the substrate of the primary forest remains intact. Therefore, impacts would be less than significant.

**Wildlife.** Wildlife in the SDZs of firing ranges may be killed from stray munitions. However, stray munitions would be minimal. Assuming that 0.01% of munitions fall outside the range and in the SDZ, an estimated 1,013 bullets would fall on land within the SDZ for Alternative A over the course of a year. All wildlife present is widespread on Guam, so populations would not be diminished. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Direct and indirect impacts would be less than significant.

Operations at the ranges and training areas would generate noise. The few migratory birds likely to be present (such as the yellow bittern and Pacific golden plover) are widespread on Guam. They would be affected and would move away from these areas, but there are large areas of habitat nearby where they could move to, when disturbed. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Direct and indirect impacts from noise and activity associated with operations would result in less than significant impacts to wildlife.

*Special-Status Species.* Stray munitions may fall within the SDZs; however, the possibility of an individual animal or plant being struck is remote. As mentioned above, an estimated 1,013 bullets would fall on land within the SDZ for Alternative A over the course of a year.

**MARIANA FRUIT BAT.** Although not documented historically in the area, essential habitat has been designated in the non-DoD northern parcel below the cliff edge and in the lower bench area along the coast (refer to Figure 10.2-11). Significant indirect impacts from general noise and activity would occur in surrounding areas. These areas are estimated in Table 10.2-8. Other noise increases would occur from the proposed training actions. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

Noise would be generated at the proposed breacher facility at Andersen South and at small arms ranges on the Route. 15 lands. Noise studies have been conducted for these facilities. The breacher facility was evaluated using the CDNL noise levels and the small arms ranges were evaluated using a metric termed the PK15 (met) which is the peak noise exceeded by 15% of firing events and is a linear peak sound pressure level of individual shots rather than a cumulative or average level (using this measure means the size of the contours would not change if the number of rounds fired increased). The 70 dB CDNL contour within essential habitat for the fruit bat would cover a total of 49 ac (20 ha) of essential habitat for the breacher facility and the 104 dB PK15 (met) would cover 241 ac (98 ha) for the small arms ranges under the proposed action. The Mariana fruit bat is not known to currently occur at Andersen South or the Route. 15 lands. However, given the limited amount of information available on the noise susceptibility of the fruit bat, noise from the breacher facility and small arms ranges may have a significant impact to individuals that may potentially forage or roost at Andersen South or the Route. 15 lands. To assess the potential for proposed range activities to impact fruit bats, regular surveys of the Route. 15 lands would be conducted to determine the occurrence of fruit bats. If fruit bats are observed, monitoring of the species in areas surrounding the range facilities would be conducted to determine potential noise impacts. If this monitoring determined that the fruit bat was being affected, techniques to reduce noise generation, such as noise barriers, would be employed. With this mitigation, impacts would be less than significant.

**MICRONESIAN KINGFISHER.** The kingfisher currently survives only in captivity, but essential habitat has been designated in the non-DoD northern parcel below the cliff edge and in the lower bench area along the coast (refer to Figure 10.2-11). As with the fruit bat, noise impacts to this species from weapons firing, should it be reintroduced, would be determined after monitoring of the species. Indirect impacts from general noise and activity to kingfishers may occur if they are reintroduced into the area. These areas are estimated in Table 10.2-8.

**MARIANA CROW.** The crow does not currently occur in the project area. No essential habitat has been determined for the area. A recovery zone is designated in the recovery plan for the coastal area and including the limestone forest in the plateau area of the parcel (see Figure 10.2-11). Significant indirect impacts from general noise and activity would occur in surrounding areas. These areas are estimated in Table 10.2-8.

**Table 10.2-8. Potential Impacts to Special-Status Species Habitat at Andersen South and Route 15 Range Complex with Implementation of Alternative 1 (ac [ha])**

<i>Parcel and Activity</i>	<i>Essential Habitat – Bat and Kingfisher</i>	<i>Crow Recovery Zone</i>
<b>Direct Impacts from Construction – Habitat Removed</b>		
Ranges (Alternative A)	0	22
Ranges (Alternative B)	0	20
Habitat Removed Totals (using Alternative A)	0	22
Percentage of Habitat Type on Guam that is Removed (using Alternative A)	0 %	0.06 %
<b>Indirect Impacts (unoccupied habitat) – Noise, Lighting, Human Activity (Alternative A)</b>		
60 m buffer for MC (F,N): Ground Ops; 100 m for KF (F,N): Ground Ops		
Perimeter Fencing	3.6 (1.4)	2.5 (0.9)
Range Roads	3.3 (1.3)	1.7 (0.7)
Range Control Towers	4.2 (1.7)	2.3 (1.0)
MG Range	6.7 (2.7)	16 (6.3)
UD Range	1.4 (0.6)	0.1 (0.03)
KD Range	1.2 (0.5)	3.3 (1.3)
Totals	20 (8.1)	26 (10)
150 m buffer for FB (R): Ground Ops		
Perimeter Fencing	7 (2.8)	NA
Range Roads	10 (4.1)	NA
Range Control Towers	12 (4.7)	NA
MG Range	15 (6.1)	NA
UD Range	4.8 (1.9)	NA
KD Range	4.3 (1.7)	NA
Totals	53 (21)	NA
<b>Indirect Impacts (unoccupied habitat) – Noise, Lighting, Human Activity (Alternative B)</b>		
60 m buffer for MC (F,N): Ground Ops; 100 m for KF (F,N): Ground Ops		
Perimeter Fencing	1.6 (0.6)	4.0 (1.6)
Range Control Towers	1.1 (0.4)	2.8 (1.1)
UD Range	0 (0)	13 (5.4)
KD Range	0	5.0 (2.0)
Totals	2.7 (1.0)	25 (10)
150 m buffer for FB (R): Ground Ops		
Perimeter Fencing	4.3 (1.7)	NA
Range Control Towers	6.9 (2.8)	NA
UD Range	6.2 (2.5)	NA
KD Range	0.9 (0.3)	NA
Totals	18 (7.3)	NA

Notes: Each habitat category is considered independently of others and is not additive. NA – Not applicable.

FB – Fruit Bat, MC - Mariana Crow, KF – kingfisher, F – Foraging, R – Roosting/Colony, N – Nesting.

**MARIANAS EIGHT-SPOT BUTTERFLY.** This candidate species was observed near the Alternative A machine gun range area during 2008 site-specific surveys (NR Survey Report in preparation). Its two host plants were also observed in that area, and in areas within the machine gun range footprint. The eight-spot butterfly is unlikely to be affected by noise and activity in nearby ranges. Impacts would be less than significant.

**HERITIERA LONGIPETIOLATA.** As mentioned above, one specimen of this species is located within or near the machine gun range and additional surveys would be conducted. Any individuals within the SDZ would have a small chance of being struck by projectiles but these would not likely harm trees. Impacts to this species from operations would be less than significant.

ALL SPECIAL-STATUS SPECIES. The movement and spread of invasive plant and animal species within Guam and to other locations from Guam would degrade habitat for special-status species and are potential indirect impacts resulting from actions proposed in Alternative 1, Alternative A. Invasive species might be accidentally introduced to Guam, spread on Guam, or transported to other islands through aircraft operations, shipment of supplies and equipment to the new facilities, movement of troops and supplies during training activities, or movement of household goods. Species that might be introduced or spread include various plants such as *Vitex* that can degrade habitat by displacing native species and ultimately reducing food or important nesting or roosting habitat, invertebrates such as coconut beetles or the flatworm predator of native snails, BTS, various frog species, rodents, dogs, or cats. These influences could have significant impacts on all special-status species potentially occurring in the project area (the same as those discussed under construction direct impacts). To prevent potentially invasive species from being moved or spreading, and in particular the BTS from being introduced in other areas from Guam, the project would fund and facilitate a 100% inspection effort for all cargo, vehicles, munitions, household goods, and other items leaving Guam. In addition, various plans and procedures would be developed and implemented to address existing invasive species concerns such as invasive plants and ungulate damage that is affecting habitat quality of special-status species. These are described in Section 10.2.2.6, Potential Mitigation Measures. The successful implementation of a Biosecurity Plan (presently under preparation) and specific invasive species control procedures would help control the movement of invasive species so that impacts would be less than significant.

There is potential for ordnance-ignited wildfires that might impact designated habitat areas for the fruit bat, kingfisher, and crow. As mitigation, a Wildland Fire Management Plan would be developed for use in this area which would include prevention, planning, and suppression methods (see mitigation section 10.2.2.6). It would include protocols for monitoring fire conditions and adjusting training as needed (e.g., firing may be disallowed under certain fire conditions) and location and management of fire breaks, fire fighting roads, and a fire fighting water system. Protocols for units undergoing training at the ranges would be briefed by range control on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). With implementation of the Wildland Fire Management Plan and procedures, impacts from training-related wildfires would be less than significant.

#### Andersen South and Non-DoD – Alternative B

##### *Construction*

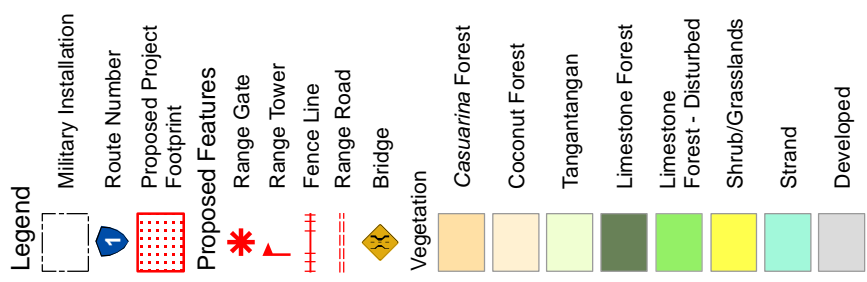
*Vegetation.* Vegetation would be removed to construct various facilities at Andersen South and non-DoD Lands. A total of 16 ac (6.5 ha) of primary (mature forest dominated by native species) limestone forest and 112 ac (45 ha) of disturbed limestone forest would be removed during proposed construction activities at Andersen South and the non-DoD Lands (refer to Table 10.2-7 and Figure 10.2-12). The primary limestone forest that would be removed is mixed plateau forest. The limestone forest in the area does harbor a special-status plant species (see discussion below).

*Wildlife.* Impacts to wildlife would be the same as for Alternative A.

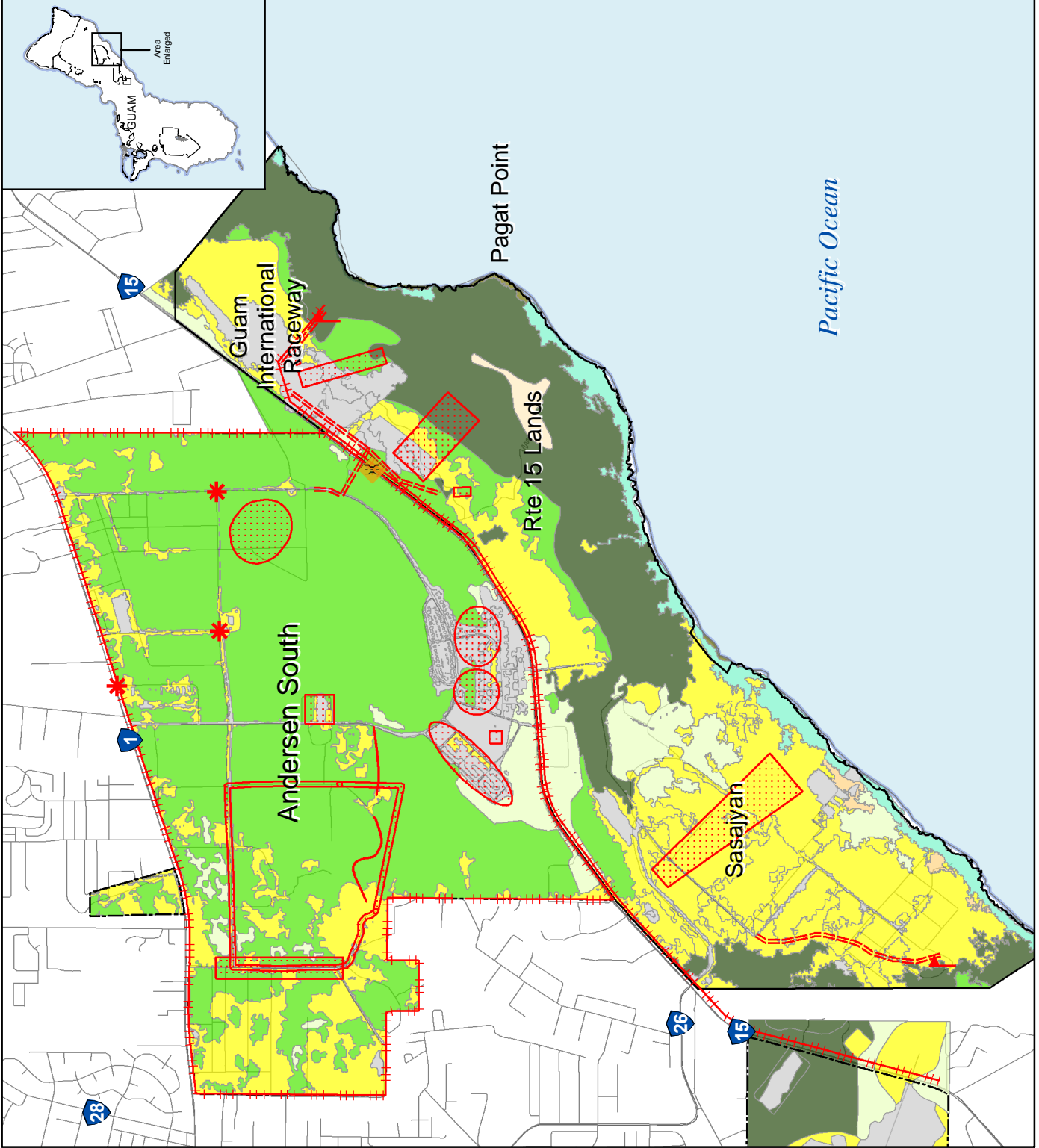
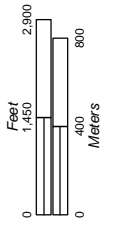
*Special-Status Species.* At Andersen South, no special-status species have been reported from the site, and none were observed in recent project-specific surveys. At the non-DoD parcels, proposed construction activities could directly impact habitat for a number of ESA-listed species that currently occur on Guam. Construction activities would generate noise throughout the area. In the area proposed for construction, no species are currently known to regularly use the area. Therefore, noise and activity from construction associated with the proposed action would be less than significant.



**Figure 10.2-12**  
 Potential Vegetation  
 Impacts - Andersen  
 South and Rte 15  
 Lands (Range  
 Complex Alternative B)



Source: USFS 2006  
 (modified by TEC Inc)





**MARIANA FRUIT BAT.** The fruit bat has not been documented in historical or project-specific surveys from project areas and surrounding areas. Essential habitat has been designated for the species in the non-DoD northern parcel below the cliff edge and in the lower bench area along the coast, but project areas do not extend into the essential habitat or any other designated habitat area. (Figure 10.2-13). However, some primary limestone forest that is potential habitat would be removed. Because no designated habitat areas are removed there would be a less than significant impact on the fruit bat from construction activities.

**MICRONESIAN KINGFISHER.** The kingfisher currently survives only in captivity. Essential habitat has been designated for the species in the northern parcel beginning along the cliff and down into the lower bench area along the coast (see Figure 10.2-13), but project areas do not extend into the essential habitat or any other designated habitat area. However, some primary limestone forest that is potential habitat would be removed. Because no designated habitat areas are removed there would be a less than significant impact on the fruit bat from construction activities.

**MARIANA CROW.** Removal of this currently unoccupied habitat would have a less than significant impact on the species because the amount removed would be minor in relation to the overall recovery zone about on Guam (0.06%), including large areas adjacent to the proposed construction (see Figure 10.2-13), and would not significantly affect the recovery of the species (the amount of habitat required to meet recovery plan goals for the species is estimated at 8,100 ac [3,278 ha] compared to the total currently available of 23,004 ac [9,309] in Section 10.1.1.3).

**GUAM RAIL.** The rail survives only in captivity at this time. Proposed construction activities would include the loss of shrub/grassland habitat that is potential foraging and nesting habitat for the Guam rail, should it be reintroduced. No specific areas of essential habitat have been designated for this species (see Figure 10.2-13). Based on the current absence of the species in the area and lack of designated habitat, there would be no impact on the species.

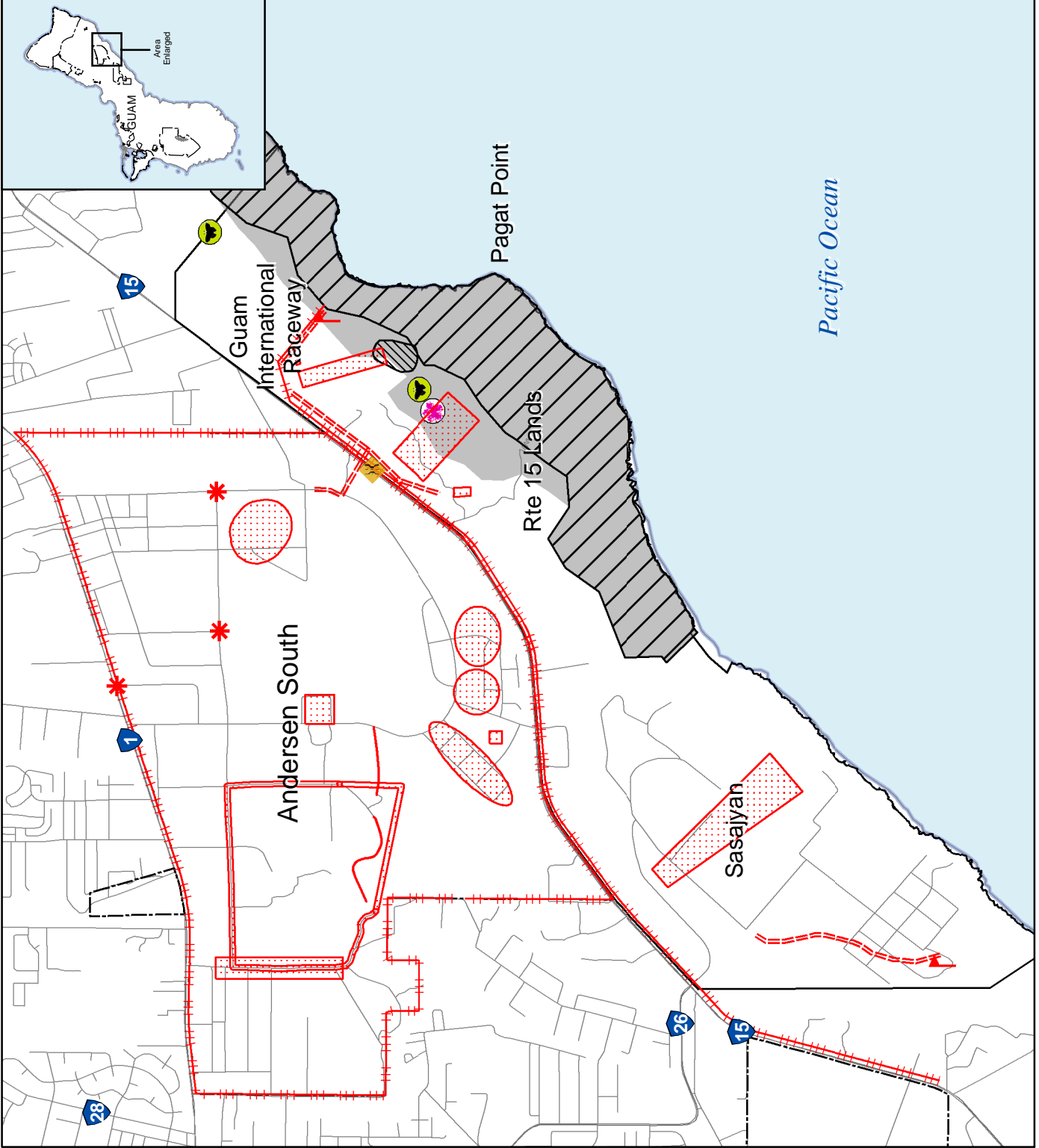
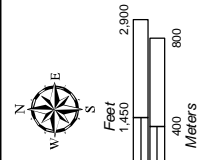
**MARIANAS EIGHT-SPOT BUTTERFLY.** This candidate species was observed in a mixed host plant area approximately 500 ft (152 m) from the Alternative B UD range area during 2008 site-specific surveys (see Figure 10.2-13). No host plants or butterflies have been documented within or near the range footprints. Impacts would be less than significant.

