CHAPTER 12. TERRESTRIAL BIOLOGICAL RESOURCES

12.1 INTRODUCTION

This chapter contains a discussion of the potential environmental consequences associated with implementation of the alternatives within the region of influence (ROI) for this resource. For a description of the affected environment for all resources, refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that volume include the ROI for the utilities and roadway projects, and the chapters are presented in the same order as the resource areas contained in this volume.

Species mentioned in this section are described using the common name when there is an English common name that is in relatively common use on Guam (all wildlife and some plants). Common names are cross-referenced to scientific names in Appendix G. Where there is no commonly used English name for plants, the scientific name is used with the Chamorro name in parentheses when first used.

12.2 ENVIRONMENTAL CONSEQUENCES

12.2.1 Approach to Analysis

12.2.1.1 Methodology

The affected environment for terrestrial biological resources for the proposed roadway improvement projects is described in Volume 2 of this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS).

Biological resource issues and concerns include the potential direct, indirect, and cumulative impacts of the proposed actions 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., noise and lighting). Potential types of direct impacts include, but are not limited to:

- Loss of habitat due to vegetation removal during construction.
- Temporary loss of habitat during construction from noise, lighting, and human activity.
- Potential loss of habitat due to disturbance of species in areas surrounding operations from noise, lighting, and human activity.
- 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 forseeable (e.g., increased likelihood of invasive species moving into the area after disturbance). Potential indirect impacts include, but are not limited to:

- All disturbance 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.
- Adverse effects from pollutants that are released from construction or military operations.

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.

Many of the proposed roadway improvement projects were excluded from further analysis of direct impacts if such projects would not require road widening, where all proposed improvements would occur within the existing impervious cover footprint because these projects would not directly or indirectly affect terrestrial biological resources (i.e., vegetation communities, wildlife resources, or special-status species). In addition, roadway projects were excluded from further direct impact analysis if they would occur in developed areas with no appreciable effect to terrestrial biological resources (i.e., vegetation communities, wildlife resources, or special-status species). These types of projects would require clearing of vegetation, but the area required for clearing has been so heavily degraded, modified, or characterized by urban vegetation that the loss of the area would not appreciably affect terrestrial biological resources (i.e., vegetation communities, wildlife resources, or special-status species). The analysis of indirect impacts for roadways considers the potential for runoff, sedimentation, and non-point source pollution inputs into freshwater (non-marine) aquatic environments and surrounding vegetation communities.

12.2.1.2 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 mitigation is biosecurity. This issue is discussed under mitigation measures after the evaluation of impacts (see Section 10.2.2.3).

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 Volume 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 10.2.2.3.

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-collard 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 Volume 2. 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 actions 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.

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 Biological Assessment (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 Biological Opinion (BO) issued by the USFWS after their review of the BA, will 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 will be made in the BO. The BO will provide an Incidental Take Statement that will list the amount or extent of take anticipated. Based on that take it will 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 will 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 will be incorporated into the Final EIS/OEIS.

12.2.1.3 Issues Identified during Public Scoping Process

Terrestrial biological resource issues identified by the public, including regulatory stakeholders, during the public scoping process that are applicable to the proposed action include the following:

- 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 federal trust species.
- Potential for harm to fragile ecosystems on Guam and in the Marianas from the introduction of non-native species due to increased traffic among the islands from the movement of personnel and materials. Such species include the brown tree snake (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 the 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 Commonwealth of the Northern Mariana Islands (CNMI) must be instituted. The Navy must ensure 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.

12.2.2 Power

12.2.2.1 Interim Alternative 1 (Preferred Alternative)

Interim Alternative 1 would recondition existing combustion turbines and upgrade T&D systems and would not require new construction or enlargement of the existing footprint of the facility. This work would be undertaken by the GPA on its existing permitted facilities. Reconditioning would be made to existing permitted facilities at the Marbo, Yigo, Dededo No. 1, and Macheche combustion turbines. These combustion turbines are not currently being used up to permit limits. T&D system upgrades would be on existing above ground and underground transmission lines. This alternative supports Main Cantonment Alternatives 1 and 2 and Main Cantonment Alternatives 3 and 8 would require additional upgrades to the T&D system.

Terrestrial biological resources would not be impacted under this alternative as proposed activities involve only upgrades to existing facilities and infrastructure and installation of underground powerlines in already developed areas.

12.2.2.2 Interim Alternative 2

Interim Alternative 2 is a combination of reconditioning of existing permitted GPA facilities, an increase in operational hours for existing combustion turbines, and upgrades to existing T&D systems. Interim Alternative 2 would not require new construction or enlargement of the existing footprint of the facility. Reconditioning would be performed on the existing permitted GPA facilities at the Marbo, Yigo, and Dededo combustion turbines. This alternative supports Main Cantonment Alternatives 1 and 2 and Main Cantonment Alternatives 3 and 8 would require additional upgrades to the T&D system.

Terrestrial biological resources would not be impacted under this alternative as proposed activities involve only upgrades to existing facilities and infrastructure and installation of underground powerlines in already developed areas.

12.2.2.3 Interim Alternative 3

Interim Alternative 3 is a combination of reconditioning existing GPA permitted facilities at Marbo, Yigo, and Dededo and upgrades to the Department of Defense power plant at Orote. Upgrades would be made to existing T&D. The proposed reconditioning to the existing power generation facilities at Marbo, Yigo, and Dededo would not require new construction or enlargement of the existing footprint of the facility. For the Orote power plant, upgrades would include a new fuel storage facility to facilitate longer run times between refueling. This would disturb approximately 1 acre (4,047 square m). This alternative supports Main Cantonment Alternatives 1 and 2 and Main Cantonment Alternatives 3 and 8 would require additional upgrades to the T&D system.

Terrestrial biological resources would not be impacted under this alternative as proposed activities involve only upgrades to existing facilities and infrastructure and construction and placement of powerlines in already developed areas.

12.2.2.4 Summary of Impacts

Table 12.2-1 summarizes the potential impacts of each interim alternative.

Table 12.2-1. Summary of Potential Impacts to Terrestrial Biological Resources-Power

*Interim Alternative 1**	*Interim Alternative 2*	*Interim Alternative 3*
Vegetation		
NI • No impacts to vegetation	NI • No impacts to vegetation	NI • No impacts to vegetation
Wildlife		
NI • No impacts to wildlife	NI • No impacts to wildlife	NI • No impacts to wildlife
Special-Status Species		
NI • No impacts to special-status species	NI • No impacts to special-status species	NI • No impacts to special-status species

Legend: NI = No Impact.*Preferred Alternative

There would be no impacts to any terrestrial biological resources because each of the proposed alternatives involves only upgrades to existing facilities and construction and installation of powerlines in already developed areas.

12.2.3 Potable Water

As discussed in Volume 6 Chapter 2 (Section 2.2.2), potable water alternatives are not distinguished as interim or long-term. Impacts from proposed potable water waterlines that run along public roadways are not evaluated since roadway improvements that would disturb these same areas are being evaluated for impacts in Chapter 4 of this EIS/OEIS and no additional impact beyond construction is anticipated.

12.2.3.1 Basic Alternative 1 (Preferred Alternative)

Basic Alternative 1 would consist of installation of up to 22 new potable water supply wells at Andersen Air Force Base (AFB), rehabilitation of existing wells, interconnection with the GWA water system, and associated T&D systems. A new 5 MG (19 ML) water storage tank would be constructed at ground level at Finegayan.