**HERITIERA LONGIPETIOLATA.** The cluster of 22 mature trees of this Guam-listed tree that were identified in 2000 (Duenas and Associates 2000) are located immediately to the south of the Alternative B KD range boundary. A complete survey of other range footprints and surrounding area has not been completed but would be completed prior to clearing. If any individuals are in areas to be cleared, they would be transplanted if possible, or attempts would be made to propagate the species for transplanting elsewhere. Additional information is provided under the mitigation discussion (Section 10.2.2.6). With implementation of this mitigation, impacts to the species would be less than significant.

**Figure 10.2-13**  
 Potential Impacts to  
 Special-Status Species  
 and Essential Habitat  
 and Recovery Zones  
 for ESA-listed Species  
 at Andersen South  
 and Rte 15 Lands  
 (Range Complex  
 Alternative B)

- Legend**
- Military Installation
  - Route Number
  - Proposed Project Footprint
  - Proposed Features**
  - Range Gate
  - Range Tower
  - Fence Line
  - Range Road
  - Bridge
  - Vegetation**
  - Mariana Fruit Bat and Guam
  - Micronesian Kingfisher Essential Habitat
  - Mariana Crow Recovery Zones
  - Heritiera longipetiolata* Clusters
  - Mariana Eight-Spot Butterfly Location
  - Heritiera longipetiolata* Location

Sources: USFWS 2002, 2004, 2005b; Campora and Lee 2009; NR Survey Report, in preparation



ALL SPECIAL-STATUS SPECIES. Other indirect effects on all species would occur as a result of the proposed construction. Movement of construction personnel, equipment, and supplies could result in the movement and spread of invasive plant and animal species to Guam, within Guam, and to other locations from Guam. Invasive species would affect special-status species or degrade habitat, thus are potential indirect impacts resulting from actions proposed in Alternative 1. Invasive species impacts for construction would be similar to those for operations but shorter-term. Awareness training and inspection of gear, clothing, and equipment as part of existing control measures would occur. The impacts are discussed in detail under operations below. Impacts would be significant but numerous mitigation measures and BMPs, as specified under mitigation in Section 10.2.2.6, would be implemented to reduce impacts to less than significant.

#### *Operation*

*Vegetation.* Trees and shrubs in the SDZs of firing ranges would be damaged from stray munitions. However, stray bullets would be minimal and are unlikely to damage the vegetation enough to kill individual specimens. Invasive plant species are likely to expand ranges and new species are likely in some areas due to the increase in activities such as more training, more personnel, and more vehicles. However, this is unlikely to substantially impact primary limestone forest as long as the substrate of the primary forest remains intact. Therefore, impacts would be less than significant.

*Wildlife.* Impacts to wildlife would be the same as for Alternative A.

*Special-Status Species.* Stray munitions may fall within the SDZs; however, the likelihood of any single animal or plant being struck is negligible. As mentioned above, the estimated number of bullets that would fall on land within the SDZ is approximately 1,013 for Alternative B over the course of a year.

MARIANA FRUIT BAT. Although not documented historically in the area, essential habitat has been identified within the non-DoD northern parcel below the cliff edge and in the lower bench area along the coast (see Figure 10.2-11). As described above under Alternative A, noise would be generated beyond current levels from small arms ranges. The 104 dB PK15 (met) contour for the small arms ranges would cover 41 ac (17 ha) of essential habitat for the fruit bat (Table 10.2-8). Given the limited amount of information available on the noise susceptibility of the fruit bat, noise from the small arms ranges may have a significant impact to individuals that may potentially forage or roost within the non-DoD lands. To assess the potential for proposed range activities to impact fruit bats, regular surveys of the range areas would be conducted to determine the occurrence of fruit bats. If fruit bats are observed, monitoring of the species in areas surrounding the range facilities would be conducted to determine potential noise impacts.

MICRONESIAN KINGFISHER. The kingfisher currently survives only in captivity but essential habitat has been designated in the non-DoD northern parcel below the cliff edge and in the lower bench area along the coast (see Figure 10.2-11). As with the fruit bat, noise impacts to this species from weapons firing, should it be reintroduced, would be determined after monitoring of the species. Indirect impacts from general noise and activity to kingfishers may occur if they are reintroduced into the area. These areas are estimated in Table 10.2-8.

MARIANA CROW. The crow does not currently occur in the project area. Essential habitat has been designated for the species in the northern parcel beginning along the cliff and down into the lower bench area along the coast (see Figure 10.2-11). In addition, a recovery zone is designated in the recovery plan for this same essential habitat area and extends beyond it to include limestone forest in the plateau area of the parcel. As with the fruit bat, noise impacts to this species from weapons firing, should it be reintroduced, would be determined after monitoring of the species. Indirect impacts from general noise

and activity to kingfishers may occur if they are reintroduced into the area. These areas are estimated in Table 10.2-8.

As described above for Alternative A for the crow, noise would be generated beyond current levels from the small arms ranges. The 104 dB PK15 (met) contour from the small arms ranges would cover 148 ac (60 ha) of crow essential habitat. However, given the limited amount of information available on the noise susceptibility of the crow, noise from the small arms ranges may have a significant impact on the ability of the area to support the reintroduction of crows. To evaluate this potential, if the species were reintroduced to the area, monitoring in areas surrounding the facilities would be conducted to determine potential noise impacts. If this monitoring determined that the crow was being affected, techniques to reduce noise generation, such as noise barriers, would be employed. With this mitigation, impacts would be less than significant.

**MARIANAS EIGHT-SPOT BUTTERFLY.** This candidate species was observed near the Alternative B UD range area during 2008 site-specific surveys (NR Survey Report in preparation). Its two host plants were also observed in that area, and in areas within the UD range footprint. The eight-spot butterfly is unlikely to be affected by noise and activity in nearby ranges. Impacts would be less than significant.

**HERITIERA LONGIPETIOLATA.** Previous studies identified 22 mature individuals of this Guam-listed tree near or within the boundary of the Alternative B UD range. With standard range design there would be a minimal number of projectiles falling immediately behind the range footprint, therefore impacts to this species from operations would be less than significant.

**ALL SPECIAL-STATUS SPECIES.** Impacts from the movement and spread of invasive plant and animal species within Guam and to other locations from Guam and from wildfires from range-related activities would be the same as for Alternative A.

#### 10.2.2.3 Apra Harbor

##### Harbor

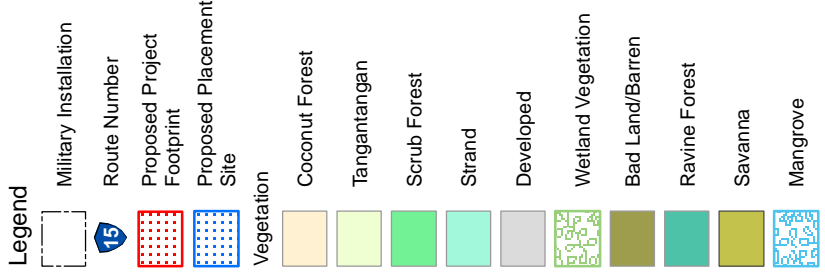
Impacts to off-shore areas are discussed in Chapter 11, Marine Biological Resources.

##### Naval Base Guam

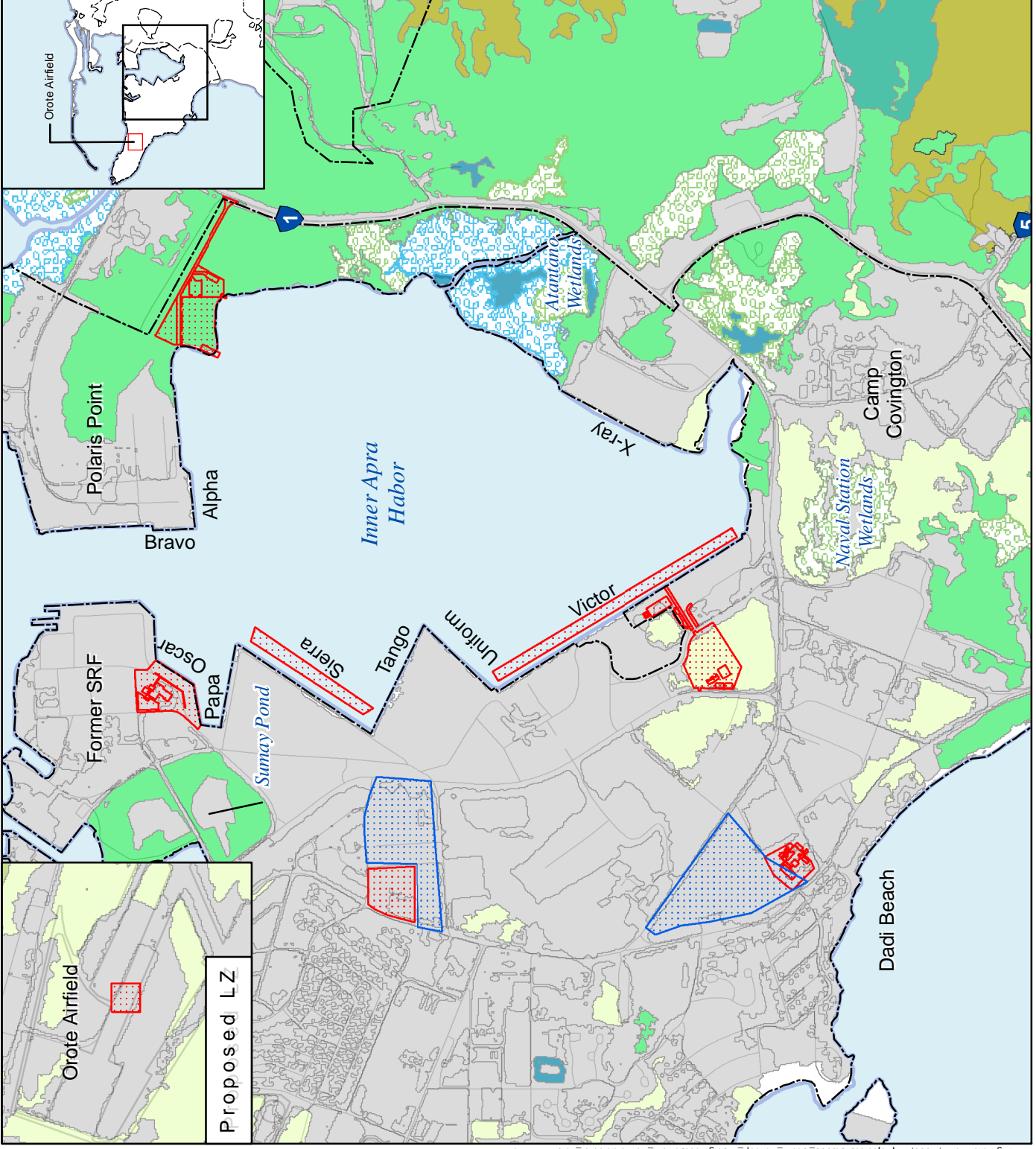
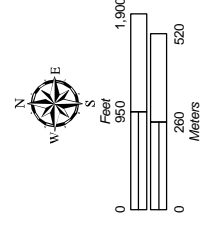
##### *Construction*

*Vegetation.* All project areas are in locations that have been previously disturbed and do not include limestone forest (Figure 10.2-14 and Table 10.2-9). The Orote airfield LZ would not require construction. Impacts to vegetation would be less than significant.

**Figure 10.2-14**  
**Potential Vegetation**  
**Impacts -**  
**Naval Base Guam**



Sources: COMNAV Marianas 2001; USFS 2006



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**Table 10.2-9. Potential Impacts to Vegetation Communities at Apra Harbor with Implementation of Alternative 1 (ac [ha])**

<i>Parcel and Activity</i>	<i>Shrub/ Grassland</i>	<i>Tangantangan</i>	<i>Developed</i>
Construction Areas (vegetation removed)			
Waterfront Projects	0	0	0
LCAC & AAV	12 (4.9)	0	9.9 (4)
Medical/Dental Clinic	0	0	7.8 (3.2)
CVN Berthing Area	0	0	11 (4.5)
USCG Relocation	0	0	11 (4.5)
Embarkation East	0	0	1.0 (.4)
Upland Placement Areas (vegetation removed)			
Dredge Upland Placement Sites	51 (21)	34 (14)	150 (61)
<b>Total Vegetation Removed</b>	<b>62 (25)</b>	<b>34 (14)</b>	<b>191 (77)</b>

*Wildlife.* Project areas include developed areas of the base where there is minimal habitat for avian species. The indigenous gray-tailed tattler and Pacific reef heron utilize food resources within the Apra Harbor shoreline areas. A small amount of shoreline habitat that is not currently developed would be removed at the landing craft air cushion (LCAC) and amphibious assault vehicle (AAV) ramp project site, and at a sediment dewatering project site in that same area. Similar areas of habitat are common in the area and any individuals affected would move to these other areas. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Impacts to wildlife would be less than significant.

Potential impacts include noise and activity, pollutants, and dredging sedimentation. Only common migratory bird species widespread on Guam are known from the area. Proposed construction activities and associated noise would force them to temporarily move from the project area into adjacent areas. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Impacts would be less than significant.

Fueling of project-related construction or operations vehicles, watercraft, and equipment could result in accidental releases of petroleum products that would migrate within Apra Harbor. The Atantano River mangrove area is approximately 4,000 ft (1,220 m) distant from the wharf area project locations (Figure 10.2-14). Required Best Management Practices (BMPs) during construction would make it unlikely for a major spill to occur. A mandatory spill plan exists for Navy Main Base for response to spills. There would be time for small spills to be cleaned up before reaching the mangrove area. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Potential impacts would be less than significant.

Proposed dredging and shoreline activities would result in sediment disturbance and suspension that could migrate to mangrove areas. However, modeling results from outer Apra Harbor dredge modeling show that sediments would largely be contained within silt curtains employed for the dredging; any sediment plume would migrate only a very short distance under all scenarios modeled (Ericksen 2009). Because the dredging being considered here is in the more-protected inner harbor, sediment migration should not be greater than that modeled for the outer harbor, and is likely to be less. It would be very unlikely that suspended sediments would reach the nearest mangroves at Atantano, approximately 4,000 ft (1,220 m) away. Use of silt curtains is part of the mitigation measures to minimize suspended sediment migration. With mitigation, there would be no diminished population sizes or distributions of migratory birds or regionally important native animal species and impacts would be less than significant.

*Special-Status Species.* No special-status species are known to be present in the project areas or in the vicinity of Apra Harbor. However, two species may be potentially impacted by proposed activities.

**MARIANA MOORHEN.** The only special-status species currently present in the Apra Harbor area is the Mariana moorhen. This species uses the freshwater wetland area of the Atantano wetlands east of the highway (Figure 10.2-15). The LCAC and AAV ramp construction area is within approximately one-half mile of the Atantano River, designated as secondary habitat for the Mariana common moorhen (USFWS 1991b). The site is also designated Overlay Refuge land and 12 ac (4.9 ha) would be removed during construction of the facility. Noise and activity from construction would be very unlikely to affect these areas. Any potential impact from project construction sedimentation or pollutants would be to the mangroves that are adjacent to the harbor waters, and not the freshwater wetlands that are further inland where the moorhen is known to occur. Impacts would be less than significant.

**GUAM RAIL.** The Guam rail is not currently present and exists only in captivity but 12 ac (4.9 ha) of shrub/grassland habitat potentially suitable for the reintroduction of the species is present and is designated Overlay Refuge (see Figure 10.2-15). However, because the Guam rail is currently extirpated in the wild and most of Guam has habitat that is potentially suitable for the recovery of the species, removal of these areas due to construction would result in a less than significant impact.

**ALL SPECIAL-STATUS SPECIES.** Other indirect effects on all species would occur as a result of the proposed construction. Movement of construction personnel, equipment, and supplies could result in the movement and spread of invasive plant and animal species to Guam, within Guam, and to other locations from Guam. Invasive species would affect special-status species or degrade habitat, thus are potential indirect impacts resulting from actions proposed in Alternative 1. Invasive species impacts for construction would be similar to those for operations but shorter-term. The impacts are discussed in detail under operations below. Awareness training and inspection of gear, clothing, and equipment as part of existing control measures would occur. Impacts would be significant but numerous mitigation measures and BMPs, as specified under mitigation in Section 10.2.2.6, would be implemented to reduce impacts to less than significant.

### *Operation*

*Vegetation.* There is no primary limestone forest in the project areas. No wetland or mangrove habitat would be removed. Therefore, there would be less than significant impacts to vegetation.

*Wildlife.* Operations would generate noise. Only a few, widespread migratory bird species would be affected. They would move away from the operational areas but there are other areas of habitat nearby. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Therefore, direct and indirect impacts to wildlife from operations would be less than significant.










The LCAC and AAV ramp construction area is within approximately one-half mile of the Atantano River, a major mangrove and wetland complex. However, noise and activity from operations would be unlikely to affect these areas. Impacts would be less than significant.