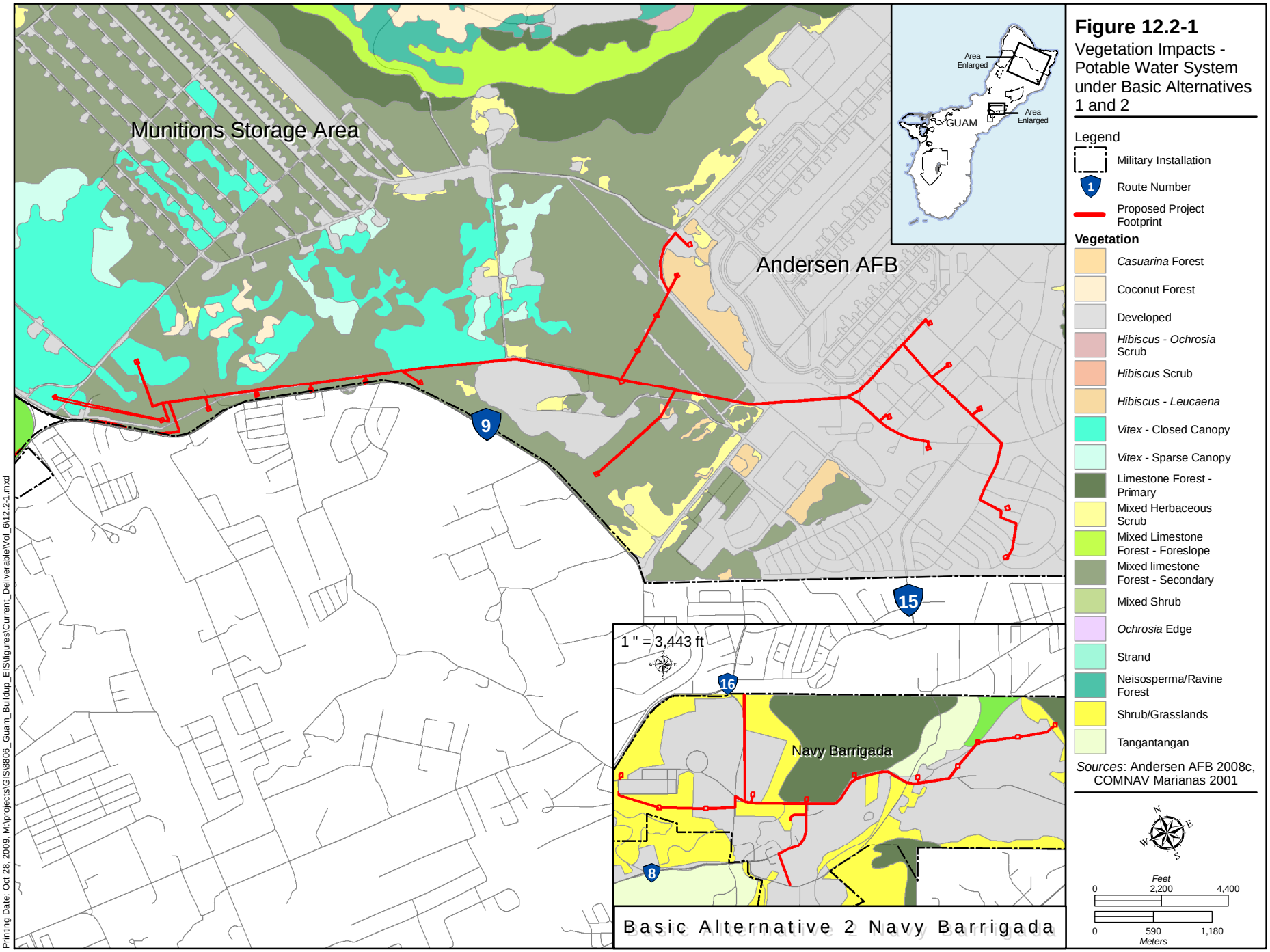
Construction

Vegetation

The vegetation associated with the various components under Alternative 1 that would be removed is shown in Figure 12.2-1 and listed in Table 12.2-2. Disturbed limestone vegetation community types on Andersen AFB that would be affected are primarily mixed limestone forest – plateau/secondary and vitex – closed canopy forest. At NCTS Finegayan, all water system components would be placed in areas already included in the proposed developed cantonment area so that there would be no additional impacts to vegetation. Impacts to vegetation at Andersen AFB and Andersen South would be less than significant because minimal primary limestone forest would be removed. Vegetation removed does provide habitat for wildlife and special-status species. These impacts are evaluated in subsequent sections.

Wildlife

Based on studies by others and observations in other similar areas on Andersen AFB, NCTS Finegayan, and Andersen South (discussed in Volume 2, Section 10.1), the only native bird species likely to be present in the project areas are the yellow bittern and possibly the Pacific golden plover in open areas; both species are ubiquitous throughout Guam. Native species of skinks and geckos have not been reported in the project areas in any recent studies (within the past 10 years) and were not observed in surveys conducted in project areas for this EIS/OEIS.


Munitions Storage Area
Andersen AFB
Area Enlarged
GUAM
Area Enlarged
9
15
16
8
1 " = 3,443 ft
Navy Barrigada
Basic Alternative 2 Navy Barrigada
Figure 12.2-1
Vegetation Impacts - Potable Water System under Basic Alternatives 1 and 2
Legend
Military Installation
Route Number
Proposed Project Footprint
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/Ravine Forest
Shrub/Grasslands
Tangantangan
Sources: Andersen AFB 2008c, COMNAV Marianas 2001
Feet
0
2,200
4,400
0
590
1,180
Meters
Printing Date: Oct 28, 2009, M:\projects\GIS\8806_Guam_Buildup_EIS\figures\Current_Deliverable\Vol_6\12.2-1.mxd

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. 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.

Table 12.2-2. Potential Direct Impacts to Vegetation Communities with Implementation of Potable Water Basic Alternative 1

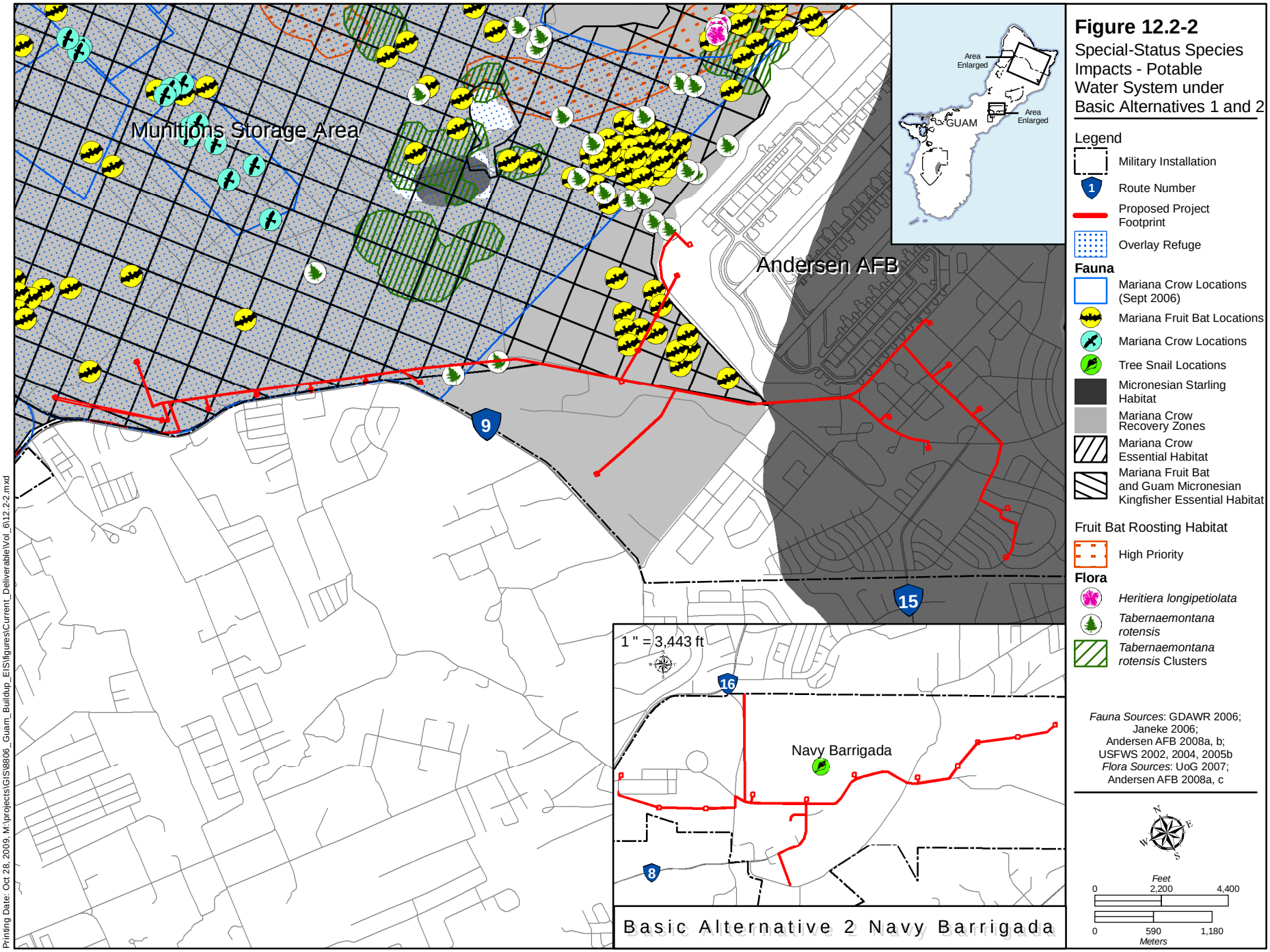
Parcel and Activity	*Limestone Forest, Disturbed ac (ha)*	*Leucaena (Tangan tangan), Casuarina ac (ha)*	*Shrub/ Grasslands, Savanna ac (ha)*	*Developed ac (ha)*
Andersen AFB				
Water Wells	2.9 (1.2)	0.2 (0.1)	0	1.9 (0.8)
Waterlines	11 (4.5)	0.4 (0.2)	0	16 (6.5)
Andersen South				
Waterlines	2.3 (0.9)		0.1 (0.04)	0.1 (0.04)
Total area removed	**16 (6.5)**	**0.6 (0.2)**	**0.1 (0.04)**	**18 (7.3)**