Fueling and movement of petroleum in wharf areas could result in accidental releases of petroleum products that would migrate within Apra Harbor. A mandatory spill prevention plan that would be in place would minimize the likelihood of this happening. If there were a release, the Atantano River mangrove area is approximately 4,000 ft (1,220 m) distance from the wharf area project locations (refer to Figure 10.2-13). The Atantano mangroves provide important habitat for sponges, mollusks, bivalves, crustaceans, and fish, and is particularly well-suited for mollusks due to its location in Inner Apra Harbor

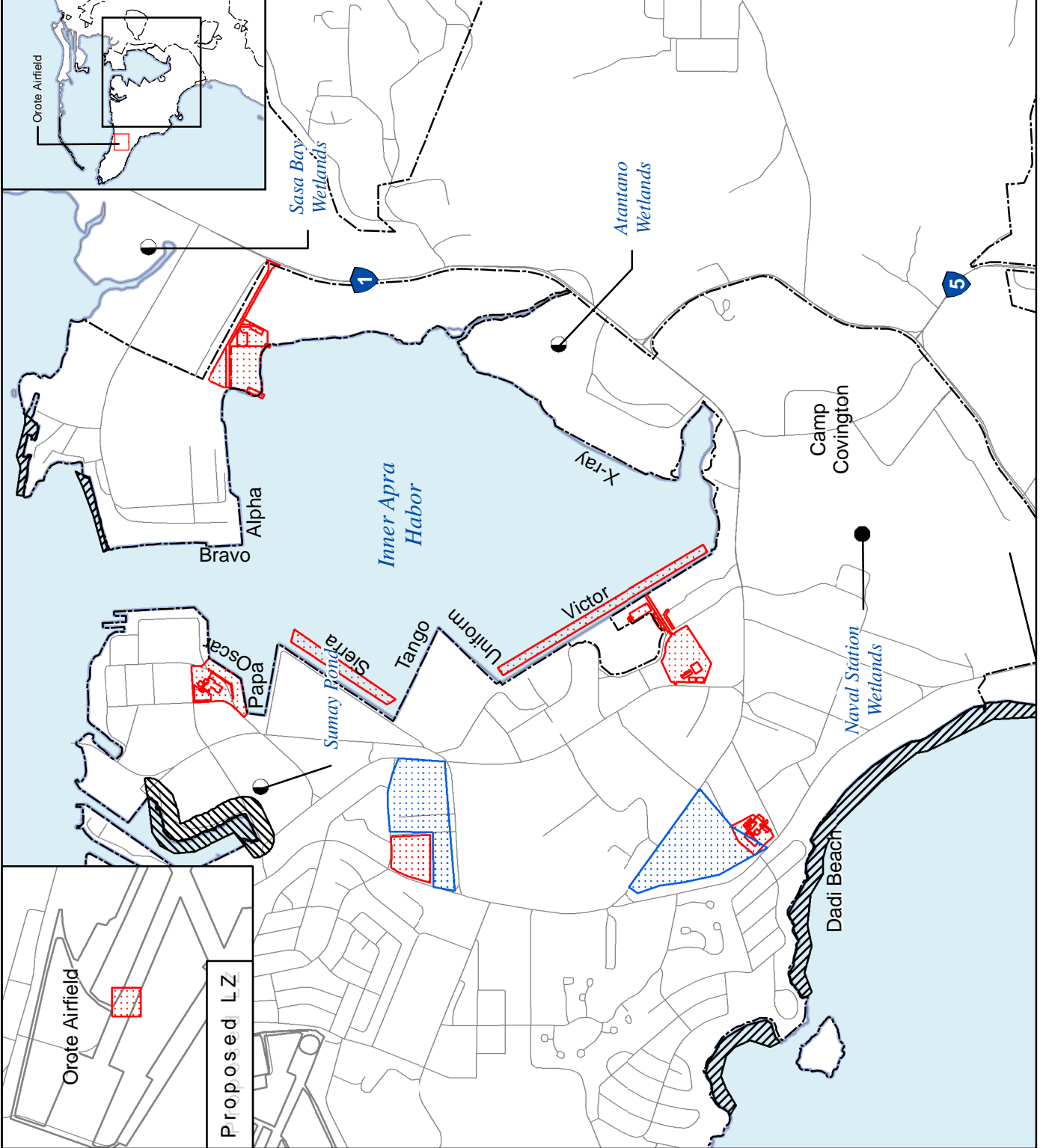
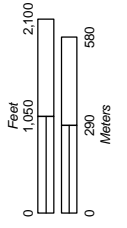


**Figure 10.2-15**  
**Potential Impacts to**  
**ESA-listed Species -**  
**Naval Base Guam**

**Legend**

-  Military Installation
-  Route Number
-  Proposed Project Footprint
-  Proposed Placement Site
-  Sea Turtle Nesting
-  Potential Sea Turtle Nesting
-  Mariana Common Moorhen Habitat
-  Primary
-  Secondary

Source: USFWS 1991b;  
 NOAA 2005; GDAWR 2007;  
 Grimm and Farley 2008





where water turbidity is higher and water circulation is lower than in other mangroves on the island. The mangroves are also important nursery grounds for various marine fishes (Wiles and Ritter 1993).

Potential oil spills in Apra Harbor from proposed action under Alternative 1 are unlikely given the history of Navy operations. If a severe oil spill were to occur and reach the mangroves, substantial damage to that community would likely occur. Mangrove responses to oil spills have been summarized by Hoff et al. (2002). Mangrove tree species themselves are highly susceptible to oil exposure, and the lighter oils are more acutely toxic than heavier oils. Acute effects of oil (mortality) occur within six months of exposure and usually within a much shorter time frame (a few weeks). Common responses of mangrove tree species to oil include yellowing of leaves, defoliation, and tree death. Mangrove communities are complex, but the available information suggests that the mangrove faunal community recovers faster than the mangroves themselves, so the long term effects in this community from an oil spill is from loss of primary vegetative cover.

The potential that oil spills at the Inner Apra Harbor berthing area would reach the mangroves is partly controlled by currents in Apra Harbor. Currents in outer Apra Harbor are predominantly wind-driven, and occur as a two-layer system and currents tend to be weak with surface currents at 7.9 to 15.7 ft/second (4 to 8 centimeters/second) (Eriksen 2009). Currents within the inner harbor where the projects would occur are likely to be even weaker.

The capability to respond to any spill resulting from the proposed action is substantial. NOAA has developed a modeling tool for spills called the General NOAA Operational Modeling Environment, and has developed specific information for Apra Harbor (NOAA 2009). Various booms, skimmers and sorbents are available to response agencies and the Navy has a waste oil barge (ITOPF 2000).

The potential for sediment migration and petroleum spills in Inner Apra Harbor reaching mangrove areas would be minimized through implementation of avoidance and minimization measures and specific mitigation measures. With implementation of these measures, potential impacts to the mangrove areas and the associated migratory birds and migratory birds or regionally important native animal species would be less than significant.

The Orote LZ area is an open paved area. Migratory birds such as whimbrels and other shorebirds may use the area for resting but would disperse to other suitable areas during temporary training exercises. Impacts would be less than significant.

*Special-Status Species.* Any direct impacts such as incidental bird-vehicle or bird-boat strikes would be uncommon. Impacts would be less than significant. As mentioned previously, the only special-status species known to occur in the Apra Harbor area is the Mariana moorhen, but habitat is also present for the Guam rail.

Noise and activity from operations would affect special-status species that might use Overlay Refuge land in the future. Using a 60 m zone surrounding the perimeter, there would be indirect effects on 12 ac (4.9 ha) of Overlay Refuge. Using a 328 ft (100 m) zone surrounding the perimeter there would be indirect effects on 18 ac (7.3 ha). Using a 492 ft (150 m) buffer here would be indirect effects on 27 ac (11 ha). No essential habitat has been specifically determined for this area.

At the Orote LZ no special-status species are known to use the area. The boundary of the Overlay Refuge is approximately 1,000 ft (305 m) from the LZ. Because of the distance the Overlay Refuge and the present lack of special-status species, impacts from operations at this LZ would be less than significant.

The movement and spread of invasive plant and animal species within Guam and to other locations from Guam would degrade habitat for special-status species and are potential indirect impacts resulting from actions proposed in Alternative 1. Invasive species might be accidentally introduced to Guam, spread on Guam, or transported to other islands through aircraft operations, shipment of supplies and equipment to the new facilities, movement of troops and supplies during training activities, or movement of household goods. Species that might be introduced or spread include various plants such as *Vitex* that can degrade habitat by displacing native species and ultimately reducing food or important nesting or roosting habitat, invertebrates such as coconut rhinoceros beetles or the flatworm predator of native snails, BTS, various frog species, rodents, dogs, or cats. These influences could have significant impacts on all special-status species potentially occurring in the project area (the same as those discussed under construction direct impacts). To prevent potentially invasive species from being moved or spreading, and in particular the BTS from being introduced in other areas from Guam, the project would fund and facilitate a 100% inspection effort for all cargo, vehicles, munitions, household goods, and other items leaving Guam. In addition, various plans and procedures would be developed and implemented to address existing invasive species concerns such as invasive plants and ungulate damage that is affecting habitat quality of special-status species. The successful implementation of a Biosecurity Plan (presently under preparation) and specific invasive species control procedures would restrict the movement of invasive species so that impacts would be less than significant.

#### 10.2.2.4 South

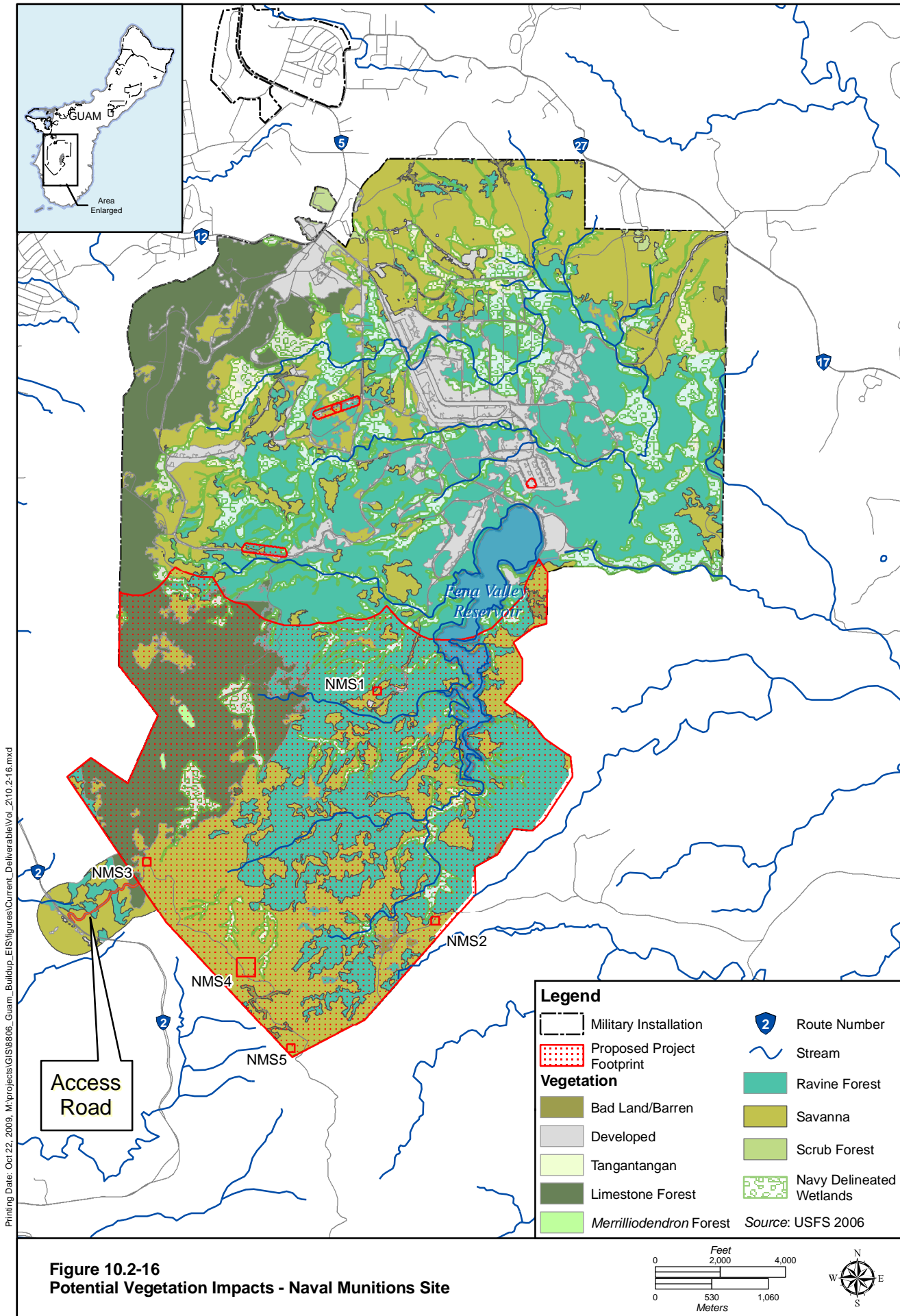
##### Naval Munitions Site

##### *Construction*

*Vegetation.* Proposed action at NMS would potentially remove a small area of limestone forest and a maximum of 4.3 ac (1.7 ha) of ravine forest during construction activities for the munitions magazines, clearing vegetation from the LZs, and constructing the access road under Alternative A (Table 10.2-10 and Figure 10.2-16). Access road Alternative A would traverse an area mapped as limestone forest by the USFS (see Figure 10.2-16) a portion of which is merrilliodendron forest adjacent to the existing road (NR Survey Report in preparation). This merrilliodendron forest area would not be removed or at most only a few trees would need to be removed to make the road passable for military vehicles. The remainder of the mapped limestone forest that would be affected under Alternative A is degraded limestone dominated by non-native species based on a recent inspection (NR Survey Report in preparation). Based on this information, impacts to vegetation would be less than significant for Alternative A.

**Table 10.2-10. Potential Impacts to Vegetation Communities at NMS with Implementation of Alternative 1 (ac [ha])**

<i>Parcel and Activity</i>	<i>Limestone Forest, Primary</i>	<i>Ravine Forest</i>	<i>Savanna</i>	<i>Developed Land</i>
<b>Direct Impacts from Construction – Vegetation Removed</b>				
New Magazines (Alt. A)	0	2.9 (1.2)	4.7 (1.9)	1.2 (0.5)
New Magazines (Alt. B)	0	5.8 (2.3)	1.6 (0.6)	1.4
Access Road (Alt. A)	0.4 (0.2)	0.8 (0.3)	2.5 (0.4)	0
Access Road (Alt. B)	0	0	0	0
Helicopter LZs	0	0.6 (0.2)	13 (5.3)	0
<b>Totals for Construction Areas (with A Alternatives)</b>	<b>0.4 (0.2)</b>	<b>4.3 (1.7)</b>	<b>20 (8.1)</b>	<b>1.2 (0.5)</b>
<b>Indirect Impacts from Use of Non-Firing Training Area and Access Road- Vegetation not Removed</b>				
Southern Training Maneuver Area	745 (301)	1,344 (544)	1,147(464)	3.5 (1.4)



Based on limited project-specific field evaluation of some areas within the southern training area, the ravine forest community is significantly degraded in many areas by invasion of non-native woody plant species including *Vitex* and betelnut palm, and heavy infestation by herbaceous invasive plants. Training impacts on this vegetation would be less than significant.

The ravine forest and other areas that would be removed or used for training are not known to harbor any sensitive plant species identified by government or conservation groups. However, the vegetation removed serves as potential habitat for sensitive animal species that are addressed under the Special-Status Species section below.

*Wildlife.* Proposed construction activities at the magazine areas and access road would displace wildlife or destroy slow-moving species. However, species potentially affected such as the yellow bittern and Pacific golden plover are regionally abundant, as is this habitat type, so impacts would not be significant. No construction is proposed in the southern training area; LZs would be cleared of vegetation but the soil would not be disturbed. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Impacts would be less than significant.

Construction activities for the magazines, LZs and the new access roads would generate noise. Only a few, widespread migratory bird species are present that would be affected. They would move away from the construction areas but there are other areas of habitat nearby and they could return during evenings and to some of the area when construction is complete. Effects would be short-term. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Therefore, indirect impacts to wildlife from construction would be less than significant.

*Special-Status Species.* Proposed construction activities for the magazines and the access road could directly impact essential habitat for a number of ESA-listed species that currently occur on Guam or that might be reintroduced. The ground would not be disturbed at LZs so direct impact for these features would be minimal. Indirect impacts from noise and activity would not occur during construction because species that might be affected by noise and activity are not currently present. These species could be affected by air and ground operations if they were present in the area in the future.

**MARIANA FRUIT BAT.** Currently fruit bats are rarely observed at NMS. Proposed construction activities would include the loss of ravine forest that is potential foraging and roosting habitat for the Mariana fruit bat on the base. A total of 20 ac (8.1 ha) of essential habitat would be removed for construction of the various project components on NMS (Table 10.2-11). This essential habitat is also designated National Wildlife Overlay Refuge land. Because the removal of habitat is minimal compared to what is available in the area, the quality of habitat removed is not high due to the mostly savanna vegetation in the project areas, and the proximity to existing roads for the magazines, impacts would be less than significant.

**GUAM MICRONESIAN KINGFISHER.** Proposed construction activities would include the loss of ravine forest that is potential habitat for the future reintroduction of the kingfisher. A total 20 ac (8.1 ha) of essential habitat would be removed for construction of the various project components on or adjacent to NMS (see Table 10.2-11). This essential habitat is also designated Overlay Refuge (see Figure 10.2-16). For the same reasons given for the fruit bat, impacts would be less than significant.

**MARIANA CROW.** The crow does not presently occur at NMS. Proposed construction activities would include the loss of ravine forest that is potential foraging and nesting habitat for the crow. A total of 36 20 ac (8.1 ha) of essential habitat would be removed for construction of the various project components on

**Table 10.2-11. Potential Impacts to Special-Status Species Habitat at NMS with Implementation of Alternative 1 (ac [ha])**

<i>Parcel and Activity</i>	<i>Overlay Refuge*</i>	<i>Essential Habitat – Bat, Crow, and Kingfisher*</i>	<i>Crow Recovery Zone*</i>
<b>Direct Impacts from Construction – Habitat Removed</b>			
New Magazines (Alternative A)	10 (4.0)	10 (4.0)	10 (4.0)
New Magazines (Alternative B)	10 (4.0)	10 (4.0)	10 (4.0)
New Access Road (Alternatives A and B)	0	0	0
Helicopter LZ	13 (5.3)	9.6 (3.9)	13 (5.3)
Habitat Removed Totals (using road Alternative A)	23 (9.3)	20 (8.1)	23 (9.3)
Percentage of Habitat Type on Guam that is Removed (using A Alternatives)	0.1 %	0.1 %	0.1 %
<b>Indirect Impacts (unoccupied habitat) – Noise, Lighting, Human Activity</b>			
60 m buffer for <u>MC (F,N)</u> : Ground Ops			
LZs	40 (16)	31 (13)	40 (16)
100 m buffer for <u>KF (F,N)</u> : Ground Ops			
LZs	80 (32)	62 (25)	80 (32)
150 m buffer for <u>FB (R)</u> : Ground Ops			
LZs	136 (55)	111 (45)	142 (58)
300 m buffer for <u>MC (F,N)</u> : Air Ops			
LZs	366 (148)	342 (138)	395 (160)
<b>Indirect Effects from use of Non-Firing Training Area - Habitat not Removed</b>			
Southern Training Maneuver Area	3331 (1348)	3149 (1274)	3272 (1324)

Notes: Each habitat category is considered independently of others and are not additive.

FB – Fruit Bat, MC - Mariana Crow, KF – kingfisher.