Special-Status Species

Specific designated habitat areas would be removed under Alternative 1 for potable water, including (NWR overlay); essential habitat for the federal- and Guam-listed Mariana fruit bat, Mariana crow, and Micronesian kingfisher; and Mariana crow recovery zone habitat (Figure 12.2-2). The amount of these habitats that would be removed are shown in Table 12.2-3. At NCTS Finegayan and FAA, all water system components would be in areas already included in the proposed developed cantonment area so that there would be no additional impacts to habitat areas. Based on the removal of these habitat areas at Andersen AFB, there would be significant impacts to the three species. Several wells and connecting waterlines in the eastern cluster would be constructed in habitat of the Micronesian starling, a Guam-listed species (Figure 12.2-2) but loss if this small amount of habitat would result in less than significant impacts to this species.

Areas potentially impacted are shown in Table 12.2-3. Special-status species present in the area are discussed below.

Mariana Fruit Bat. Specific designated habitat areas would be removed under Alternative 1 for potable water, including Overlay Refuge and essential habitat for the fruit bat (Figure 12.2-2, Table 12.2-3). There would be no temporary direct impacts from noise and activity during construction at Andersen AFB to roosting and nesting activities of the Mariana fruit bat because construction would only occur during the daytime. Based on the removal of Overlay Refuge and essential habitat areas, there would be significant impacts to the fruit bat. This significant impact would be mitigated to less than significant with measures described in Volume 2, Section 10.2.2.


Munitions Storage Area
Andersen AFB
9
15
16
8
Navy Barrigada
1 " = 3,443 ft
Basic Alternative 2 Navy Barrigada
Area Enlarged
Area Enlarged
GUAM
Figure 12.2-2
Special-Status Species Impacts - Potable Water System under Basic Alternatives 1 and 2
Legend
Military Installation
Route Number
Proposed Project Footprint
Overlay Refuge
Fauna
Mariana Crow Locations (Sept 2006)
Mariana Fruit Bat Locations
Mariana Crow Locations
Tree Snail Locations
Micronesian Starling Habitat
Mariana Crow Recovery Zones
Mariana Crow Essential Habitat
Mariana Fruit Bat and Guam Micronesian Kingfisher Essential Habitat
Fruit Bat Roosting Habitat
High Priority
Flora
Heritiera longipetiolata
Tabernaemontana rotensis
Tabernaemontana rotensis Clusters
Fauna Sources: GDAWR 2006; Janeke 2006; Andersen AFB 2008a, b; USFWS 2002, 2004, 2005b
Flora Sources: UoG 2007; Andersen AFB 2008a, c
Feet
0
2,200
4,400
0
590
1,180
Meters
Printing Date: Oct 28, 2009, M:\projects\GIS\8806_Guam_Buildup_EIS\figures\Current_Deliverable\Vol_6\12.2-2.mxd

Mariana Crow. Specific designated habitat areas would be removed under Alternative 1, including Overlay Refuge and essential habitat for the crow (Figure 12.2-2, Table 12.2-3). The Mariana crow is not currently present in areas where these projects would occur so there would be no impacts from construction. Based on the removal of habitat areas, there would be significant impacts to the Mariana crow. This significant impact would be mitigated to less than significant with measures described in Volume 2, Section 10.2.2.

Micronesian Kingfisher. Specific designated habitat areas would be removed under Alternative 1, including Overlay Refuge and essential habitat for the kingfisher (Figure 12.2-2, Table 12.2-3). Based on the removal of habitat areas, there would be significant impacts to the Micronesian kingfisher. This significant impact would be mitigated to less than significant with measures described in Volume 2, Section 10.2.2.

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. 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.

Micronesian Starling. Several wells and connecting waterlines in the eastern cluster would be constructed in habitat of the Micronesian starling, a Guam-listed species (see Figure 12.2-2). The loss of small areas of habitat would result in less than significant impacts to this species.

Mariana Eight Spot Butterfly. The two host plant species for this species were not observed in field work conducted in project areas in September 2009. Furthermore, 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, it is unlikely the eight spot butterfly is present in the project area so removal of these areas due to construction would have no impact on the species.

Table 12.2-3. Potential Impacts to Special-Status Species Habitat with Implementation of Potable Water – Basic Alternative 1

Parcel and Activity	*Overlay Refuge ac (ha)*	*Essential Habitat – Bat and Kingfisher* ac (ha)*	*Essential Habitat – Crow* ac (ha)*	*Recovery Zone – Crow * ac (ha)*
Direct Impacts from Construction – Habitat Removed				
Andersen AFB				
Water Wells	2.0 (1.0)	2.2 (0.9)	2.2 (0.9)	2.9 (1.2)
Waterlines	9.4 (3.8)	12 (4.9)	12 (4.9)	16 (6)
Total area removed	**11 (4.5)**	**14 (5.7)**	**14 (5.7)**	**19 (7.7)**
Percentage of Habitat on Guam that would be Removed	<0.1 %	<0.1 %	<0.1 %	<0.1 %

Note: *Each habitat category is considered independently of others and is not additive.

Operation

Terrestrial biological resources would not be impacted under this alternative because, once installed, the potable water lines and wells will require minimal maintenance.

Potential Mitigation Measures

Impacts to special-status species habitat resulting from proposed potable water projects would be mitigated with a suite of protection and conservation measures for all impacts on Guam described in this

EIS/OEIS. See Volume 2, Section 10.2.2 for a description of these measures.

BMPs that would be employed during all project construction and operations are described in Volume 7.

12.2.3.2 Basic Alternative 2

Basic Alternative 2 would consist of installation of up to 20 new potable water supply wells at Andersen AFB, up to 11 new potable water supply wells at Barrigada, rehabilitation of existing wells, interconnection with the GWA water system, associated transmission and distribution systems upgrades. Additionally, new 3.6 MG (13.6 ML) and 1 MG (3.8 ML) water storage tanks would be constructed at ground level at Finegayan and Barrigada, respectively.

Impacts at each facility are discussed below.

Andersen AFB and Andersen South

Construction

Vegetation. Impacts would be the same as those under Alternative 1 except that two water wells and associated piping would not be installed. Acreages affected are shown in Table 12.2-4. Impacts would be less than significant because no primary limestone forest would be removed.

Wildlife. Impacts would be the same as those under Alternative 1

Special-Status Species. Impacts would be the same as those under Alternative 1 except that two water wells and associated piping would not be installed so less habitat would be affected. Acreages affected are shown in Table 12.2-5.

Operation

Terrestrial biological resources would not be impacted under this alternative because, once installed, the potable water lines, tanks, and wells will require minimal maintenance.

Table 12.2-4. Potential Direct Impacts to Vegetation Communities with Implementation of Potable Water – Basic Alternative 2

Parcel and Activity	*Limestone Forest, Primary ac (ha)*	*Limestone Forest, Disturbed ac (ha)*	*Leucaena (Tangan tangan or Casuarina ac (ha)*	*Shrub/ Grasslands, Savanna ac (ha)*	*Developed ac (ha)*
Andersen AFB					
Water Wells	0	2.1 (0.8)	0.2 (0.1)	0	1.4 (0.6)
Waterlines	0	11 (4.5)	0.4 (0.2)	0	16 (6.5)
Andersen South					
Waterlines	0	2.3 (0.9)	0	0.1 (0.04)	0.1 (0.04)
Navy Barrigada					
Water Wells and Waterlines	0.5 (0.2)*	0	0	2.8 (1.1)	9.8 (4.0)
Air Force Barrigada					
Water Storage Tank	0	0	0.8 (0.3)	0	0.1 (0.04)
Waterlines	0	0	1.0 (0.04)	0	1.1 (0.4)
Total area removed	**0.5 (0.2)**	**15 (6.1)**	**2.4 (1.0)**	**2.9 (1.2)**	**29 (12)**

Note: *This primary limestone forest removal is already accounted for in the development of the Army Cantonment in Volume 5, Alternative 2.

Table 12.2-5. Potential Impacts to Special-Status Species Habitat with Implementation of Potable Water - Alternative 2

Parcel and Activity	*Overlay Refuge ac (ha)*	*Essential Habitat – Bat and Kingfisher* ac (ha)*	*Essential Habitat – Crow* ac (ha)*	*Recovery Zone – Crow* ac (ha)*
Direct Impacts from Construction – Habitat Removed				
Andersen AFB				
Water Wells	1.5 (0.6)	1.6 (0.9)	1.6 (0.9)	2.1 (0.8)
Waterlines	9.4 (3.8)	12 (4.9)	12. (4.9)	16 (6.5)
Total area removed	**11 (4.5)**	**14 (5.7)**	**14 (5.7)**	**19 (7.7)**
Percentage of Habitat on Guam that is Removed	<0.1 %	<0.1 %	<0.1 %	<0.1 %

Note: *Each habitat category is considered independently of others and is not additive.

Barrigada

Construction

Vegetation. The vegetation associated with Navy and Air Force Barrigada components under Alternative 2 that would be removed are listed in Table 12.2-4. Two water wells would be constructed within the limestone forest but they would be at the edge of the forest, near the road. Habitat near the roads are typically partially invaded by non-native species so the forest is of lower quality. Because of the size and location of the forest that would be removed, impacts to the primary limestone forest would be less than significant.

Wildlife. Wildlife species that currently occur at 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. All these species are common on Guam. Proposed construction activities would displace 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 these species are abundant in surrounding areas and would rapidly repopulate suitable portions of the affected area. Therefore, the impacts to wildlife would be less than significant.

Construction activities for the operation buildings 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 suitable habitat nearby. 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.

Special-Status Species. Proposed construction activities at Navy and Air Force Barrigada would not impact any designated habitat areas. There would be no indirect impacts to special-status species. Species that would be directly affected are described below.

Guam Tree Snail. The Guam tree snail, an ESA candidate species, was documented in the primary limestone forest on one transect during site-specific surveys in 2008 in support of this EIS/OEIS (see Figure 12.2-2). The distribution and numbers of tree snails at the site is unknown. Proposed construction activities would remove 0.5 ac (0.2 ha) of primary limestone forrest habitat. This area would be surveyed

prior to removal of vegetation and if present, tree snails would be relocated. With this mitigation, impacts would be less than significant.

Operation

Terrestrial biological resources would not be impacted under this alternative because, once installed, the potable water lines, wells, and tanks will require minimal maintenance.

Potential Mitigation Measures

Potential mitigation measures for Andersen AFB, and Finegayan components would be the same as for Alternative 1. Mitigation for Navy Barrigada would be part of overall conservation measures that are described in Volume 2 Chapter 10, Alternative 3 for Navy Barrigada.

12.2.3.3 Summary of Impacts

Table 12.2-6 provides a summary of the potential impacts of each alternative.

Table 12.2-6. Summary of Potential Impacts to Terrestrial Biological Resources - Potable Water

*Basic Alternative 1**	*Basic Alternative 2*
Vegetation	
LSI • No primary limestone forest would be removed	LSI • A minimal amount of primary limestone forest (0.5 acre [0.2 ha]) would be removed along the forest edge
Wildlife	
LSI • Less than significant impacts to wildlife	LSI • Less than significant impacts to wildlife
Special-Status Species	
SI-M • Significant direct impacts due to removal of essential habitat for several endangered species at Andersen AFB, mitigated to less than significant; habitat is also NWR Overlay	SI-M • Significant direct impacts due to removal of essential habitat for several endangered species at Andersen AFB, mitigated to less than significant; habitat is also NWR Overlay • Significant impacts due to possible presence of the Guam tree snail that has been found in the area, mitigated to less than significant

Legend: LSI = Less Than Significant Impact, SI-M = Significant impact mitigable to less than significant.
*Preferred Alternative.

Impacts would be less than significant to vegetation because no limestone forest would be removed. Impacts to wildlife would be less than significant because there would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Significant impacts would result from construction of water wells and waterlines at Andersen AFB because some of the areas where they would be placed is Overlay Refuge and recognized essential habitat for the Mariana fruit bat, Micronesian kingfisher, and Mariana crow. These impacts would be mitigated to less than significant with measures described in Volume 2, Section 10.2.2.

12.2.3.4 Summary of Potential Mitigation Measures

Table 12.2-7 provides a summary of the potential mitigation measures of each alternative.

Table 12.2-7. Summary of Potential Terrestrial Biological Mitigation – Potable Water

Alternatives 1 and 2	*Alternative 2 Additional*	*No-Action Alternative*
Vegetation		
None specifically for vegetation.	None	None
Wildlife and Special-Status Species		
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	Conduct survey in limestone forest water well footprint at Navy Barridage and, if found, translocation of Guam tree snails	None
Biological surveys would be conducted for crows and bat before clearing		
Natural resource awareness briefings would be conducted for construction personnel		
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 (general mitigation item - same item as Volume 2 mitigation)		
A BioSecurity Plan (comprehensive for all actions on Guam and CNMI) would be developed and implemented (general mitigation item - same item as Volume 2 mitigation)		
Invasive insect management options would be investigated for the ESA-listed fire tree and SOGCN cycad (general mitigation item - same item as Volume 2 mitigation)		
Establishment or expansion of new ecological reserves and conservation areas would be considered (general mitigation item - same item as Volume 2 mitigation)		
Sea Turtle natural history studies would be undertaken to better understand the species and benefit long-term military mission planning (general mitigation item - same item as Volume 2 mitigation)		
High-quality habitat areas would be fenced to exclude invasive species and foraging plots would be established within (general mitigation item - same item as Volume 2 mitigation)		
Fencing, patrols, or cameras would be used to prevent poaching (general mitigation item - same item as Volume 2 mitigation)		
Greenbelt development would be considered for watershed protection, wildfire control, and restoration of habitat (general mitigation item - same item as Volume 2 mitigation)		

12.2.4 Wastewater

12.2.4.1 Basic Alternative 1a (Preferred Alternative) and 1b

Basic Alternative 1 (Alternative 1a supports Main Cantonment Alternatives 1 and 2; and Alternative 1b supports Main Cantonment Alternatives 3 and 8) combines upgrade to the existing primary treatment facilities and expansion to secondary treatment at the Northern District Wastewater Treatment Plant (NDWWTP). The difference between Alternatives 1a and 1b is a requirement for a new sewer line from Barrigada housing to NDWWTP for Alternative 1b.

Construction

Vegetation

Construction of a new sewer line from the former FAA parcel to the NDWWTP would require a 24 ft (7.3 m) corridor approximately 8,300 ft (2,530 m) in length for a total of 4.6 ac (1.9 ha). The sewer line would follow trails that are evident on aerial photographs and traverse primarily through shrub/grassland and tangantangan habitat. Based on vegetation mapping by the USFS (2006), at most 1,000 ft (305 m) would traverse through disturbed limestone habitat, although there are also open trails in through these areas that would be used for some some of the pipeline corridor. Assuming the entire 1,000 ft (305 m) would need to be cleared, 0.6 ac (0.2 ha) disturbed limestone forest would be cleared, in addition to areas of shrub/grassland and tangantangan. Impacts from this removal would be less than significant because no primary limestone forest would be removed.

Wildlife

Based on studies by others and observations in other similar areas on the former FAA parcel and South Finegayan, (discussed in Volume 2, Section 10.1), the only native bird species likely to be present in the project areas are the yellow bittern and possibly the Pacific golden plover in open areas; both species are ubiquitous throughout Guam. Native species of skinks and geckos have not been reported in nearby project areas and were not observed in surveys conducted in project areas for this EIS/OEIS.

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. 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 1a.

Special-Status Species

No special-status species have been identified in the area in historical studies or in recent project-specfic surveys in similary nearby areas at South Finegayan, former FAA parcel, and the GLUP77 parcel. There would be no impacts to special-status species.

Operation

Terrestrial biological resources would not be impacted under this alternative as proposed activities involve only upgrades to existing facilities and infrastructure and sewer pipelines will be placed underground.