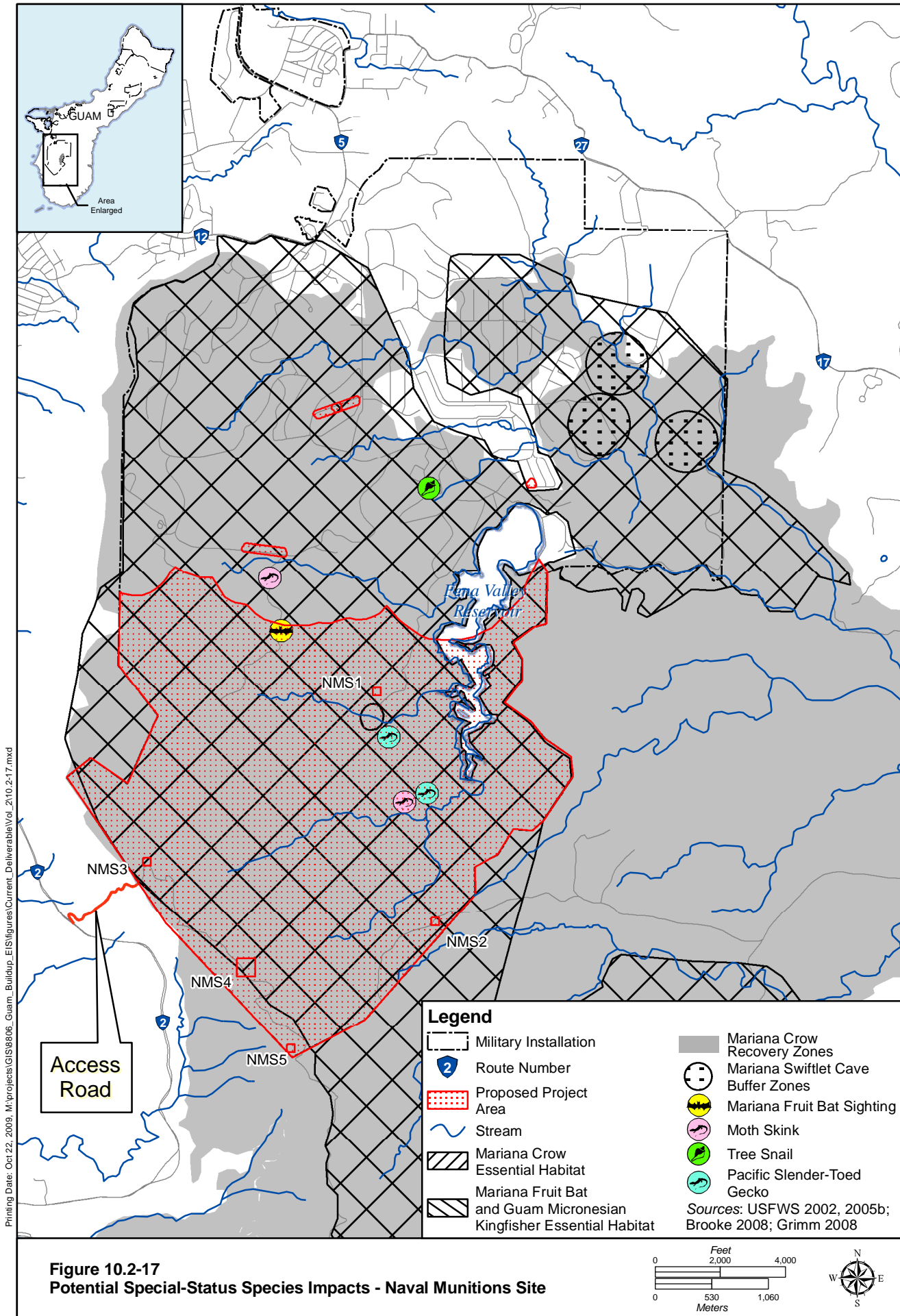
F – Foraging, R – Roosting/Colony, N - Nesting.

NMS (see Table 10.2-11). This essential habitat is also designated Overlay Refuge (Figure 10.2-17). For the same reasons given for the fruit bat, impacts would be less than significant.

GUAM RAIL. The rail survives only in captivity at this time. Proposed construction activities would include the loss of ravine forest and savanna but these areas are unlikely to support significant foraging and nesting habitat for the Guam rail. Based on habitat present, the fact that the Guam rail is currently extirpated in the wild, and that most of Guam has habitat that is potentially suitable for the recovery of the species, removal of these areas due to construction would result in a less than significant impact.

SKINKS and GECKOS. Two Guam-listed species, the moth skink and the Pacific slender-toed gecko, were present historically within NMS. The moth skink was present throughout NMS and the gecko in the southern portion only. The moth skink has been documented in project-specific surveys in or near the southern training area and the Alternative B magazine group. Proposed construction activities at the magazine areas and access roads may result in mortality of these less mobile species. However, long-term, permanent impacts to populations of such species would be unlikely to result because these species would be present in surrounding areas of extensive habitat similar to that being removed. Impacts to these species would be less than significant.

ALL SPECIAL-STATUS SPECIES. Other indirect effects on all species would occur as a result of the proposed construction. Movement of construction personnel, equipment, and supplies could result in the movement and spread of invasive plant and animal species to Guam, within Guam, and to other locations from Guam. Invasive species would affect special-status species or degrade habitat, thus are potential indirect impacts resulting from actions proposed in Alternative 1. Invasive species impacts for construction would be similar to those for operations but shorter-term. The impacts are discussed in detail



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**Figure 10.2-17  
Potential Special-Status Species Impacts - Naval Munitions Site**

under operations below. Impacts would be significant but numerous mitigation measures, as specified under mitigation in Section 10.2.2.6, would be implemented to reduce impacts to less than significant.

#### *Operation*

*Vegetation.* The southern training area contains 745 ac (301 ha) of limestone forest and 1,147 ac (464 ha) of ravine forest, as well as a large amount of savanna and smaller areas of barren and developed land (see Table 10.2-10 and Figure 10.2-16). Clearing of vegetation is currently not allowed during training in Marianas training areas in accordance with the Marianas Training Handbook and this practice would be maintained. Invasive plant species could expand ranges and new species could be introduced in some areas due to the increase in number of increased activities such as more training, more personnel, and more vehicles. However most activities and all vehicles would be located away from these primary limestone forest areas which are generally at the higher elevations in the west. Impacts would be less than significant.

*Wildlife.* Training impacts in the southern training area would involve company-level maneuvers. There is the potential for certain wildlife species to be crushed, but most wildlife would be able to move away from the maneuvers to avoid this. The level of mortality would be negligible and would not affect population levels. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Direct and indirect impacts would be less than significant.

Use of the access roads would involve short periods where vehicles move through and there would be minimal disturbance of wildlife. Magazine areas would be infrequently used. No motorized vehicles would be used during training within the facility, and the low frequency and intensity of training would result in only minimal wildlife disturbance. Aquatic habitats may be temporarily impacted during crossings but this would be infrequent and short in duration. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Direct and indirect impacts to wildlife would be less than significant.

*Special-Status Species.* Proposed ground training is company-level maneuver training supporting foot land navigation training with no weapons firing for 5-7 consecutive days, 12 weeks per year, day and night in the 3,300 ac (1,335 ha) southern training area. This area is all within the Overlay Refuge, most of which is essential habitat for the fruit bat, kingfisher, and crow (refer to Figure 10.2-11). These species are not currently present (or very rarely present in the case of the fruit bat) but may return or be reintroduced in the future.

The same also applies to special-status reptile species that are present in the training area. For all special-status species, direct impacts from training would be less than significant.

Noise disturbance would occur from company-level foot training for limited time periods and aircraft activity from proposed terrain flights and at the four proposed LZs in the southern training area and one south of the explosive ordnance disposal pit. Three of the LZs are in very open savanna areas with forested areas at least 350 ft (107 m) distance (see Figure 10.2-11). Two LZs are in open areas but within 100 ft (30 m) of forested areas.

**MARIANA FRUIT BAT.** Since fruit bats are only rarely present and in small numbers throughout a very large area, there would be no direct disturbance from ground training or aircraft. Under future conditions that assume the return of substantial numbers of the fruit bats, impacts from ground training would be less than significant because of the infrequent training and large size of the entire training area such that disturbance would be limited and the animals could easily avoid or move away from the training site.



For helicopter takeoff and landings at the LZs, using 492 ft (150 m) as a distance in which fruit bats would not be disturbed, the amount of fruit bat essential habitat that may be directly impacted by the air operations at NMS is approximately 222 ac (90 ha). However, for the following reasons the impacts are considered less than significant: LZs are near the edge of essential habitat areas; much of the area affected is savanna; and there large acreage of undisturbed habitat in surrounding areas.

Noise would be generated from helicopter training from approximately 1 sortie/day and 1 night sortie every 10 days at the NMS LZs. Estimated noise contours from LZ operations at NMS would not exceed 70 dBA within the immediate vicinity of the proposed LZs. In addition, terrain flights would occur within southern NMS. A total of 95 daytime and 5 nighttime terrain flight operations per year are proposed, or one daytime sortie every 3 days and one night-time sortie every 50 days. Terrain flights are conducted at 50-200 ft above ground level and would result in noise levels less than 53 dBA. Under future conditions that assume the return of substantial numbers of the fruit bats, impacts to roosting or foraging fruit bats or essential habitat from aircraft training would be less than significant given the low frequency of use of the NMS for aircraft operations, the localized area of potential noise impacts and the levels of noise generated.

For this species, increased Marine Corps presence from ground training would also have a positive benefit since this would reduce the number and frequency of poachers in the area.

**MICRONESIAN KINGFISHER.** The kingfisher currently survives only in captivity but essential habitat has been designated at NMS (Figure 10.2-17). Because Micronesian kingfishers are not currently present in the area, there would be no disturbance from ground or aircraft training. In the future, noise would be generated from helicopter training. For helicopter takeoff and landings at the LZs, using 328 ft (100 m) as a distance in which fruit bats would not be disturbed the amount of fruit bat essential habitat that may be directly impacted by the air operations at NMS is approximately 123 ac (50 ha). However, for the following reasons the impacts are considered less than significant: LZs are near the edge of essential habitat areas; much of the area affected is savanna; the essential habitat is currently unoccupied; and there large acreage of undisturbed habitat in surrounding areas. .

**MARIANA CROW.** The crow does not currently occur in the project area. Essential habitat has been designated for the species at NMS (see Figure 10.2-17). Since Mariana crows are not currently present in the area, there would be no disturbance from ground or aircraft training. In the future, noise would be generated from helicopter training. For helicopter takeoff and landings at the LZs, using 984 ft (300 m) as a distance in which fruit bats would not be disturbed the amount of fruit bat essential habitat that may be directly impacted by the air operations at NMS is approximately 645 ac (261 ha). However, for the following reasons the impacts are considered less than significant: LZs are near the edge of essential habitat areas; much of the area affected is savanna; the essential habitat is currently unoccupied; and there large acreage of undisturbed habitat in surrounding areas. .

**GUAM RAIL.** The rail does not currently occur in the project area. No Essential habitat has been designated for the species at NMS but some Overlay Refuge habitat is that could support the species is present. Since the rail is not currently present in the area, there would be no disturbance from ground or aircraft training. In the future, noise would be generated from helicopter training. Given the large size and low frequency of use of the NMS for aircraft operations, the localized area of potential noise impacts (described above for the fruit bat), and the fact that most of Guam has habitat that is potentially suitable for the recovery of the species, impacts would be less than significant.

**SKINKS and GECKOS.** Impacts from ground training in the southern training area would be minimal because of the large size of the training area and the relatively low frequency of training. Use of the



ccess road would involve only short periods of vehicle movement through primarily savanna habitat, so there would be minimal mortality, if any. Impacts would be less than significant.

**ALL SPECIAL-STATUS SPECIES.** The movement and spread of invasive plant and animal species within Guam and to other locations from Guam would degrade habitat for special-status species and are potential indirect impacts resulting from actions proposed in Alternative 1. Invasive species might be accidentally introduced to Guam, spread on Guam, or transported to other islands through aircraft operations, shipment of supplies and equipment to the new facilities, movement of troops and supplies during training activities, or movement of household goods. Species that might be introduced or spread include various plants such as *Vitex* that can degrade habitat by displacing native species and ultimately reducing food or important nesting or roosting habitat, invertebrates such as coconut rhinoceros beetles or the flatworm predator of native snails, BTS, various frog species, rodents, dogs, or cats. These influences could have significant impacts on all special-status species potentially occurring in the project area (the same as those discussed under construction direct impacts). To prevent potentially invasive species from being moved or spreading, and in particular the BTS from being introduced in other areas from Guam, the project would fund and facilitate a 100% inspection effort for all cargo, vehicles, munitions, household goods, and other items leaving Guam. In addition, various plans and procedures would be developed and implemented to address existing invasive species concerns such as invasive plants and ungulate damage that is affecting habitat quality of special-status species. The successful implementation of a Biosecurity Plan (presently under preparation) and specific invasive species control procedures would restrict the movement of invasive species so that impacts would be less than significant.

Fire potential would be increased due to the presence of marines during ground training exercises. Fire is a serious problem on Guam. Fire history records available from 1979 – 2002 indicate that over this 23-year period more than 16,000 fires have occurred in Guam (averaging more than 700 per year) that have burned in excess of 100,000 ac (40,469 ha). For the same period on Naval Base Guam, primarily at

Apra Harbor and NMS, the number of fires was 477 (just over 21 per year) burning more than 9,800 ac (3,966 ha) (COMNAV Marianas 2008). Potentially greater access to trespassers including hunters due to the development of the proposed NMS training access road would be prevented by installation of fencing and gates at the access road entrance. Impacts would be significant. As mitigation BMP, the recently completed Wildland Fire Management Plan would be implemented in this area. It would include protocols for monitoring fire conditions and adjusting training as needed (e.g., certain types of training may be disallowed under certain fire conditions); location and management of fire breaks, fire fighting roads, and a fire fighting water system. Units undergoing training would be briefed on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken) (see Section 10.2.2.6). With implementation of the Wildland Fire Management Plan and procedures, impacts from training-related wildfires would be less than significant.

#### 10.2.2.5 Summary of Impacts

Construction impacts would include direct significant impacts to vegetation from loss of 28 ac (11 ha) of primary limestone forest. There would be direct significant impacts to the endangered Mariana fruit bat and Micronesian kingfisher from clearing of 309 ac (125 ha) of essential habitat and to the endangered Mariana crow from clearing of 254 ac (103 ha) of essential habitat. There would be direct impacts to 704 ac (285 ha) of Overlay Refuge, which includes the essential habitat just listed and other additional lands. There would be additional direct significant impacts to the Mariana fruit bat and indirect significant effects to the Mariana crow and Micronesian kingfisher due to loss of habitat in areas surrounding new

facilities because of noise and lighting from facility operations and aircraft takeoff and landings. The specific habitat requirements of special-status species impacted are not understood well enough to conclude that the type of habitat that would remain upon implementation of the proposed action is adequate to meet the goals of the recovery plans. There would be potential significant direct impacts to a Guam endangered tree species on non-DoD lands at Route 15, mitigated to less than significant.

Overall effects for all actions being proposed in this EIS are in Volume 7, Potential Mitigation Measures

#### 10.2.2.6 Potential Mitigation and BMP Measures

Specific conservation BMPs are described in this section. Protection measures and conservation measures are described as well as existing conservation measures which are relevant to the terrestrial natural resources that may be affected. These BMPs are mentioned, although they are not generally considered mitigation because they are actions, plans or standard operating procedures that would be implemented as part of the proposed action. A detailed description of BMPs and resource protection measures required by regulatory mandates can be found in Volume 7. A more detailed explanation of regulatory permitting requirements may also be available in Volume 8.

#### Existing Conservation Measures/Bat Andersen AFB

Existing conservation measures at Andersen AFB would be continued under the proposed action. The conservation measures developed by the Air Force were designed to compensate and minimize the potential impacts from implementation and operation of the ISR/Strike action to the Mariana fruit bat, Mariana crow, Guam Micronesian kingfisher, and the Guam rail. The conservation measures correspond to recovery actions outlined in various USFWS recovery plans for these species. Overall goals of the conservation measures contribute to important habitat and species management objectives on Guam, and may be grouped into the following categories: (1) habitat improvement measures including establishment of ungulate exclosures, Mariana fruit bat foraging plots, and habitat management units (2) studies and research, (3) BTS interdiction and control, and (4) adaptive management and avoidance/minimization measures. The BTS interdiction and control measures are implemented by an Air Force Instruction (36 WG INSTRUCTION 32-7004, dated March 15, 2006).

Specific conservation measures in place include aircraft training restrictions and Post-typhoon Training Schedule restrictions to protect fruit bats and crows. At Northwest Field, helicopter overflights north of the South Runway below 1,000 ft (305 m) above ground level are prohibited. Overflights of the MSA are prohibited below 1,000 ft (305 m) above ground level. Overflights within 3,000 ft (914 m) of Pati Point are prohibited below 1,600 ft (488 m) above mean sea level, except for flights from the end of the Andersen AFB primary runways.

#### Existing Conservation Measures on Navy Lands

Existing conservation measures on Navy lands would be continued under the proposed action. Conservation measures currently in place include:

- The Navy would maintain the 328 ft (100 m) radius No-Training Areas around the three known Mariana swiftlet caves within the NMS. The largest cave, Mahlac, has been monitored since 1984 by GDAWR and NAVFACPAC biologists. Two smaller caves, Fachi and Maemong, have been monitored since 1992 and 2004, respectively. A recent survey of the three known swiftlet caves suggests an overall increase in swiftlet numbers in Mahlac Cave and Maemong Cave, and Fachi Cave may have reached a maximum capacity to support swiftlets (due to limited size of roosting sites) (NAVFACMAR 2008a). The Navy has

contracted USDA WS to trap brown treesnakes in areas surrounding the caves since 2005, which has resulted in the removal of 488 snakes (NAVFACMAR 2008a). The Navy believes that 100-meter buffers to exclude training activities are sufficient to meet conservation goals for the swiftlet because (1) populations have increased under similar training restrictions and (2) the Navy would continue trapping efforts in swiftlet cave areas, which is likely to have factored into the population increases within the NMS. Some normal day-to-day operations of the NMS may occur within the buffers (such as driving on roads), but no training would occur within the buffers.

- No maneuver and navigation training occurs in areas with known Mariana common moorhen nesting activity. In addition there would be no clearing of vegetation during training events.
- Environmental restrictions and requirements for training operations are included in the COMNAV Marianas Training Handbook (COMNAV Marianas Instruction 3500.4, June 2000). The instruction contains the following components: guidance for developing an Environmental Protection Annex in support of a major military exercise plan; training requirements; BTS control and interdiction; monitoring and monitoring reports; emergency procedures; environmental monitor checklists; and an environmental awareness pocket card.
- BTS interdiction and control measures are implemented by a *Brown Treesnake Control and Interdiction or Management Plan* (COMNAV Instruction 5090.10A, dated February 2005). The BTS plan was used as a basis to develop the BTS-related project-specific protection measures discussed below.

#### Project-Specific Protection Measures and Best Management Practices

The Navy is considering some or all of the potential protection measures described below to minimize potential impacts to special-status species.

##### *Avoidance and Minimization of Effects to Special Status Species*

- Construction at any areas with Mariana crow nesting activity in the year prior to construction would be limited to outside the Mariana Crow breeding/nesting season of October through April if the potential exists for new nesting activity in the area. Crow nesting activity is currently being monitored (Andersen AFB 2008d).
- All construction in areas with Mariana fruit bats and Mariana crows would be limited to daytime hours to avoid nighttime impacts.
- One week prior to clearing vegetation, a qualified biologist would conduct surveys to determine if federally protected species are present in the project site. For example, if crows are nesting within 984 ft (300 m) of the project site the work would be postponed. If fruit bats are present within 492 ft (150 m) of the project site, the work must be halted and not started again until the bat has left the area.
- Standard SOPs/Operating Instructions would be developed and included within the Joint Region INRMP and in an updated COMNAV Marianas Training Handbook (COMNAV Marianas Instruction 3500.4, June 2000) to describe restricted activities and areas and procedures if special-status species are observed during construction or training or for other special requirements identified for special-status species including limitations to training if fruit bat or nesting Mariana crows were present, and reporting procedures for injured or dead birds, mammals, or reptiles observed during construction or training.

- For the protection of fruit bats, hooded lights would be used on roads associated with the proposed North Gate and truck inspection area, aircraft staging areas, and magazines on Andersen AFB.
- A qualified biologist would conduct weekly monitoring of Mariana fruit bats at all roost sites in the project area until 1 year after the proposed project is fully constructed. After a typhoon event occurs on Rota, monitoring would be increased to three times per week for 8 weeks to more accurately monitor potential migration of bats between Rota and Guam.
- The Navy would adopt the Andersen AFB aircraft operations monitoring program for Mariana fruit bats and crows by providing additional support for the current monitoring effort of the effects of aircraft operations on Mariana fruit bats and crows and following the Air Force's adaptive management strategy, which allows for modification of overflight patterns if adverse effects to fruit bats or crows are documented.
- To evaluate potential noise impacts from expanded use of the demolition area at Andersen AFB and use of the breacher facility and small arms ranges at Andersen South and the Route 15 ranges, monitoring of the Mariana fruit bat and Mariana crow, if present, would be conducted in areas surrounding these facilities to determine potential noise impacts. If this monitoring determined that these species were being affected, techniques to reduce noise generation, such as noise barriers, would be employed.
- To prevent disturbance of sensitive species in recreational areas, restrictions on the use of Haputo Beach and ERA would be included within the Joint Region INRMP.
- Vehicle traffic would be carefully controlled on the access road to the NMS southern training area; only military training units and other authorized military personnel on military business would be allowed to use the road.
- Excessive lighting would be prohibited at beaches that have the potential to be used by sea turtles.
- Mature specimens of *Heritiera longipetiolata*, a Guam-listed tree identified near the KD range in the Duenas and Associates (2000) study would not be removed. Any seedlings identified in the area to be cleared would be transplanted. A survey would be conducted by a qualified biologist in all of the Route 15 range footprint areas prior to clearing for *Heritiera longipetiolata*. If the species is found in areas to be cleared, individuals would be transplanted if possible, or if not possible efforts would be made to propagate the species and replace the number of trees lost with an equal number on adjacent lands.
- Before the start of construction, all personnel involved would receive a briefing on special-status species potentially present and avoidance measures.
- The COMNAV Marianas Training Handbook (COMNAV Marianas Instruction 3500.4, June 2000) would be updated and include all avoidance, minimization, and monitoring requirements applicable to the actions described in this EIS.