12.2.4.2 Basic Alternative 1b

Under Basic Alternative 1b, the existing primary treatement system at NDWWTP will be refurbished and upgraded to accept additional wastewater flow and load from both central and northern Guam, and new sewer lines and lift pump stations. In addition to the sewer line proposed in Basic Alternative 1a, a new sewer line and pump stations would be installed to convey wastewater generated from Barrigada housing to the NDWWTP.

Construction

Vegetation

The new sewer line and pump from Barrigada would traverse existing roadway or utility corridors with heavily disturbed vegetation or no vegetation. Impacts from the sewer line in the Finegayan area would be the same as for Alternative 1a. Impacts to vegetation would be less than significant.

Wildlife

The new sewer line and pump from Barrigada would traverse existing roadway or utility corridors where there would be minimal wildlife. Impacts from the sewer line in the Finegayan area would be the same as for Alternative 1a. Impacts to wildlife would be less than significant.

Special-Status Species

The new sewer line and pump from Barrigada would traverse existing roadway or utility corridors. Impacts from the sewer line in the Finegayan area would be the same as for Alternative 1a. There would be no impacts to special-status species.

Operation

Terrestrial biological resources would not be impacted under this alternative as proposed activities involve only upgrades to existing facilities and infrastructure, sewer pipelines will be placed underground, and the pump station will be located within already developed area.

12.2.4.3 Summary of Impacts

Table 12.2-8 summarizes summarizes the potential impacts of each alternative.

Table 12.2-8. Summary of Potential Impacts to Terrestrial Biological Resources-Wastewater

*Basic Alternative 1a**	*Basic Alternative 1b*
Vegetation	Vegetation
LSI • Less than significant impacts to vegetation	LSI • Less than significant impacts to vegetation
Wildlife	Wildlife
LSI • Less than significant impacts to wildlife	LSI • Less than significant impacts to wildlife
Special-Status Species	Special-Status Species
NI • No impacts to special-status species	NI • No impacts to special-status species

Legend: NI = No Impact. *Preferred Alternative.

Installation of a new sewer line from former FAA to the NDWWTP would traverse disturbed and developed vegetation in areas with wildly distributed wildlife species so impacts would be less than significant. No special-status species or recognized habitat areas are in the area so there would be no impact.

12.2.5 Solid Waste

12.2.5.1 Basic Alternative 1 (Preferred Alternative)

The Preferred Alternative for solid waste would be the continued use of the Navy Landfill at Apra Harbor until Layon Landfill is opened, which is scheduled for July 2011.

The existing Navy landfill and landfill extent would be used and not expanded until the government of Guam landfill was ready. Since operations will not change substantially from present conditions, terrestrial biological resources would not be impacted under this alternative. The proposed Layon landfill and its impacts were analyzed in a separate environmental impact statement by the GovGuam.

12.2.5.2 Summary of Impacts

Table 12.2-9 summarizes the potential impacts of Alternative 1.

Table 12.2-9. Summary of Potential Impacts to Terrestrial Biological Resources-Solid Waste

*Basic Alternative 1**
Vegetation
NI • No impact to vegetation
Wildlife
NI • No impacts to wildlife
Special-Status Species
NI • No impact to special-status species

Legend: NI = No Impact. *Preferred Alternative.

There would be no impacts to any terrestrial biological resources because the proposed alternative involves no expansion of the fill area of the existing Navy landfill that would be used until the new government of Guam landfill opens. No special-status species are know from the area of the landfill. The proposed Layon landfill and its impacts were analyzed in a separate environmental impact statement by the GovGuam.

12.2.6 Off Base Roadways

As discussed in Volume 6 Chapter 2.5, some Guam Road Network (GRN) projects involve road widening, bridge replacements, new road construction or roadway realignment, and pavement strengthening projects. This section addresses the potential direct and indirect impacts of the proposed GRN projects to terrestrial biological resources and also describes mitigation measures to avoid or minimize these potential impacts. Each project included under the alternatives described in Volume 6 Chapter 2.5 is analyzed below and grouped by each region (North, Central, Apra Harbor, and South). The type and duration of the impact may vary depending on the project location and the project description. For instance, projects that involve pavement strengthening would occur within the existing roadway corridor on previously developed surfaces and no direct impacts to terrestrial biological resources are anticipated; however, surrounding areas outside of the roadway corridor may be subject to indirect impacts associated with runoff during the construction phase of the pavement strengthening activity. Other project types may potentially directly or indirectly impact terrestrial biological resources. Potential runoff impacts would be addressed with BMPs. Table 12.2-10 describes the direct and indirect impacts for each type of roadway project (non-widening pavement strengthening, intersection improvements, projects that require vegetation removal [e.g. roadway widening, new road construction, and roadway

realignment projects], military access point modification or construction, and bridge replacements). Table 12.2-11 describes potential direct and indirect impacts for each roadway improvement project within the North Region. Table 12.2-12, Table 12.2-13, and Table 12.2-14 describe the same information for projects within the Central, Apra Harbor, and South regions, respectively.

Table 12.2-10. GRN Project Type and Potential Impacts to Terrestrial Biological Resources

Project Type[1]	*Type of Impact Evaluated*	*Potential Impact Description*[2]
Pavement Strengthening	Indirect impacts during construction phase	Uncontrolled runoff may impact down stream or down gradient vegetation communities, wildlife, and special status species that utilize these areas during the construction phase. Construction noise may disturb special status species and wildlife within the vicinity of construction activity.
Intersection Improvements		
Roadway Widening, New Road Construction (Finegayan Connection), Military Access Point Modifications / Construction, &Road Realignment (Route 15)	Direct impacts	Removal of vegetation. Some vegetation may support special status species habitat, and displacement of wildlife.
	Indirect impacts-construction phase	Uncontrolled runoff may impact down gradient vegetation communities, wildlife, and special status species that utilize these areas during the construction phase. Construction noise may disturb special status species and wildlife within the vicinity of construction activity.
	Indirect impacts-operational phase	Additional impervious cover would contribute runoff to adjacent terrestrial habitats. Increased potential for wildland fires and invasive species encroachment along new edges.
Bridge Replacements (Agana, Atantano, Fonte, Laguas, & Sasa Bridges)	Direct impacts	Removal of vegetation on streambed slopes adjacent to bridge structures. Disturbance of aquatic habitats under and adjacent to the bridge structures during construction.
	Indirect impacts-construction phase	Uncontrolled runoff may impact down stream aquatic communities, wildlife, and special status species that utilize these areas during the construction phase. Construction noise may disturb special status species and wildlife within the vicinity of the bridge replacement.
	Indirect impacts-operational phase	Alteration of the hydraulic conveyance due to the new bridge design may impact downstream aquatic habitats.

Note [1]: The GRN project descriptions are included in Volume 6 Chapter 2.5.
Note [2]: Mitigation measures are included later in this chapter that minimize or avoid potential direct or indirect impacts

Table 12.2-11. North Region GRN Projects, Alternatives, and Potential Impacts

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
8	x	x	x	x	Runoff during the construction phase for this project and construction noise in areas north of Okkodo School (e.g. Navy Refuge Overlay unit).	***None:*** this project does not require widening, only pavement strengthening, to modify the access to Okkodo High School on the interior portion of the road.

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
9	x	x	x	x	Runoff during the construction phase for this project and construction noise in areas west of Route 3 (e.g. Navy Refuge Overlay unit and Andersen AFB Refuge Overlay unit). Increased potential for invasive species encroachment and wildland fires along new edges after construction.	Wildlife displacement and removal of vegetation communities through the road widening areas from NCTS Finegayan to Route 28 along Route 3, including Navy Refuge Overlay lands, essential habitat areas, and lands designated as recovery zones.
10	x	x	x	x		Wildlife displacement and removal of vegetation communities through the road widening areas from NCTS Finegayan to Route 9 along Route 3.
22	x	x	x	x	Runoff during the construction phase for this project and construction noise in areas north of Route 9 (e.g. Andersen AFB Refuge Overlay units). Increased potential for invasive species encroachment and wildland fires along new edges after construction.	Wildlife displacement and removal of vegetation communities through the road widening areas from Route 3 to the proposed Andersen AFB North Gate along Route 9.
22A	X	x	x	x	Runoff during the construction phase for the medians and shoulders and construction noise in areas north of Route 9 (e.g. Andersen AFB Refuge Overlay units).	Although this project is a pavement strengthening project, medians and shoulders would be added, that would expand the project footprint into forested areas of Andersen AFB along Route 9 between the Andersen AFB North Gate and the Andersen AFB Main Gate.
23	x	x	x	x	Runoff during the construction phase for these projects and construction noise in areas north of Route 9 (e.g. Andersen AFB Refuge Overlay units). Increased potential for invasive species encroachment and wildland fires along new edges after construction.	***None:*** This project does not require widening, only pavement strengthening, from Chalan Lujuna to Route 9.
38		x	x			These military access point projects would require the removal of limestone forest within essential habitat areas for the Mariana crow, Mariana fruit bat, and Micronesian kingfisher.
38A	x			x		
39		x	x			These military access point projects would require the removal of limestone forest within essential habitat areas for the Mariana crow, Mariana fruit bat, and Micronesian kingfisher.
39A	x			x		
41		x				These military access point projects would require the removal of limestone forest within essential habitat areas for the Mariana crow, Mariana fruit bat, and Micronesian kingfisher.
41A	x			x		
42	x	x	x	x		This military access point project, although within limestone forests, was analyzed as part of the Intelligence, Surveillance, and Reconnaissance/Strike Final EIS (Andersen AFB 2006).