#### *Invasive Species Avoidance, Minimization, and Control*

- The 5-Step Hazard Analysis and Critical Control Point (HACCP) planning method (an international standard, ASTM E2590-08) for reducing or eliminating the spread of unwanted species would be used for high-risk activities (to be identified in the Biosecurity Plan (see below under Potential Conservation Measures) and would be required for all construction project sites.
- All personnel involved in training activities would adhere to the COMNAV Marianas Training Handbook, which calls for individual troops to be responsible for conducting self inspections to avoid potential introductions of invasive species to Guam (both on to Guam and intra-Guam) and

the CNMI. Troops would inspect all gear and clothing (e.g. boots, bags, weapons, pants) for soil accumulations, seeds, invertebrates, and possible inconspicuous stow away brown treesnakes). The intent of this measure is to minimize the potential effects associated with transport of troops and personnel to and in and around Guam and the CNMI from areas that contain species not native to terrestrial habitats within the area. In addition, compliance with the COMNAV Marianas Training Handbook, COMNAV Marianas Instruction 5090.10A and per requirements in DoD 4500.9-R (Chapters 505 and 506) would be required for travel to and from training sites within the Mariana Islands Range Complex. The intent of these measures is to minimize the transport of potentially invasive plant and animal species (other than BTS which is addressed separately below) associated with transport of troops and personnel within and between Guam and the CNMI. The Navy is in ESA section 7 consultation with USFWS Pacific Islands Field Office to develop SOP and/or Operating Instruction templates and exercise planning to better meet invasive species management needs associated with proposed operations and training on Guam.

- To prevent predation on native wildlife, the escape, abandonment, or intentional release of pets (such as cats and dogs, but including all pets) would be prevented through pet ownership policies and Base instructions or orders to ensure that pets are controlled and not allowed at Haputo ERA, Overlay Refuge, or other conservation lands.
- Invasive Species Avoidance, Minimization, and Control – BTS Specific. The Navy would supplement and update the existing environmental education program for new arrivals. The updates may include (1) mandatory viewing of a new BTS educational video, (2) pocket guides with BTS information and personal inspection guidelines, and (3) assurance that BTS awareness extends from the chain of command to the individual marine and sailor.
- The DoD, working in collaboration with the USFWS, and USDA –Wildlife Services (USDA-WS) and Animal and Plant Health Inspection Service (APHIS) would decide how best to implement the Joint Region BTS Control Plan relevant to the proposed activities. The Navy strategy would involve three components: (1) avoidance, (2) minimization, and (3) offsetting measures. Specific aspects of these strategies are still in development and would be included in the USFWS Biological Opinion; however, the overall strategies are outlined in the following bullets.
- The Navy, in compliance with the DoD Defense Transportation Regulations, Chapter 505 protocols, is committed to implementing 100 percent inspection of all outgoing vessels and aircraft with dog detection teams. This could be supplemented by other pest control expertise (with appropriate USDA-WS BTS detection training and oversight) to meet 100 percent inspection goals for large scale training activities. The Navy understands that inspection capacity limitations exist within the present USDA-WS interdiction capabilities. In the event of DoD-related, vehicles, and equipment leaving Guam without inspection, the Navy would notify the point of destination port or airport authorities.
- The Navy could support rapid response actions to BTS sightings within the CNMI and locations outside of the CNMI and Guam, specifically Hawaii, by working with USGS Biological Resources Discipline (BRD) in developing procedures and protocols that would support rapid action for a BTS sighting. The Navy could also establish temporary snake-free quarantine areas for cargo traveling from Guam to CNMI and locations outside of the CNMI and Guam. These BTS sterile areas would be subject to multiple night searches with appropriately trained interdiction (dog) teams. Temporary barriers are preferable to permanent enclosures because of the variable sizes needed for various training activities.

- The Navy would fund additional research to protect ESA-listed and recently delisted species from BTS. From the research and development list provided by the BTS Technical Working Group, the Navy proposes to fund the USGS-led project for integrating canine and human search teams, which would improve snake sightings in low density areas (e.g., to ensure a snake can be found if a sighting occurs on Tinian). Other promising research would also be funded such as chemical irritants to assist dog teams with capture of detected snakes. If successful, this method enhancement would fully integrate three tools: human searching, dog-aided searches, and snake repellents/irritants.
- Additional trapping of BTS and rodent control near new housing areas would be conducted.

#### Potential Conservation Measures and Best Management Practices

##### *Ungulate Management Plan*

This plan is currently being developed by the Navy to control and monitor ungulates including deer, pigs, and carabao on all military lands in Guam; this plan would greatly reduce the habitat degradation currently occurring because of excessive ground disturbance and herbivory; the plan would be extended to include the Joint Region (includes AAFB) and new non-DoD lands proposed for use and would be used to compensate for displacement of ungulates (and resulting greater potential damage in neighboring areas) due to construction at NCTS Finegayan, former FAA parcel, and Harmon Annex.

##### *Wildland Fire Management Plan*

A Wildland Fire Management Plan exists that has been developed by the USFS for Navy lands (USFS 2008). The plan currently includes a series of recommended actions to develop and implement an effective wildland fire management program, covering such topics as staffing, equipment, training, and development and implementation of fire management strategies, prevention, suppression methods, preparedness, impacts, and management techniques. Reasons for not implementing any of the recommendations would be specifically addressed. The plan does not currently address the proposed new ranges at Route 15 and other proposed new training areas so would be updated to address these areas. The plan would also include BMPs such as for cleaning gear and equipment to prevent the spread of invasive species resulting from wildfire suppression. Any impacts related to fire breaks, fire fighting roads, or other land disturbance related to fire management would be addressed in subsequent NEPA documentation.

##### *Micronesian BioSecurity Plan (MBP)*

BTS management plans (Base instructions) for Navy and Air Force lands are currently in place for ongoing operations (see above under existing conservation measures). The military buildup in Guam and CNMI would result in a substantial increase in the amount of cargo and personnel arriving and departing in Guam and the CNMI. This increase would significantly increase the risk of marine and terrestrial invasive species arriving in Guam and the CNMI as well as being transported throughout the region. Invasive species such as the BTS, coconut rhinoceros beetle, cycad scale, fruit fly and numerous other vines, weeds, and pathogens already significantly impact the Pacific region.

Biosecurity is mission critical and actions that prevent or control invasive species support the Executive Order 13112; Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.), as amended (ESA); National Invasive Species Act of 1996; Brown Treesnake Control and Eradication Act of 2004; Sikes Act (16 U.S.C. 670a et seq.); Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855); and the Animal Damage Control Act of 1931, as amended (46 Stat. 1486; 7 U.S.C. 426-426c).

The MBP, including a risk analysis, is currently being developed by the National Invasive Species Council in conjunction with USFWS, USDA, GDAWR, Commonwealth of the Northern Mariana Islands Division of Fish and Wildlife, and other interested parties to facilitate a comprehensive approach to control invasive species export, import, and spread. This comprehensive approach looks at the potential pathways for inadvertent introduction of species and allows for the control or spread of multiple species. This plan intended to be the basis for a large-scale strategic biosecurity plan for Micronesia. Of particular concern is the export of the BTS to other islands in the Pacific. The plan would be comprehensive for all Marine Corps and Navy actions on Guam and CNMI, including those being proposed in this EIS/OEIS. It would include the BTS interdiction and control measures described above as well as additional measures for both BTS and other invasive species.

The risk analysis component would include the following: 1) identification of and ranking of priority species and vectors and potential pathways, particularly those requiring pre-departure mitigation measures for the Micronesian region and Hawaii; these could include, but are not limited to, nuisance and noxious species, construction equipment, personal protective equipment, foot traffic, vehicles and vessels, and shipping material; 2) risk ranking for ports of origin for the Micronesian region; and 3) development of a regional monitoring strategy.

The biosecurity plan component would include the following: 1) certification of goods and transport, standard operating procedures for regional ports, warehouses, shipping and consolidation facilities to include training, inspections and monitoring, early detection of newly establishing species; 2) mitigation measures such as rapid response; 3) a public outreach program; 4) projection of required resources, facilities and manpower to match the planned military build-up with the goal of 100 % prevention, control and treatment for the identified highest risk pathways; and 5) a strategy, produced collaboratively with local and regional officials, on the policy and regulatory changes needed to achieve 100 percent prevention, control and treatment for the identified highest risk pathways, ports of origin, and species for the region.

Once the MBP is developed, the Navy would dedicate resources to address high-priority action items specified in the plan. Regarding cargo inspections and procedures, although the Navy cannot require the inspection of non-DoD cargo, the plan would be available for others to use. The Navy would be working with non-DoD partners to evaluate prioritization and implementation of management actions identified in the MBP

A detailed outline of the MBP would be in the BA that supports Section 7 consultation with USFWS for the preferred actions described in this EIS/OEIS. The MBP elements in the BA would be part of the conservation measures for this EIS/OEIS.

#### *Invasive Species Management*

In addition to ungulate and BTS control and management, management options would be assessed for other invasive species that are threatening special-status or SOGCN species. Insects that are threatening the native cycads and the few remaining fire trees and preventing the recovery of that species would be evaluated and management options would be developed to evaluate and address the problems.

## Potential Mitigation Measures

### *Ecological Reserve and Conservation Area*

The Navy would expand the existing Orote ERA and would consider the creation of new ERAs or conservation areas. Ecological Reserve Areas (ERA) have previously been established on Guam (the Orote and Haputo ERAs) as mitigation for a previous project.

The general objectives of ERAs, as established by guidelines are to identify and protect examples of ecosystems and of physical or biological phenomena;

- Provide research and education opportunities for scientists in the observation and study of the environment;
- Preserve the full range of biological diversity; and
- Provide a basis for organized research and exchange of information on these areas.

According to guidelines in establishing ERAs, those areas should show no evidence of human disturbance over the past fifty-years; however, exceptions may be made for unique or particularly valuable ecological communities. The areas should contain typical or unusual flora or fauna or other biotic phenomena or characteristics or outstanding geologic, pedologic, or aquatic features or processes. ERAs should be large enough to provide essentially unmodified conditions in their interior portions.

Orote ERA would be expanded to protect the Spanish Steps area that has turtle nesting and Orote Island which supports nesting seabirds. The current Orote ERA has a marine unit consisting of 133 ac (54 ha) and a terrestrial unit of 30 ac (12 ha). Orote ERA would be expanded to include Orote Island and Adotgan Point which would add a total of 113 ac (46 ha), of which there would be 81 ac (33 ha) of marine area and 32 ac (13 ha) of terrestrial area.

### *ESA-Protected Sea Turtle Natural History*

Green turtles (*Chelonia mydas*) nest on Navy and Air Force lands along with foraging in the nearshore waters off the installations. As a measure to benefit long-term military mission planning, collection of key information on sea turtles is being considered. Population abundance estimates, demographic information and near shore habitat use of marine turtles in the waters of Guam, Saipan, Tinian and Rota of the Mariana Archipelago is necessary to develop a better understanding of population baseline and long-term ecological processes. Long-term foraging habitat capture-mark-recapture programs combined with laparoscope examinations can acquire necessary abundance estimates as well as growth, reproductive status, and sex ratio information essential for adequate population demographic modeling. A long-term in-water study would provide valuable information regarding near shore foraging habitat use, and combined with applied research techniques including sonic (or acoustic) tags, satellite telemetry, and genetic analysis would provide greater insight into foraging ecology, migratory movements and connectivity within the greater Western Pacific Region.

This would be a joint Navy and NMFS project. It is a 3-5 year capture-mark-recapture laparoscopy program for green sea turtles occurring in near shore waters surrounding Guam, Saipan, Tinian and Rota.

### *Fencing Enclosures and Foraging Plots*

A potential conservation measure would be constructing enclosures similar to those on or proposed at Andersen AFB to exclude one or more of the following: BTS, ungulates, rats, dogs, monitor lizards, and cats. These would be constructed in areas of high quality habitat at NCTS Finegayan and/or at NMS.



Within these areas all feral animals and BTS would be removed to protect special-status species. Foraging plots could be established to ensure quality food sources are present. Invasive plants would be removed.

AAFB is erecting an ungulate-proof fence and eradicating ungulates as a part of their ISR Strike and Redhorse Beddown BOs. After this occurs, an additional step would be to install additional measures to prevent entry by brown treesnake and other feral mammals. This would provide a more complete restoration of the native ecosystem and would set the stage for reintroduction of threatened and endangered species. This multi-phased project could include:

- Forest enhancement by planting of native species that have been removed by typhoons, ungulate browsing, logging, poaching, (such as native breadfruit, joga, ifit, Pisonia)
- Protection and establishment of endangered Serianthes trees
- Development of seedling protectors appropriate for tropical tree species
- Reintroduction of native skink species
- Translocation of native birds non-endangered (Micronesian starlings from AFB, other bird species from Rota, fan-tails, white-eyes)
- Initial release of endangered Guam rail

#### *Greenbelt Development*

An example of greenbelt development on Southern Guam (or NMS) would be reclamation of forest habitat on savanna lands for watershed protection, to limit the spread of wildland fires, and to restore threatened and endangered species habitat. This could include:

- Establish greenbelts of *Acacia* to fix soil nitrogen, build soil quality and limit the spread of wildland fires, extend greenbelts to become continuous forest areas
- Underplanting of *Acacia* with native species, and then
- Reduction of *Acacia* after native species is established

#### *Fencing, Patrols, or Cameras to Exclude Poachers and Prevent Deliberately Set Fires*

A potential conservation measure would be to fence, patrol, or place cameras in certain areas to help prevent intrusion by poachers who may try to illegally take endangered Mariana fruit bats from areas where they currently occur or have the potential to occur in the future, or those who set fires.

### **10.2.3 Alternative 2**

#### 10.2.3.1 North

##### Andersen AFB

For Andersen AFB, Alternative 2 is identical to Alternative 1.

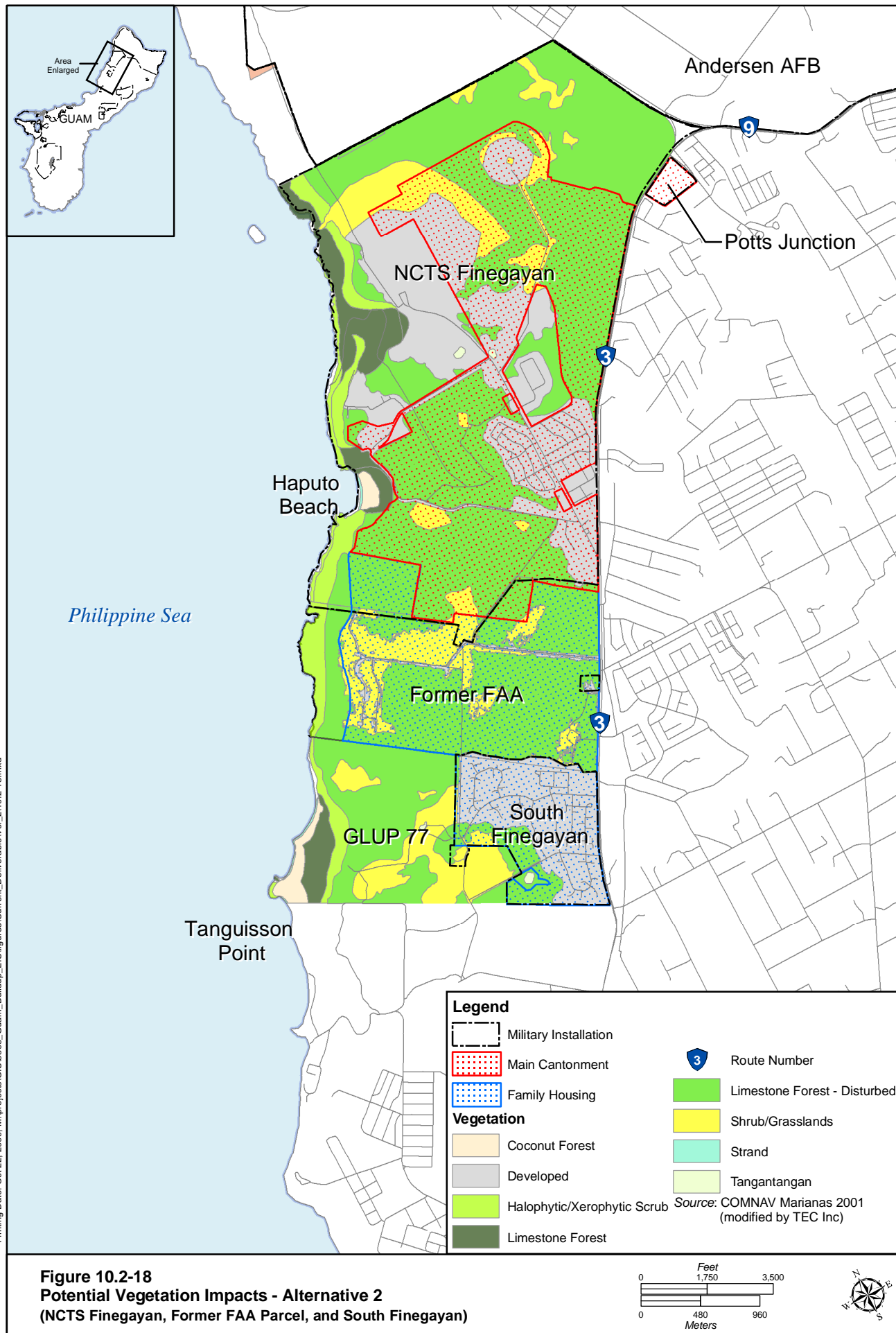
##### Finegayan

##### *Construction*

*Vegetation.* A total of 0.7 ac (0.3 ha) of primary limestone forest and 890 ac (360 ha) of disturbed limestone forest would be removed during proposed construction activities at NCTS Finegayan and South Finegayan (Table 10.2-12 and Figure 10.2-18). Approximately 140 ac (57 ha) of shrub/grassland and 1.0 ac (0.4 ha) of tangantangan would be removed from these same areas.

The limestone forest in these areas is not known to harbor any sensitive plant species identified by a government or conservation groups. It serves as potential habitat for sensitive animal species that are

Printing Date: Oct 22, 2009, M:\projects\GIS\8806\_Guam\_Buildup\_EIS\figures\Current\_Deliverable\Vol\_2\10.2-18.mxd



**Figure 10.2-18**  
**Potential Vegetation Impacts - Alternative 2**  
**(NCTS Finegayan, Former FAA Parcel, and South Finegayan)**

**Table 10.2-12. Potential Impacts to Vegetation Communities at NCTS Finegayan, South Finegayan, and Former FAA Parcel with Implementation of Alternative 2 (ac [ha])**

<i>Parcel and Activity</i>	<i>Limestone Forest, Primary</i>	<i>Limestone Forest, Disturbed</i>	<i>Shrub/Grassland</i>	<i>Tangantangan</i>	<i>Developed</i>
NCTS and South Finegayan Vegetation Removed					
Main Cantonment	0.7 (0.3)	890 (360)	140 (57)	1.0 (0.4)	578 (234)
Former FAA Parcel Vegetation Removed					
Main Cantonment	0	445 (180)	134 (54)	0	26 (11)
<b>Total Vegetation Removed</b>	<b>0.7 (0.3)</b>	<b>1,335 (540)</b>	<b>274 (111)</b>	<b>1.0 (0.4)</b>	<b>604 (244)</b>

addressed under the Special-Status Species section below. The most pristine vegetation and habitats are on Haputo ERA which would remain unchanged. Impacts to vegetation would be less than significant.

*Wildlife.* Wildlife species that currently occur at NCTS Finegayan are species that are common elsewhere on Guam including Pacific golden plover, yellow bittern, black francolin, Eurasian tree sparrow, blue-tailed skink, mutilating gecko, and mourning gecko. Construction activities would displace wildlife from habitat in the proposed project areas. The loss of woody vegetation would result in the loss of nesting areas for the bittern, but this loss would not result in significant adverse effects on its population. Smaller, less mobile species, and those seeking refuge in burrows, could inadvertently be killed during construction activities. However, long-term, permanent impacts to populations of such species would not result because these species are abundant in surrounding areas and would rapidly repopulate portions of the affected area. Therefore, impacts to wildlife would be less than significant with implementation of Alternative 2 at Finegayan.

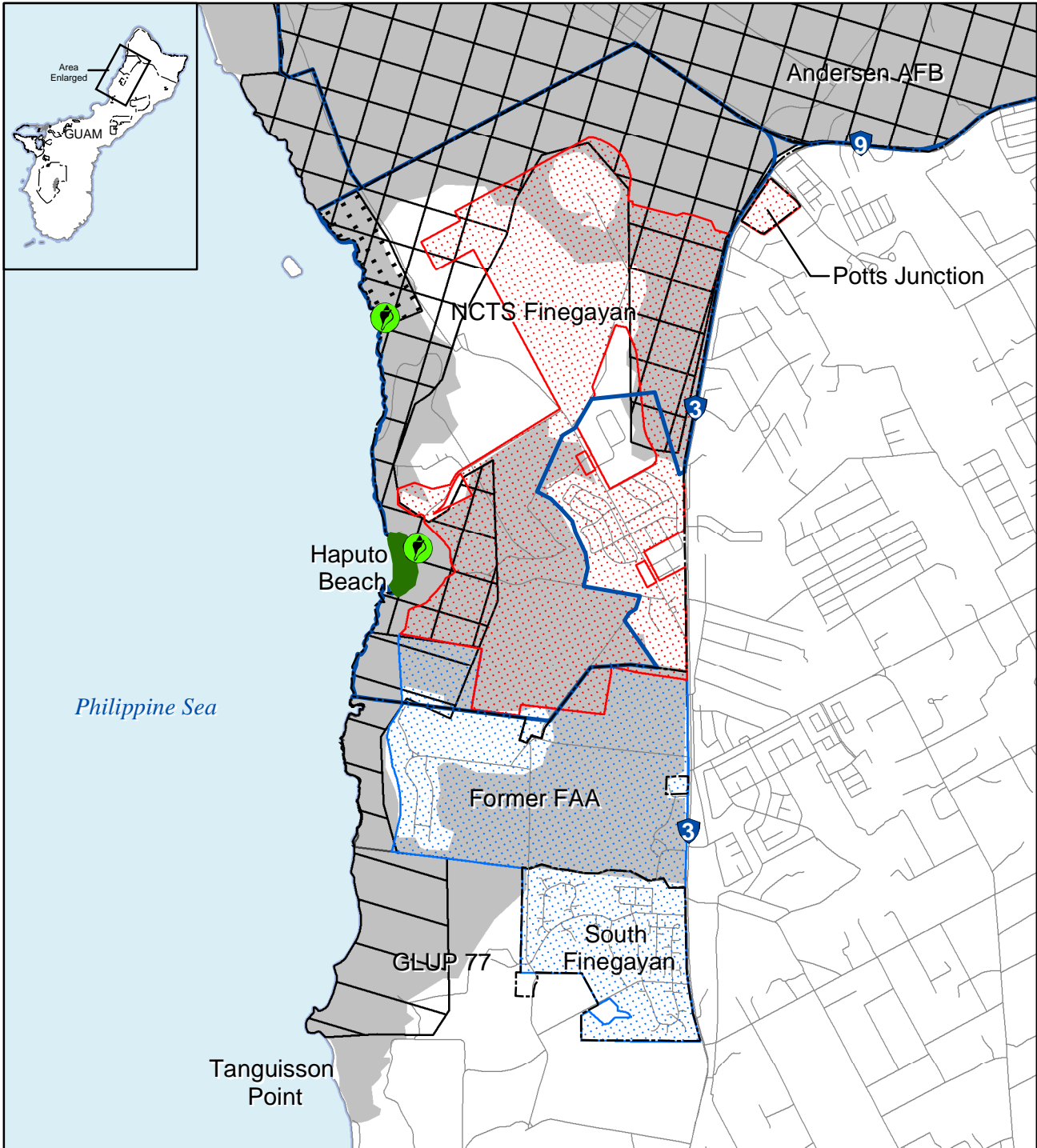
Construction activities for the cantonment would generate noise. Only a few widespread migratory bird species are present that would be affected. They would move away from the construction areas, but there are other areas of habitat nearby. Therefore, indirect impacts to wildlife from construction would be less than significant.

*Special-Status Species.* All main cantonment components would be constructed on the upper plateau area. Haputo ERA would remain as is and would be available to serve as a migration corridor for species moving or dispersing from Andersen AFB to potential habitat further south or from these areas to the north. Proposed construction activities would directly impact habitat for a number of ESA-listed species that currently occur on Guam and impact essential habitat and recovery zones that could serve as potential reintroduction areas for ESA-listed species (Table 10.2-13).

**MARIANA FRUIT BAT.** Sightings of the fruit bat are uncommon at NCTS Finegayan (2 sightings reported in 10 observation days) and occur in the Haputo ERA area or the very northern portion of the facility and there are no known roost areas. Proposed construction activities would include the loss of disturbed limestone forest that is potential, but currently mostly unused foraging and roosting habitat for the Mariana fruit bat. A total of 433 ac (175 ha) of essential habitat would be removed for construction of the various project components on the base (Figure 10.2-19). This essential habitat is also designated Overlay Refuge. Removal of these areas due to construction would have a significant impact. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

Since the fruit bat is rarely observed south of Andersen AFB, noise impacts from construction would be less than significant.

Damage from ungulate disturbance of forested areas is a serious concern in Guam. Ungulate damage on Finegayan ranges from moderate to severe throughout all of Finegayan in the area proposed for the main

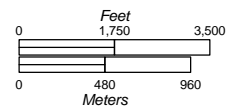


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**Legend**

- |   |                                   |
|---|-----------------------------------|
| Military Installation   | Main Cantonment                   |
| Route Number  | Family Housing                    |
| Mariana Crow Essential Habitat                                      | Mariana Crow Recovery Zones       |
| Mariana Fruit Bat and Guam Micronesian Kingfisher Essential Habitat | Tree Snail Locations              |
|   | Green Sea Turtle Nesting Area     |
|   | Mariana Eight-Spot Butterfly Area |
- Sources: USFWS 2002, 2004, 2005b; Grimm and Farley 2008; Smith et al. 2008

**Figure 10.2-19**  
**Potential Special-Status Species Impacts - Alternative 2**  
**(NCTS Finegayan, Former FAA Parcel, and South Finegayan)**



**Table 10.2-13. Potential Impacts to Special-Status Species Habitat at NCTS Finegayan, South Finegayan, and Former FAA Parcel with Implementation of Alternative 2 (ac [ha])**

<i>Parcel and Activity</i>	<i>Overlay Refuge</i>	<i>Essential Habitat – Bat and Kingfisher</i>	<i>Essential Habitat – Crow</i>	<i>Crow Recovery Zone</i>
<b>Direct Impacts from Construction – Habitat Removed</b>				
NCTS Finegayan Habitat Removed	1106 (448)	433 (175)	379 (153)	800 (324)
Former FAA Parcel Habitat Removed	0	0	0	450 (182)
Total Habitat Removed	1106 (448)	433 (175)	379 (153)	1,250 (506)
Percentage of Habitat Type on Guam that is Removed	5.1 %	1.7 %	1.6 %	3.5 %
<b>Indirect Impacts (unoccupied habitat) – Noise, Lighting, Human Activity</b>				
<b>60 m buffer for MC (F, N) – Ground Ops</b>				
NCTS and South Finegayan	104 (42)	NA	38 (29)	87 (35)
Former FAA Parcel	2.6 (1.1)	NA	0	24 (10)
Totals	107 (43)	NA	38 (29)	111 (45)
<b>100 m buffer for KF (F, N) – Ground Ops</b>				
NCTS and South Finegayan	166 (67)	135 (55)	NA	NA
Former FAA Parcel	5.7 (2.3)	25 (10)	NA	NA
Totals	172 (70)	160 (65)	NA	NA
<b>150 m buffer for FB (R) – Ground Ops</b>				
NCTS and South Finegayan	242 (98)	202 (82)	NA	NA
Former FAA Parcel	12 (4.9)	51 (21)	NA	NA
Totals	254 (103)	253 (102)	NA	NA

Notes: Each habitat category is considered independently of others and is not additive. NA – Not applicable; FB – Fruit Bat, MC – Mariana Crow, KF – kingfisher; F – Foraging, R – Roosting/Colony, N – Nesting.

cantonment. Removal of the large amounts of habitat required for construction under Alternative 2 would displace feral pigs and deer into adjacent areas resulting in even greater density than currently exists. Assuming a potential density of 0.07 deer/ac (0.17 deer/ha) (NAVFAC Marianas 2009) and 0.15 pigs/ac (0.38 pigs/ha) (Knutson and Vogt 2002) and the total of 1,032 ac (418 ha) forest or shrubland to be removed, the number displaced would be 72 deer and 155 pigs. This additional ungulate activity would result in significant impacts to the Mariana fruit bat because of degradation of essential habitat. As mitigation, an ungulate management plan would be developed and implemented to control ungulates and to compensate for displacement of ungulates into adjacent areas due to construction at NCTS Finegayan. With this mitigation, impacts to fruit bat habitat from ungulate habitat damage would be less than significant.

**GUAM MICRONESIAN KINGFISHER.** The kingfisher is not currently present in the wild. Proposed construction activities would include the loss of limestone forest that is potential habitat for the possible future introduction of the kingfisher. A total of 433 ac (175 ha) of essential habitat would be removed for construction of the various project components on the base (see Table 10.2-13). This essential habitat is also designated Overlay Refuge. Removal of these areas due to construction would have a significant impact because of the removal of habitat areas designated as Overlay Refuge and essential habitat for the conservation and reintroduction of the species. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

Concerns regarding damage to kingfisher essential habitat from ungulates as an indirect result of construction would be similar to that already described for the fruit bat. With mitigation, impacts from ungulate habitat damage would be less than significant.

**MARIANA CROW.** Proposed construction activities would include the loss of limestone forest that is potential foraging and nesting habitat for the Mariana crow, although the crow does not currently occur on Finegayan. A total of 379 ac (153 ha) of essential habitat would be removed for construction of the various project components on the base (Table 10.2-13). This essential habitat is also designated Overlay Refuge. Removal of these areas due to construction would have a significant impact. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

Concerns regarding damage to Mariana crow designated essential habitat from ungulates as an indirect result of construction would be similar to that already described for the fruit bat. With mitigation, impacts from ungulate habitat damage would be less than significant.

**GUAM RAIL.** The rail survives only in captivity at this time. Proposed construction activities would include the loss of shrub/grassland habitat that is potential foraging and nesting habitat for the Guam rail. No specific areas of essential habitat have been designated for this species but 140 ac (57 ha) of favorable shrub/grasslands habitat contained within the Overlay Refuge would be removed. However, because the Guam rail is currently extirpated in the wild and most of Guam has habitat that is potentially suitable for the recovery of the species, removal of these areas due to construction would result in a less than significant impact.

**PACIFIC SLENDER-TOED GECKO.** This Guam-listed species was detected in recent natural resource surveys in northeastern NCTS Finegayan in the northeast portion of the footprint of the proposed construction area. The abundance is unknown in the area surveyed or in others areas. This species is known to be present in other areas on Guam (for example, on NMS where it was detected in project-specific surveys). Based on its habitat preference of forest edge habitat on rocky substrates, the species is likely to be present in other locations. Because the species was uncommonly observed in project-specific surveys, the only area-wide surveys conducted on Guam within the past several decades, the numbers remaining of this species is unknown. As mitigation additional surveys would be conducted for this species on NCTS Finegayan to determine its distribution there and potential impacts to the population on Guam. If the Guam population was found to be affected, a habitat improvement project would be included for the species at NMS, where the species was also found during project-specific surveys. With this mitigation, impacts would be less than significant.

**ALL SPECIAL-STATUS SPECIES.** Removal of land under Alternative 2 would displace and concentrate feral pigs and Philippine deer into adjacent areas. Greater amounts of habitat would be removed under Alternative 2 versus under Alternative 1. Assuming a potential density of 0.07 deer/ac (0.17 deer/ha) (NAVFAC Marianas 2009) and 0.15 pigs/ac (0.38 pigs/ha) (Knutson and Vogt 2002) and the total of 1,031 ac (417 ha) of forest or shrubland to be removed, the number displaced would be approximately 72 deer and 155 pigs. This additional ungulate activity would result in significant impacts to all special-status species because of degradation of essential habitat and Overlay Refuge. As mitigation, an existing ungulate management plan that is currently being finalized would be updated to include specific management and control for the increase in ungulates resulting from this action and the plan would be implemented at NCTS Finegayan. Mitigation measures are further described in Section 10.2.2.6. With mitigation, impacts to habitat from ungulates would be less than significant.

### *Operation*

*Vegetation.* There would be no impacts to vegetation.

*Wildlife.* Impacts to wildlife would be the same as for Alternative 1.

*Special-Status Species.* Impacts to special-status species would be the same as for Alternative 1 except that the indirect impacts to special-status species from avoidance of essential habitat near human activity resulting from housing and during operations and maintenance, and perimeter and facility lighting at night would affect essential habitat as follows (see Table 10.2-13): Mariana fruit bat - 202 ac (82 ha); Micronesian kingfisher – 135 ac (55 ha); and Mariana crow – 38 ac (29 ha). Indirect impacts from these human activities and lighting would be significant. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

#### Non-DoD Land

##### *Construction*

*Vegetation.* A total of 445 ac (180 ha) of disturbed limestone forest would be removed during proposed construction activities on the former FAA parcel (see Table 10.2-13). Approximately 134 ac (54 ha) of shrub/grassland would also be removed. The limestone forest is not known to harbor any sensitive plant species identified by government or conservation groups. It serves as potential habitat for sensitive animal species that are addressed under the Special-Status Species section below. Impacts to vegetation would be less than significant.

*Wildlife.* Wildlife species that currently occur at the former FAA parcel are similar to those that occur at NCTS Finegayan. Based on the similar types of actions occurring here as at Finegayan, there would be no significant impacts to wildlife with implementation of Alternative 2.

Construction activities for the cantonment would generate noise. Only a few widespread migratory bird species are present that would be affected. They would move away from the construction areas, but there are other areas of habitat nearby. Therefore, indirect impacts to wildlife from construction would be less than significant.

*Special-Status Species.* All main cantonment components would be constructed on the upper plateau area. Proposed construction activities could directly impact habitat for a number of ESA-listed species that currently occur on Guam and impact essential habitat and recovery zones that could serve as potential reintroduction areas for ESA-listed species that are currently extirpated or nearly extirpated from Guam.

**MARIANA CROW.** Proposed construction activities would include the loss of forested areas that are within a suggested recovery zone for the crow. A total of 450 ac (182 ha) of this recovery zone would be removed for construction of the various project components on the base (see Table 10.2-13). No Overlay Refuge is designated in this area. Removal of these areas due to construction would have a significant impact. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

Ungulate damage on the former FAA parcel is generally moderate in the area proposed for the main cantonment. Removal of the large amounts of habitat required for construction under Alternative 2 would displace feral pigs and deer into adjacent areas resulting in even greater density that currently exist. Assuming a potential density of 0.07 deer/ac (0.17 deer/ha) (NAVFAC Marianas 2009) and 0.15 pigs/ac (0.38 pigs/ha) (Knutson and Vogt 2002) and the total of 579 ac (234 ha) forest or shrubland to be removed, the number displaced would be 41 deer and 87 pigs. This additional ungulate activity would result in significant impacts to the Mariana crow because of degradation of recovery zone habitat. As mitigation, a plan would be developed and implemented to control ungulates to compensate for displacement due to construction at the former FAA parcel. With this mitigation, impacts would be less than significant.

GUAM RAIL. The rail survives only in captivity at this time. Proposed construction activities would include the loss of shrub/grassland habitat that is potential foraging and nesting habitat for the Guam rail. No Overlay Refuge is designated in this area. No specific areas of essential habitat or other habitat have been designated for this species but 134 ac (54 ha) of favorable shrub/grasslands habitat would be removed. Because the rail is not currently present at this location and no specific habitat areas have been designated, construction would have a less than significant impact.

#### *Operation*

*Vegetation.* There would be no impacts to vegetation.

*Wildlife.* Impacts to wildlife would be the same as for Alternative 1.

*Special-Status Species.* There would be no direct impacts from operations. Impacts to special-status species would be the same as for Alternative 1 except that the indirect impacts to special-status species from avoidance of habitat near human activity resulting from housing and during operations and maintenance, and perimeter and facility lighting at night would affect essential habitat as follows (Table 10.2-13): Mariana fruit bat - 51 ac (21 ha); and Micronesian kingfisher – 25 ac (10 ha). Indirect impacts from these human activities and lighting would be significant. Impacts would be mitigated to less than significant with a suite of actions described in Section 10.2.2.6.

#### 10.2.3.2 Central

##### Andersen South

For Andersen South, Alternative 2 is identical to Alternative 1.

##### Non-DoD Land

For non-DoD land, Alternative 2 is identical to Alternative 1.

#### 10.2.3.3 Apra Harbor

For Apra Harbor, Alternative 2 is identical to Alternative 1.

#### 10.2.3.4 South

For NMS, Alternative 2 is identical to Alternative 1.

#### 10.2.3.5 Summary of Impacts

Construction impacts would include direct significant impacts to vegetation from loss of 28 ac (11 ha) of primary limestone forest; direct significant impacts to the endangered Mariana fruit bat and Micronesian kingfisher from clearing of 568 ac (230 ha) of essential habitat and to the endangered Mariana crow from clearing of 514 ac (208 ha) of essential habitat. There would be direct impact to 1,211 ac (490 ha) of Overlay Refuge, which includes the essential habitat just listed and other additional lands. There would be additional direct significant impacts to the Mariana fruit bat and indirect significant effects to the Mariana crow and Micronesian kingfisher due to loss of habitat in areas surrounding new facilities because of noise and lighting from facility operations and aircraft takeoff and landings. The specific habitat requirements of special-status species impacted are not understood well enough to conclude that the type of habitat that would remain upon implementation of the proposed action is adequate to meet the goals of the recovery plans. There would be significant impacts to the Guam-listed Pacific slender-toed gecko that is present in the construction footprint. There would be potential significant direct impacts to a Guam endangered tree species at non-DoD Route 15 lands, mitigated to less than significant. Other indirect effects are described in Table 10.2-15.