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
57	x	x	x	x	Runoff during the construction phase for these projects.	This road widening project would require the removal of scrub forest vegetation, that may contain important resources for the recovery of special-status species.
117	x	x	x	x		***None:*** This intersection project would occur in previously developed lands with no disturbance of vegetation communities other than urban cultivated areas.
124	x	x		x	Runoff during the construction phase for this project and construction noise in areas along the new road corridor (e.g. Navy Refuge Overlay unit). Increased potential for invasive species encroachment and wildland fires along new edges after construction.	The Finegayan connector road would require clearing through limestone forest, scrub forests, and tangantangan thickets. Although most of the road corridor is through previously developed areas, the limestone and scrub forest communities may contain important resources for the recovery of special-status species.

Note [1]: The GRN project descriptions and alternatives are described in detail in Volume 6 Chapter 2.5.
Note [2]: Mitigation measures are included later in this chapter that minimize or avoid potential direct or indirect impacts

Table 12.2-12. Central Region GRN Projects, Alternatives, and Potential Impacts

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
1	x	x	x	x	***None:*** The proposed intersection improvement for Route 1 and 8 (GRN # 1) and Route 1 and 3 (GRN # 2) would occur in a previously developed commercial area in Hagatna. Runoff or construction noise would not impact terrestrial biological resources (i.e., vegetation communities, wildlife, or special-status species).	***None:*** Intersection improvements Routes 1/8 and Routes 1/3 on previously cleared land in developed areas and would not directly impact terrestrial biological resources.
2	x	x	x	x		
3	x	x	x	x	Potential sedimentation along the 260 feet (80 m) streambed of the Agana River between Agana Bridge and the river terminus (between East Hagatna Beach and Paseo de Susana Park).	The Agana bridge replacement occurs over riverine aquatic habitat away from sea turtle nesting and other special status species locations, therefore, no direct impacts to special status species. Construction activities would remove vegetation and alter aquatic habitats in the immediate project footprint.
6	x	x	x	x	***None:*** The proposed road widening would occur in previously developed mixed commercial / light industrial areas (e.g. Tumon Tank Farm). Runoff or construction noise would not impact terrestrial biological resources.	***None:***Construction (road-widening) on previously cleared land and would not impact terrestrial biological resources.

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
7	x	x	x	x	***None:*** The proposed road widening would occur in previously developed mixed commercial / light industrial areas (e.g. Micronesia Mall). Runoff or construction noise would not impact terrestrial biological resources.	
11	x	x	x	x	***None:*** the proposed roadway improvement along Chalan Lujuna would occur in residential areas (e.g. Perez Acres subdivision). Potential runoff or noise would not impact terrestrial biological resources.	***None:*** This project does not require widening, only pavement strengthening, from Route 1 to Route 15 along Chalan Lujuna to improve flow for truck traffic.
12	x	x	x	x	Runoff during the construction phase for this project. Special status species are not expected to utilize the area, so construction noise would not impact special status species.	***None:*** This project does not require widening, only pavement strengthening, from the Smith Quarry to Chalan Lujuna on Route 15 to Route 3 along Chalan Lujuna.
13	x	x	x	x	Runoff during the construction phase for this project, particularly into Asan River. Special status species are not expected to utilize the area, so construction noise would not impact special status species.	***None:*** These projects do not require widening, only pavement strengthening along Route 1 from 11 to Asan Bridge (GRN # 13), Asan Bridge to Route 6 (GRN # 14), and Route 6 to Route 4.
14	x	x	x	x		
15	x	x	x	x		
16	x	x	x	x	***None:*** the proposed roadway improvements along Route 8 would occur in commercial (Home Depot) and industrial (Airport) areas. Potential runoff or noise would not impact terrestrial biological resources.	***None:*** These projects do not require widening, only pavement strengthening from Tiyan Parkway to Route 1 along Route 8 (GRN # 16) and Route 10 to Tiyan Parkway (GRN # 17).
17	x	x	x	x		
18	x	x	x	x	***None:*** the proposed roadway improvements along Route 8 would occur in commercial areas (e.g. Harmon Flea Market, Compadres Mall) and industrial areas (e.g. Guam Power Authority substations). Potential runoff or noise would not impact terrestrial biological resources.	***None:*** These projects do not require widening, only pavement strengthening along Route 16 from Route 27 to Route 10A (GRN # 18), Route 10A to Sabana Barrigada Drive (GRN # 19), Sabana Barrigada Drive to Route 8/10 (GRN # 20).
19	x	x		x		
20	x	x		x		
21	x	x	x	x	***None:*** the proposed roadway improvements along Route 27 would occur in commercial areas (e.g. Compadres Mall), residential areas (e.g Las Palmas Subdivision), and recreational areas (e.g. Robbie Webber Soccer Field). Potential runoff or noise would not impact terrestrial biological resources.	***None:*** This project does not require widening, only pavement strengthening along Route 27.
28	x	x	x	x	***None:***the proposed roadway improvements along Route 26 would occur in commercial areas (e.g. Dededo Mall), and residential areas (e.g. Summer Place Subdivision). Potential runoff or noise would not impact terrestrial biological resources.	***None:*** This project does not require widening, only pavement strengthening along Route 26 between Route 1 and route 15.

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
29	x	x	x	x	***None:*** the proposed roadway improvements along Route 25 would occur in residential areas, and some open fields of tangantangan of no value to special status species or wildlife resources.	***None:*** Although road widening is necessary for this project, the project occurs in previously developed areas and would not impact terrestrial biological resources.
30	x	x	x	x	***None:*** the proposed roadway improvements along Route 10 would occur in residential areas, and some open fields of tangantangan of no value to special status species or wildlife resources.	***None:*** This project does not require widening, only pavement strengthening along Route 10 between Route 15 and route 18.
31	x	x		x	***None:*** the proposed roadway improvements along Route 10 would occur in residential areas, and some open fields of tangantangan of no value to special status species or wildlife resources.	***None:*** This project does not require widening, only pavement strengthening along Route 8A between Route 16 and the NAVCAMS Barrigada.
32	x	x	x	x	***None:*** the proposed roadway improvements along this section of Route 15 would occur along residential areas, recreational areas (Navy recreational fields), and open fields of tangantangan of no value to special status species or wildlife resources.	***None:*** This project does not require widening, only pavement strengthening and intersection improvements along Route 15 between Route 10 to Chalan Lujuna.
33	x	x	x	x	Portions of the proposed roadway improvements along Route 1 are adjacent to Asan Bay and Hagatna beaches, however sea turtle nesting is not known to occur here. Potential for runoff into Agana River and stormwater drainages that terminate into Tumon Bay and Tumon Bay Marine Preserve.	***None:*** This project does not require widening, only pavement strengthening and intersection improvements along Route 1 between Route 8 to Route 13.
35	x	x	x	x	Potential sedimentation between each bridge and the spanned river terminus. Laguas Bridge and Sasa Bridge replacements are upstream of mangrove and estuarine areas of Sasa Bay Marine Preserve. These habitats are not preferred Mariana common moorhen habitat, but may occasionally support foraging habitat for this species.	The bridges proposed for replacement occur over riverine aquatic habitats that may directly or indirectly impact wetland communities within the drainage. Furthermore, these areas may represent Mariana common moorhen habitat.
36	x	x	x	x	Runoff during the construction phase for this project and construction noise in areas, primarily to the south (down gradient) of the proposed route. Increased potential for invasive species encroachment and wildland fires along new edges after construction.	The relocation of Route 15 would require clearing through limestone forest, scrub forests, and tangantangan thickets. Although most of the road corridor is through previously developed areas, the limestone and scrub forest communities may contain important resources for the recovery of special-status species.