Overall effects for all actions being proposed in this EIS/OEIS are in Volume 7.

#### 10.2.3.6 Potential Mitigation Measures

Conservation measures, BMPs, and mitigation measures would be the same as those identified for Alternative 1 with adjustments based on amount of designated habitat areas impacted. An additional mitigation measure would be implemented for the Pacific slender-toed gecko since the species is known to occur in the area that would be removed in northeast Finegayan, Mitigation would include additional surveys conducted for this species on NCTS Finegayan to determine its distribution there and potential impacts to the population on Guam. If the Guam population was found to be affected, a habitat improvement project would be included for the species at NMS, where the species was also found during project-specific surveys.

### 10.2.4 Alternative 3

#### 10.2.4.1 North

##### Andersen AFB

For Andersen AFB, Alternative 3 is identical to Alternative 1.

##### Finegayan

For NCTS and South Finegayan, Alternative 3 is identical to Alternative 2. Figures are provided showing vegetation (Figure 10.2-20) and special-status species (Figure 10.2-21) for the layout of the cantonment area.

##### Non-DoD Land

Alternative 3 does not include acquisition or use of the non-DoD lands identified as the former FAA parcel and the Harmon Annex.

#### 10.2.4.2 Central

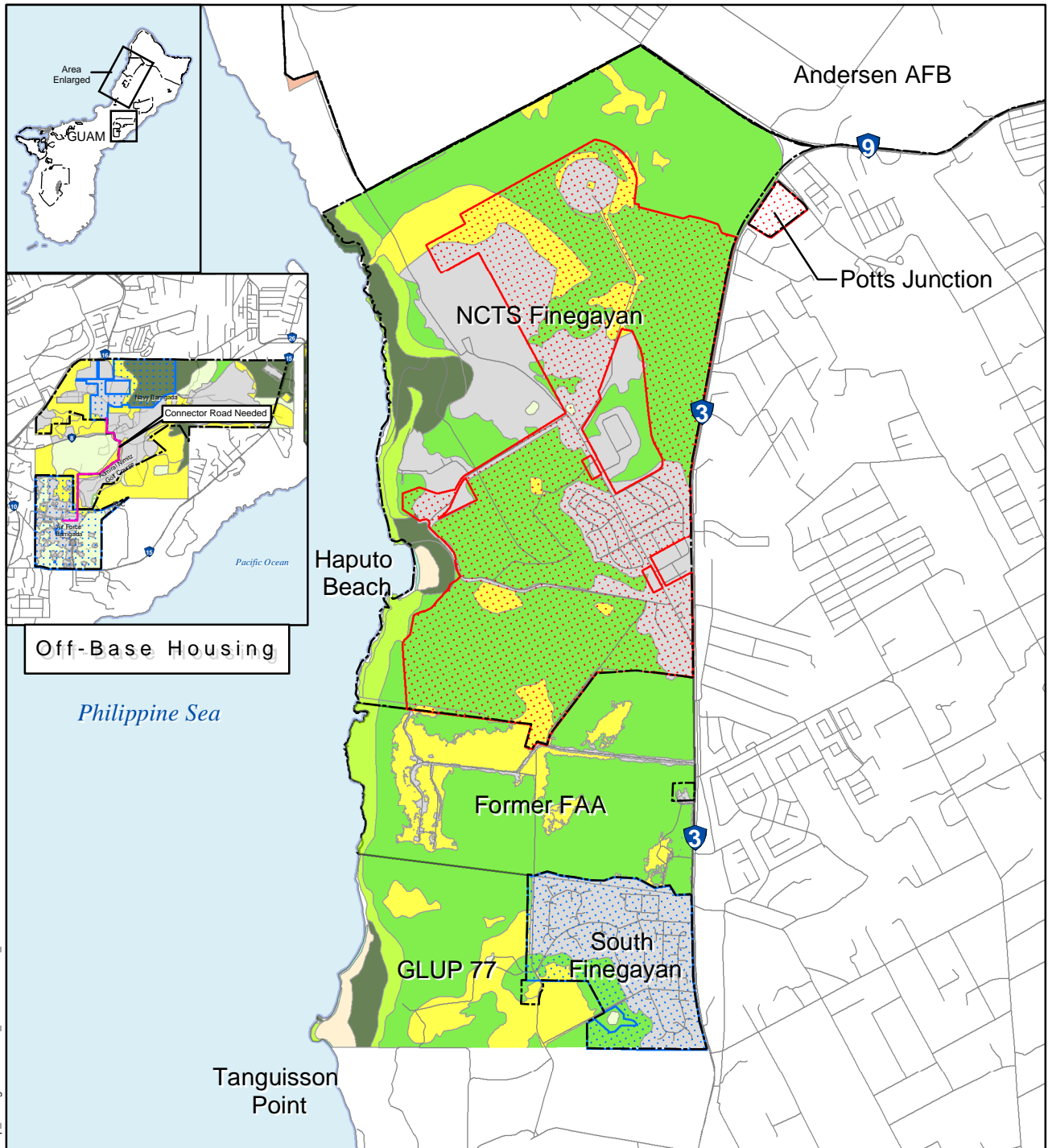
##### Andersen South

For Andersen South, Alternative 3 is identical to Alternative 1.

##### Navy and Air Force Barrigada

##### *Construction*

*Vegetation.* A total of 153 ac (62 ha) of primary (mature forest dominated by native species) limestone forest would be removed during proposed construction activities at Barrigada (Table 10.2-14 and Figure 10.2-20). Approximately 122 ac (49 ha) of shrub/grassland and 197 ac (80 ha) of tangantangan would be removed from these same areas. The limestone forest in these areas is not known to harbor any sensitive plant species identified by a government or conservation groups. It serves as potential habitat for sensitive animal species that are addressed under the Special-Status Species section below. Impacts would be significant.

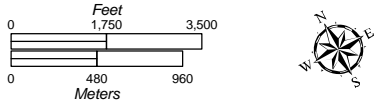


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**Legend**

Military Installation	Route Number
Main Cantonment	Limestone Forest - Disturbed
Family Housing	Shrub/Grasslands
<b>Vegetation</b>	Strand
Coconut Forest	Tangantangan
Developed	<i>Source: COMNAV Marianas 2001 (modified by TEC Inc)</i>
Halophytic/Xerophytic Scrub	
Limestone Forest	

**Figure 10.2-20**  
**Potential Vegetation Impacts - Alternative 3**  
**(NCTS Finegayan, South Finegayan, Navy Barrigada, and Air Force Barrigada)**



**Table 10.2-14. Potential Impacts to Vegetation Communities at Navy and Air Force Barrigada with Implementation of Alternative 3 (ac [ha])**

<i>Parcel and Activity</i>	<i>Limestone Forest</i>	<i>Shrub/ Grassland</i>	<i>Tangantangan</i>	<i>Developed</i>
Air Force Barrigada (Vegetation Removed)				
Air Force Barrigada	0	42 (17)	197 (80)	190 (77)
Navy Barrigada (Vegetation Removed)				
Navy Barrigada	153 (62)	80 (32)	0	143 (58)
<b>Total Vegetation Removed</b>	<b>153 (62)</b>	<b>122 (49)</b>	<b>197 (80)</b>	<b>330 (134)</b>

*Wildlife.* Wildlife species that currently occur at Navy Barrigada are native and non-native species that are common elsewhere on Guam such as Pacific golden plover, yellow bittern, island collared dove, western cattle egret, black francolin, Eurasian tree sparrow, blue-tailed skink, mutilating gecko, and mourning gecko. It is assumed that similar species would be present at Air Force Barrigada. Proposed construction activities would displace wildlife from habitat in the proposed project areas. Smaller, less mobile species, and those seeking refuge in burrows, could inadvertently be killed during construction activities; however, long-term, permanent impacts to populations of such species would not result because these species are abundant in surrounding areas and would rapidly repopulate portions of the affected area. Therefore, there impacts to wildlife would be less than significant.

Construction activities for the operation buildings and housing would generate noise. Only a few widespread migratory bird species are present that would be affected. They would move away from the construction areas, but there are other areas of habitat nearby. Therefore, indirect impacts to wildlife from construction would be less than significant.

*Special-Status Species.* Proposed construction activities would not impact any designated habitat areas.

**GUAM TREE SNAIL.** The Guam tree snail, an ESA candidate species, was documented in the limestone forest at Navy Barrigada (Figure 10.2-21) on one transect during site-specific surveys in 2008 in support of this EIS/OEIS. The distribution and numbers of tree snails at the site is unknown. Proposed construction activities would remove primary limestone forest, the habitat of the Guam tree snail, and would result in direct mortality of individuals. Mitigation would include the relocation of snails to another location with habitat that could support the species. With this mitigation, impact on the Guam tree snail would be less than significant.

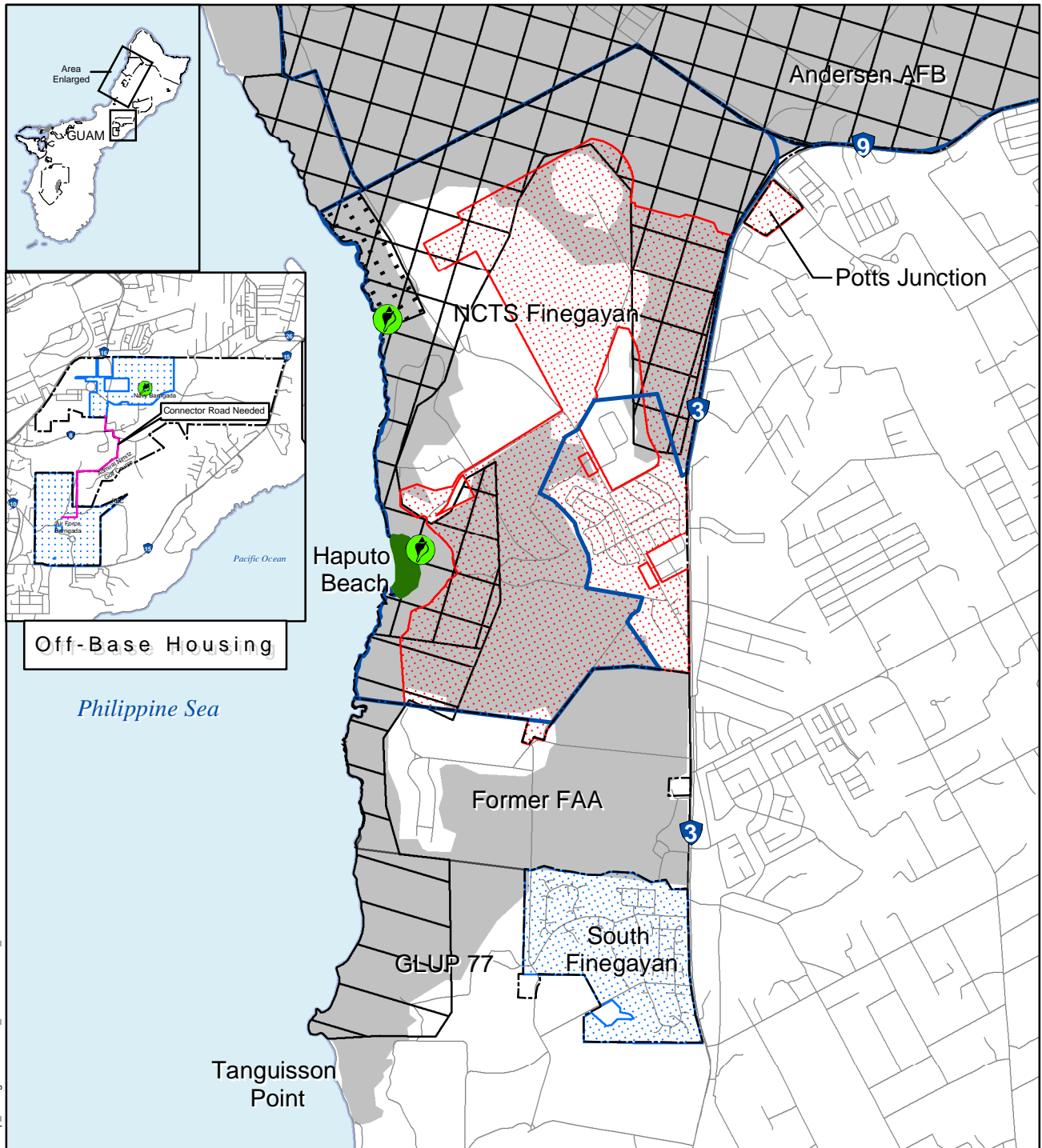
#### *Operation*

*Vegetation.* There would be no impacts to vegetation.

*Wildlife.* There would be no direct impacts to wildlife because operations would occur in previously cleared areas.

Operational activities would generate noise throughout the area. However, migratory bird species or other native wildlife that would otherwise use the area are common throughout Guam and are generalists that can utilize numerous habitats that are abundant throughout Guam. Therefore, noise and activity from operations associated with the proposed action would be less than significant.

*Special-Status Species.* There would be no direct impacts from operations on special-status species. The only special-status species that might occasionally use the area and be affected indirectly is the Mariana fruit bat but based on historical observations this would be infrequent. Impacts to special-status species would be less than significant.



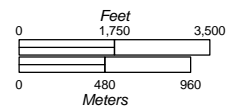
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**Legend**

Military Installation	Main Cantonment
Route Number	Family Housing
Mariana Crow Essential Habitat	Overlay Refuge
Mariana Fruit Bat and Guam Micronesian Kingfisher Essential Habitat	Mariana Crow Recovery Zones
	Tree Snail Locations
	Green Sea Turtle Nesting Area
	Mariana Eight-Spot Butterfly Area

Sources: USFWS 2002, 2004c, 2005b; (Turtle) Andersen AFB 2008b

**Figure 10.2-21**  
**Potential Special-Status Species Impacts - Alternative 3**  
**(NCTS Finegayan, South Finegayan, Navy Barrigada, and Air Force Barrigada)**



### Non-DoD Land

Alternative 3 is identical to Alternative 1.

#### 10.2.4.3 Apra Harbor

For Apra Harbor, Alternative 3 is identical to Alternative 1.

#### 10.2.4.4 South

For NMS, Alternative 3 is identical to Alternative 1.

#### 10.2.4.5 Summary of Impacts

Construction impacts would include direct significant impacts to vegetation from loss of 28 ac (11 ha) of primary limestone forest; direct significant impacts to the endangered Mariana fruit bat and Micronesian kingfisher from clearing of 568 ac (230 ha) of essential habitat and to the endangered Mariana crow from clearing of 514 ac (208 ha) of essential habitat. There would be direct impact to 1,211 ac (490 ha) of Overlay Refuge which includes the essential habitat just listed and other additional lands. There would be additional direct significant impacts to the Mariana fruit bat and indirect significant effects to the Mariana crow and Micronesian kingfisher due to loss of habitat in areas surrounding new facilities because of noise and lighting from facility operations and aircraft takeoff and landings. The specific habitat requirements of special-status species impacted are not understood well enough to conclude that the type of habitat that would remain upon implementation of the proposed action is adequate to meet the goals of the recovery plans. There would be significant impacts to the Guam-listed Pacific slender-toed gecko that is present in the construction footprint. There would be potential significant direct impacts to a Guam endangered tree species at non-DoD lands at Route 15, mitigated to less than significant.

Overall effects for all actions being proposed in this EIS/OEIS are in Volume 7.

#### 10.2.4.6 Potential Mitigation Measures

Mitigation measures would be the same as those identified for Alternative 2. In addition, a plan to translocate Guam tree snails at Navy Barrigada to another site on DoD lands would be developed and implemented after approval by USFWS. Additional mitigation would be completed for the destruction of primary limestone forest at Navy Barrigada which is habitat for the Guam tree snail. The mitigation would be improvement of existing primary limestone habitat by removal of invasive plants or additional fencing. Habitat improvement is described further under Alternative 1 mitigation.

### **10.2.5 Alternative 8**

#### 10.2.5.1 North

##### Andersen AFB

For Andersen AFB, impacts from Alternative 8 would be identical to Alternative 1.

##### Finegayan

For Finegayan, impacts from Alternative 8 would be the same as Alternative 1. Figures are provided showing vegetation (Figure 10.2-22) and special-status species (Figure 10.2-23) for the layout of the cantonment area.

### Non-DoD Land

For non-DoD land, impacts from Alternative 8 would be identical to Alternative 2. Figures are provided showing vegetation (Figure 10.1-22) and special-status species (Figure 10.2-23) for the layout of the cantonment area.

#### 10.2.5.2 Central

### Andersen South

For Andersen South, impacts from Alternative 8 would be identical to Alternative 1.

### Barrigada

For Air Force Barrigada, impacts would be the same as for Alternative 3. Figures are area provided showing vegetation (Figure 10.2-22) and special-status species (Figure 10.2-23) for the layout of the cantonment area.

### Non-DoD Land

For non-DoD lands, impacts from Alternative 8 would be identical to Alternative 1.

#### 10.2.5.3 Apra Harbor

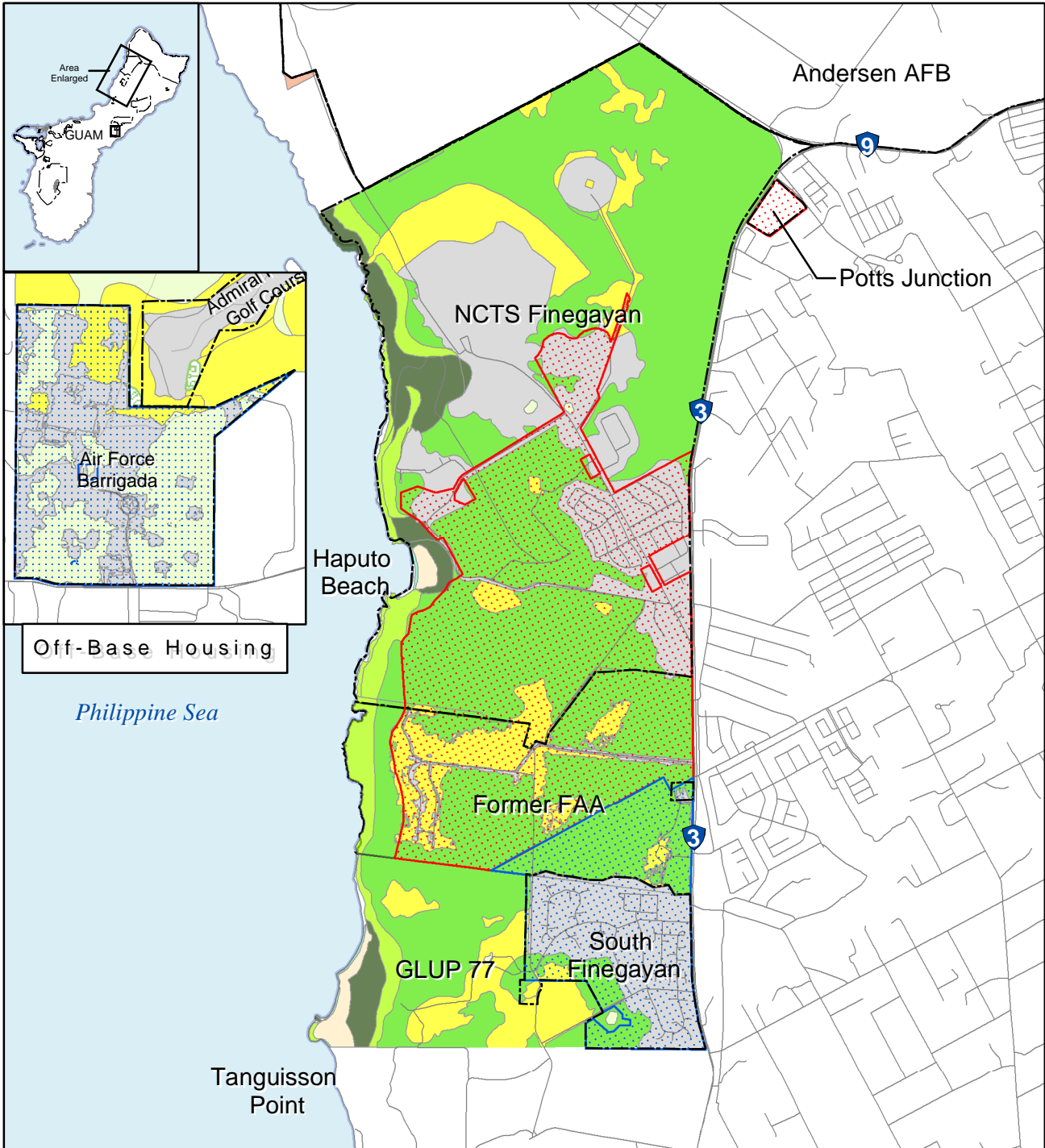
For Apra Harbor, impacts from Alternative 8 would be identical to Alternative 1.