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
44	x	x	x	x	***None:*** The proposed military access point improvement would occur in previously developed and degraded areas of Andersen South. Runoff or construction noise would not impact terrestrial biological resources.	***None:*** This military access point project would occur in previously developed lands with no disturbance of vegetation communities other than degraded tangantangan thickets.
46	x	x	x	x		
47			x		***None:***The proposed military access point improvement would occur in a previously developed and degraded areas of Barrigada (Navy). Runoff or construction noise would not impact terrestrial biological resources.	***None:*** These military access point projects would occur in previously developed lands with no disturbance of vegetation communities other than urban cultivated areas.
48			x			
49			x		***None:*** The proposed military access point improvement would occur in a previously developed and degraded areas of Barrigada (Air Force). Runoff or construction noise would not impact terrestrial biological resources.	***None:*** These military access point projects would occur in previously developed lands with no disturbance of vegetation communities other than urban cultivated areas in the vicinity of Barrigada (Air Force).
49A				x		
63			x			
74			x			
113	x	x	x	x		

Note [1]: The GRN project descriptions and alternatives are described in detail in Volume 6 Chapter 2.5.
Note [2]: Mitigation measures are included later in this chapter that minimize or avoid potential direct or indirect impacts

Table 12.2-13. Apra Harbor GRN Projects, Alternatives, and Potential Impacts

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
4	x	x	x	x	***None:*** The proposed military access point improvement would occur in a previously developed and degraded areas along Route 11. Runoff or construction noise would not impact terrestrial biological resources.	***None:*** The proposed improvements along Route 11 between the commercial port and Route 1 (GRN # 4) do not require road widening (only pavement strengthening); therefore, no terrestrial biological resources would be impacted because all work would be confined within the existing road corridor. The addition of the weigh station would require some vegetation removal (tangantangan thickets and grasses), but there are no biological resources along Route 11 that would be impacted by the proposed project. The Route 11 and Route 1 intersection improvement (GRN #5) would be constructed on grounds that have been previously cleared and would not impact terrestrial biological resources
5	x	x	x	x		
24	x	x	x	x	Portions of the proposed roadway improvements along Route 1 are adjacent to Sasa Bay Marine Preserve (on the west side of Route 1) and freshwater wetlands (on the east side of Route 1). Potential for runoff during the construction phase into Sasa Bay and Sasa River, Laguas River, Aguada River, and Atantano River, which terminate at Sasa Bay or Inner Apra Harbor.	***None:*** These projects do not require road widening (only pavement strengthening); therefore, no terrestrial biological resources would be impacted because all work would be confined within the existing road corridor with no gain in impervious cover.

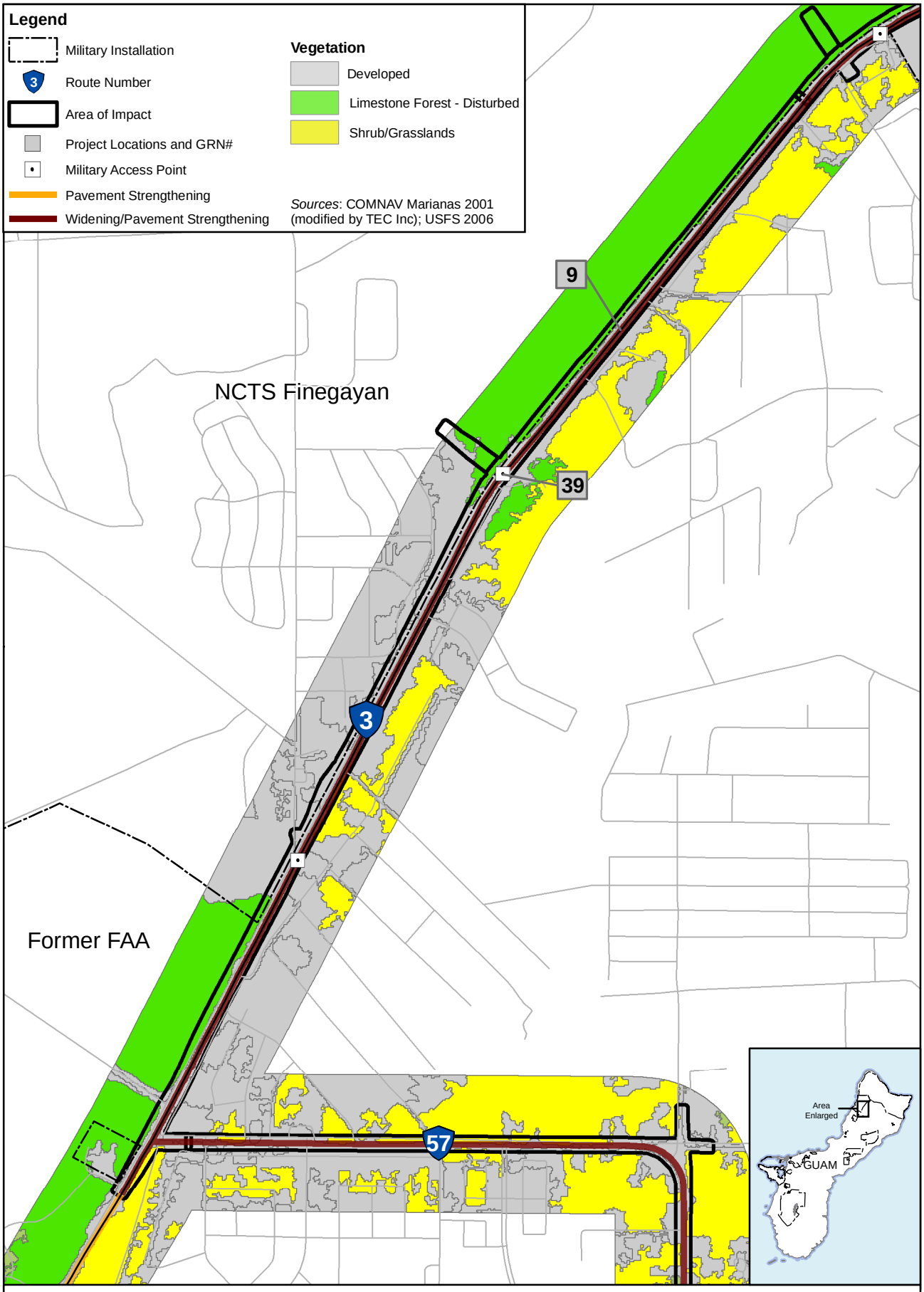
GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
26	x	x	x	x	Portions of the proposed roadway improvements along Route 2A are adjacent freshwater wetlands formed by the Atantano River. Potential for runoff during the construction phase into the these wetlands and other stormwater drainages that terminate at Inner Apra Harbor.	
50	x	x	x	x	***None:*** The proposed military access point improvement would occur in a previously developed and degraded areas of Naval Base Guam. Runoff or construction noise would not impact terrestrial biological resources.	***None:*** This military access point project would occur in previously developed lands with no disturbance of vegetation communities around the proposed location at Naval Base Guam.

Note [1]: The GRN project descriptions and alternatives are described in detail in Volume 6 Chapter 2.5.
Note [2]: Mitigation measures are included later in this chapter that minimize or avoid potential direct or indirect impacts

Table 12.2-14. South Region GRN Projects, Alternatives, and Potential Impacts

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
25	x	x	x	x	Although most of the portions of the proposed roadway improvements along Route 5 are adjacent to residential areas (e.g. Apra Heights), some portions have potential for construction runoff into freshwater wetlands formed by the Namo River near the Agat Commercial Center. The Namo River terminates at Agat Bay.	***None:*** These projects do not require widening, only pavement strengthening along Route 5 from Route 2A to Route 17 (GRN # 25), and Route 17 to the NMS. (GRN # 27).
27	x	x	x	x		
52	x	x	x	x	Potential for runoff during the construction phase into upper reaches of the Namo River.	***None:*** This military access point project at NMS would occur in previously disturbed lands with no disturbance of vegetation communities other than degraded tangantangan thickets.
110	x	x	x	x	***None:*** The proposed intersection improvement for Route 2 and 12 would occur near commercial and light industrial areas (e.g. Agat Commercial Center). Runoff or noise during the construction phase would not impact terrestrial biological resources.	***None:*** The Route 2 and Route 12 intersection improvement would be constructed on grounds that have been previously cleared and would not impact terrestrial biological resources