#### 10.2.5.4 South

For NMS, impacts from Alternative 8 would be identical to Alternative 1.

#### 10.2.5.5 Summary of Impacts

Construction would cause direct significant impacts to vegetation from loss of 28 ac (11 ha) of primary limestone forest; direct significant impacts to the endangered Mariana fruit bat and Micronesian kingfisher from clearing of 309 ac (125 ha) of essential habitat and to the endangered Mariana crow from clearing of 254 ac (103 ha) of essential habitat. There would be direct impacts to 704 ac (285 ha) of Overlay Refuge, which includes the essential habitat just listed and other additional lands. There would be additional direct significant impacts to the Mariana fruit bat and indirect significant effects to the Mariana crow and Micronesian kingfisher due to loss of habitat in areas surrounding new facilities because of noise and lighting from facility operations and aircraft takeoff and landings. The specific habitat requirements of special-status species impacted are not understood well enough to conclude that the type of habitat that would remain upon implementation of the proposed action is adequate to meet the goals of the recovery plans. There would be potential significant direct impacts to a Guam endangered tree species on non-DoD lands at Route 15, mitigated to less than significant.

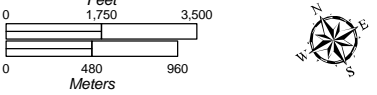


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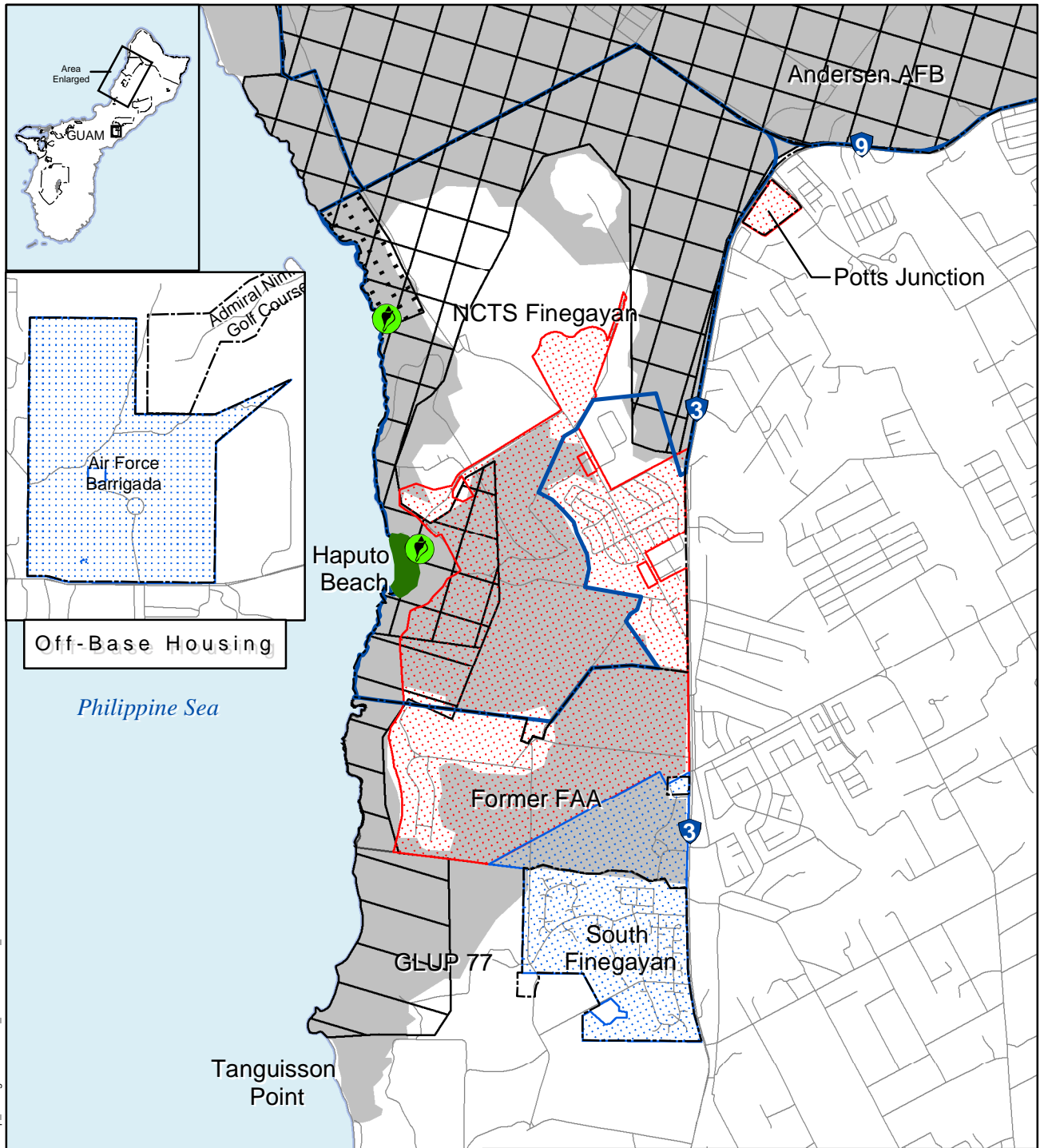
Legend	
	Military Installation
	Main Cantonment
	Family Housing
<b>Vegetation</b>	
	Coconut Forest
	Developed
	Halophytic/Xerophytic Scrub
	Limestone Forest
	Route Number
	Limestone Forest - Disturbed
	Shrub/Grasslands
	Strand
	Tangantangan

Source: COMNAV Marianas 2001 (modified by TEC Inc)

**Figure 10.2-22**  
**Potential Vegetation Impacts - Alternative 8**  
**(NCTS Finegayan, Former FAA Parcel, South Finegayan, and Air Force Barrigada)**







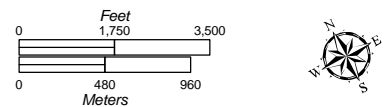
Printing Date: Oct 25, 2009, M:\projects\GIS\806\_Guam\_Buildup\_EIS\figures\Current\_Deliverable\Vol\_2\10.2-23.mxd

**Legend**

Military Installation	Main Cantonment
Route Number	Family Housing
Mariana Crow Essential Habitat	Mariana Crow Recovery Zones
Mariana Fruit Bat and Guam Micronesian Kingfisher Essential Habitat	Tree Snail Locations
	Green Sea Turtle Nesting Area
	Mariana Eight-Spot Butterfly Area

Sources: USFWS 2002, 2004, 2005b; Grimm and Farley 2008; Smith et al. 2008

**Figure 10.2-23**  
**Potential Special-Status Species Impacts - Alternative 8**  
**(NCTS Finegayan, Former FAA Parcel, South Finegayan, and Air Force Barrigada)**





10.2.5.6 Potential Mitigation Measures

Mitigation measures would be the same as those identified for Alternative 1 with adjustments based on amount of designated habitat areas impacted.

10.2.6 No-Action Alternative

Under the no-action alternative, Marine Corps units would remain in Japan and would not relocate to Guam. No construction, dredging, training, or operations associated with the military relocation would occur and the Marine Corps would not meet readiness, mission and international treaty obligations. Existing conditions on Guam would continue. Therefore, implementation of the no-action alternative would maintain existing conditions and there would be no impacts associated with the proposed action and alternatives. Implementation of the no-action alternative would not meet the mission, readiness, national security and international treaty obligations of the Marine Corps.

10.2.7 Summary of Impacts

Tables 10.2-15 through 10.2-18 summarize the potential impacts of each action alternative associated with the Main Cantonment, firing range training, ammunition storage, and NMS access roads. Table 10.2-23 summarizes the potential impacts of other training, airfield, and waterfront components of the proposed action. A text summary is provided below.

**Table 10.2-15. Summary of Main Cantonment Impacts – Alternatives 1, 2, 3 and 8**

<i>Main Cantonment Alternative 1 (North)</i>	<i>Main Cantonment Alternative 2 (North)</i>	<i>Main Cantonment Alternative 3 (North/Central)</i>	<i>Main Cantonment Alternative 8 (North/Central)</i>
<b>Construction</b>			
<ul style="list-style-type: none"> <li>• WL: SI-M. Significant potential indirect impacts due to increases in feral animals surrounding the main cantonment, mitigated to less than significant.</li> <li>• SS: SI-M. Significant potential direct impacts due to removal of essential habitat or Overlay Refuge for several endangered species at NCTS Finegayan, former FAA parcel.</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations.</li> </ul>	<ul style="list-style-type: none"> <li>• WL: SI-M. Significant potential indirect impacts due to increases in feral animals surrounding the main cantonment.</li> <li>• SS: SI-M. Significant potential direct impacts due to removal of essential habitat or Overlay Refuge for several endangered species at Finegayan, former FAA parcel,</li> <li>• SS: SI-M. Significant impacts to the Guam-listed Pacific slender-toed gecko.</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations.</li> </ul>	<ul style="list-style-type: none"> <li>• VG: SI. Significant potential direct impacts due to construction at Navy Barrigada that would remove primary limestone forest.</li> <li>• WL: SI-M. Significant potential indirect impacts due to increases in feral animals surrounding the main cantonment.</li> <li>• SS: SI-M. Significant potential direct impacts due to removal of essential habitat or Overlay Refuge for several endangered species at NCTS Finegayan</li> <li>SS: SI-M. Significant impacts to the Guam-listed Pacific slender-toed gecko.</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations.</li> </ul>	<ul style="list-style-type: none"> <li>• WL: SI-M. Significant potential indirect impacts due to increases in feral animals surrounding the main cantonment</li> <li>• SS: SI-M. Significant potential direct impacts due to removal of essential habitat or Overlay Refuge for several endangered NCTS Finegayan, former FAA parcel</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations.</li> </ul>

<i>Main Cantonment Alternative 1 (North)</i>	<i>Main Cantonment Alternative 2 (North)</i>	<i>Main Cantonment Alternative 3 (North/Central)</i>	<i>Main Cantonment Alternative 8 (North/Central)</i>
<b>Operation</b>			
<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Significant potential indirect impacts due to increased recreation at Haputo ERA</li> <li>• SS: SI-M. Significant potential indirect impacts from noise and other disturbance to ESA-listed species</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations</li> </ul>	<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Significant potential indirect impacts due to increased recreation at Haputo ERA</li> <li>• SS: SI-M. Significant potential indirect impacts from noise and other disturbance to ESA-listed species</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations</li> </ul>	<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Significant potential indirect impacts due to increased recreation at Haputo ERA</li> <li>• SS: SI-M. Significant potential indirect impacts from noise and other disturbance to ESA-listed species</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations</li> </ul>	<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Significant potential indirect impacts due to increased recreation at Haputo ERA</li> <li>• SS: SI-M. Significant potential indirect impacts from noise and other disturbance to ESA-listed species</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations</li> </ul>

Legend: VG = Vegetation, WL = Wildlife, SS = Special-Status species, SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact.

**Table 10.2-16. Summary of Training Impacts – Firing Range Alternatives**

<i>Firing Range Alternative A (Central)</i>	<i>Firing Range Alternative B (Central)</i>
<b>Construction</b>	
<ul style="list-style-type: none"> <li>• VG: SI. Significant potential direct impacts due to construction at Route 15 Lands that would remove primary limestone forest</li> <li>• WL: LSI. Less than significant impacts</li> <li>• SS: SI-M. Significant potential direct impacts due to removal of essential habitat or for several endangered species at Route 15 Lands</li> <li>• SS: SI-M. Potential removal of a Guam-listed tree species</li> <li>• SS: SI-M. Potential indirect impacts from invasive species at all locations</li> </ul>	<ul style="list-style-type: none"> <li>• VG: SI. Significant potential direct impacts due to construction at Route 15 Lands that would remove primary limestone forest</li> <li>• WL: LSI. Less than significant impacts</li> <li>• SS: SI-M. Potential indirect impacts from invasive species at all locations</li> </ul>
<b>Operation</b>	
<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Potential direct and indirect impacts from noise and other disturbance to ESA-listed species</li> <li>• SS: SI-M. Potential indirect impacts from wildfire effects</li> <li>• SS: SI-M. Potential indirect impacts from invasive species at all locations</li> </ul>	<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Potential direct and indirect impacts from noise and other disturbance to ESA-listed species</li> <li>• SS: SI-M. Potential indirect impacts from wildfire effects</li> <li>• SS: SI-M. Potential indirect impacts from invasive species at all locations</li> </ul>

Legend: VG = Vegetation, WL = Wildlife, SS = Special-Status species, SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact.

**Table 10.2-17. Summary of Training Impacts – Ammunition Storage Alternatives**

<i>Ammunition Storage Alternative A (South)</i>	<i>Ammunition Storage Alternative B (South)</i>
<b>Construction</b>	
<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Potential indirect impacts from invasive species at all locations</li> </ul>	<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: LSI</li> </ul>
<b>Operation</b>	
<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Potential indirect impacts from invasive species at all locations</li> </ul>	<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: LSI</li> </ul>

Legend: VG = Vegetation, WL = Wildlife, SS = Special-Status species, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact.

**Table 10.2-18. Summary of Training Impacts – NMS Access Roads Alternatives**

<i>Access Road Alternative A (South)</i>	<i>Access Road Alternative B (South)</i>
<b>Construction</b>	
<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Potential indirect impacts from invasive species at all locations</li> </ul>	<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: LSI</li> </ul>
<b>Operation</b>	
<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Potential indirect impacts from invasive species at all locations</li> </ul>	<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: LSI</li> </ul>

Legend: VG = Vegetation, WL = Wildlife, SS = Special-Status species, SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact.

**Table 10.2-19. Summary of Other Training, Airfield, and Waterfront Component Impacts**

<i>Other Training (North/Central/South)</i>	<i>Airfield (North)</i>	<i>Waterfront (Apra Harbor)</i>
<b>Construction</b>		
<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Significant direct impacts due to removal of essential habitat or Overlay Refuge for several endangered species at Andersen AFB</li> <li>• SS: SI-M. Significant potential impacts to the Mariana crow from noise and disturbance during construction of magazines at the MSA</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations</li> </ul>	<ul style="list-style-type: none"> <li>• VG: SI. Significant potential direct impacts due to construction at Andersen AFB that would remove primary limestone forest.</li> <li>• WL: LSI</li> <li>• SS: SI-M. Significant direct impacts due to removal of essential habitat or Overlay Refuge for several endangered species at Andersen AFB.</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations.</li> </ul>	<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Significant direct impacts due to removal of Overlay Refuge at the LCAC/AAV area that could support special-status species.</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations.</li> </ul>

<i>Other Training (North/Central/South)</i>	<i>Airfield (North)</i>	<i>Waterfront (Apra Harbor)</i>
<b>Operation</b>		
<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Significant potential direct and indirect impacts from noise and other disturbance to ESA-listed species at the Andersen AFB LZs</li> <li>• SS: SI-M. Significant potential indirect impacts from wildfire effects at NMS LZs and NMS ground training</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations</li> </ul>	<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Significant potential direct and indirect impacts from noise and other disturbance to ESA-listed species at the Andersen AFB airfield areas</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations</li> </ul>	<ul style="list-style-type: none"> <li>• VG: LSI</li> <li>• WL: LSI</li> <li>• SS: SI-M. Significant potential direct and indirect impacts from noise and other disturbance to Overlay Refuge that could support special-status species</li> <li>• SS: SI-M. Significant potential indirect impacts from invasive species at all locations</li> </ul>

*Legend:* VG = Vegetation, WL = Wildlife, SS = Special-Status species, SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact.

**10.2.8 Summary of Potential Mitigation Measures**

**Table 10.2-20. Summary of Potential Mitigation Measures**

<i>Alternatives 1, 2, 3, and 8</i>	<i>Additional for Alternatives 2 and 3</i>	<i>No-Action Alternative</i>
<b>Vegetation</b> - None	None	None
<b>Wildlife and Special-Status Species</b>		
At Andersen AFB the construction period would be limited if Mariana crows were present and there would be no work at night to avoid impacts to the Mariana fruit bat	Additional surveys would be conducted for the Pacific slender-toed gecko at NCTS Finegayan and, habitat enhancement at NMS if necessary	None
Biological surveys would be conducted for crows and bats before clearing		
The COMNAV Marianas Training Handbook would be updated with procedures to protect special-status species during project-specific training		
Hooded lights would be used on roads associated with the proposed new Andersen AFB access gate, truck inspection station, and aircraft staging areas		
Fruit bat monitoring would occur weekly at all roost sites in the project area until 1 year after the construction was completed, with increased frequency after typhoon events		
The Andersen AFB aircraft operations monitoring program and adaptive management strategy for Mariana fruit bats and crows would be adopted and modified as necessary for project-specific actions.		
Monitoring of the Mariana fruit bat, Micronesian kingfisher, and Mariana crow, if present, would be conducted in areas surrounding demolition, breacher, and small arms training areas to determine potential noise impacts and if this monitoring determined that these species were being affected, techniques to reduce noise generation, such as noise barriers, would be employed.		
Restrictions would be placed on the use of Haputo beach and ERA		
Controls would be placed on the use of the access road established for NMS training		

<i>Alternatives 1, 2, 3, and 8</i>	<i>Additional for Alternatives 2 and 3</i>	<i>No-Action Alternative</i>
Conduct sea turtle natural history studies to better understand the species and benefit the long-term military mission planning		
A survey would be conducted in the Route 15 range footprint areas prior to clearing for <i>Heritiera longipetiolata</i> with subsequent translocation or propagation if found; mature trees identified in previous studies would not be removed		
Natural resource awareness briefings would be conducted for construction personnel		
HACCP planning would be used for high-risk activities and construction projects		
Base policies, instructions, or orders would be put in place to ensure that cats and dogs are documented and all pets are controlled and not allowed at Haputo ERA		
Translocate Guam tree snails at Navy Barrigada to another site on DoD lands after approval by USFWS (not required for preferred alternative).		
The existing Navy Ungulate Management Plans would be updated to include the new lands to be used for training and cantonment areas and additional project-specific actions that would be necessary to ensure sensitive ecological resources are protected		
The existing Navy Fire Management Plan would be updated to include new lands to be used for training and additional project-specific actions that would be necessary to ensure sensitive ecological resources are protected		
Invasive insect management options would be investigated for the ESA-listed fire tree and SOGCN cycad		
Establishment of new or expansion of existing ERAs and conservation areas would be considered		
Fencing, patrols, or cameras would be used to prevent poaching		
Greenbelt development would be considered for watershed protection, wildfire control, and restoration of habitat		
Exclusion fencing and foraging plots would be set up for protection of wildlife and special-status species		

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