Notes [1]: The GRN project descriptions and alternatives are described in detail in Volume 6 Chapter 2.5; [2]: Mitigation measures are included later in this chapter that minimize or avoid potential direct or indirect impacts



Printing Date: Oct 28, 2009, M:\projects\GIS\8806_Guam_Buildup_EIS\figures\Current_Deliverable\Vol_6\12.2-3.mxd

Figure 12.2-3
GRN Projects in the North Region Considered for Analysis - Map 1

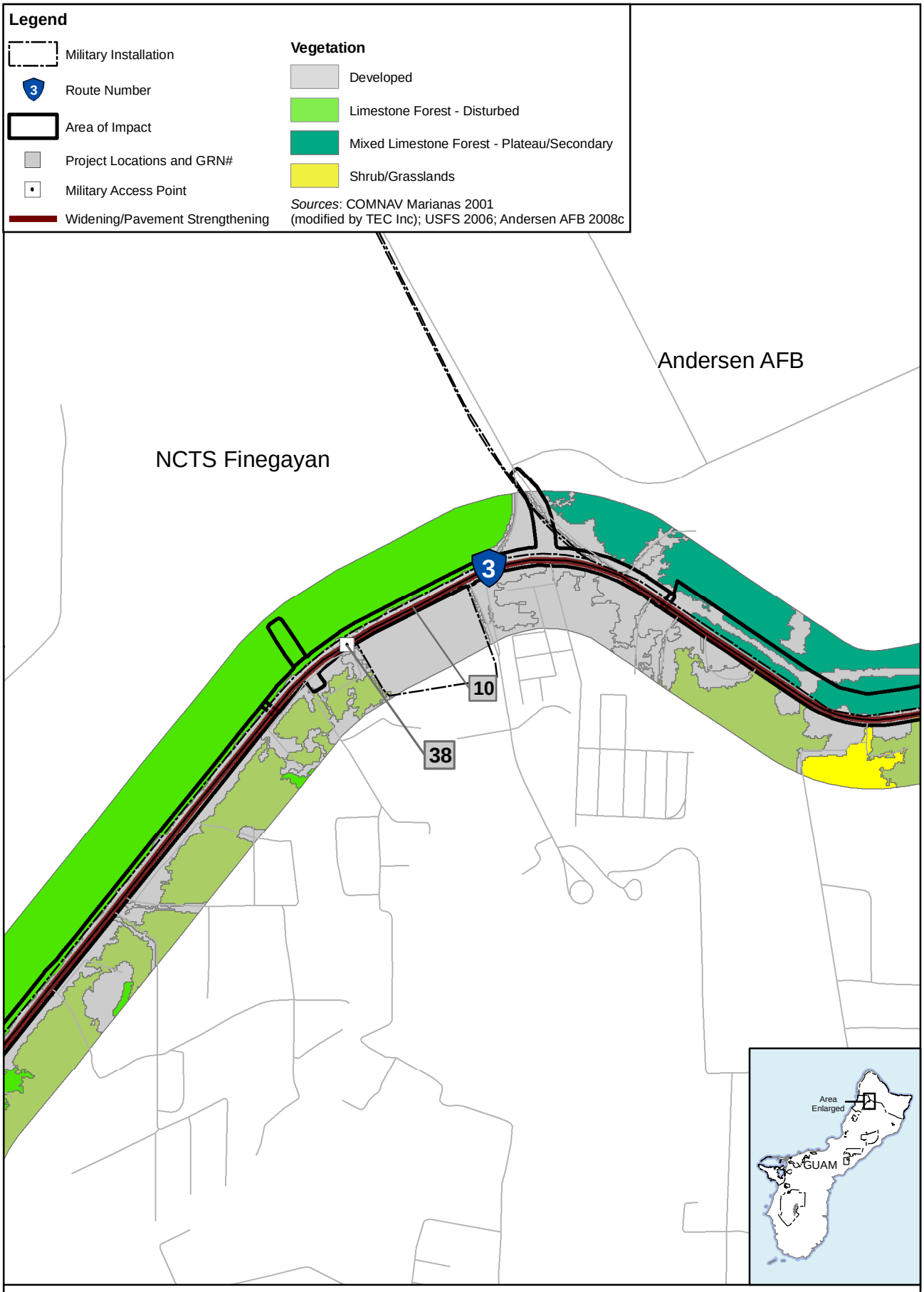
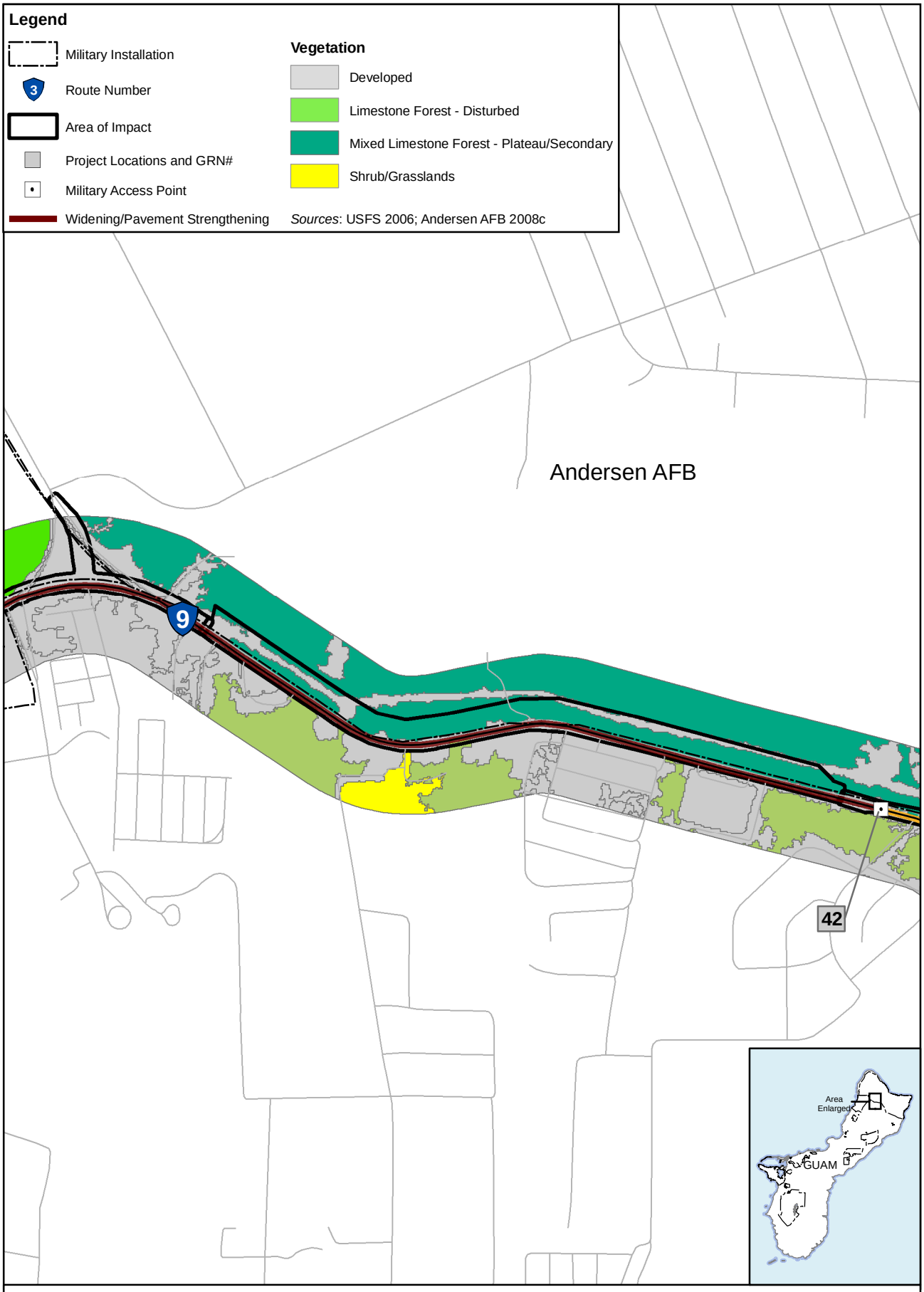


Figure 12.2-4
GRN Projects in the North Region Considered for Analysis - Map 2



Printing Date: Oct 28, 2009, M:\projects\GIS\8806_Guam_Buildup_EIS\figures\Current_Deliverable\Vol_6\12.2-5.mxd

Figure 12.2-5
GRN Projects in the North Region Considered for Analysis - Map 3

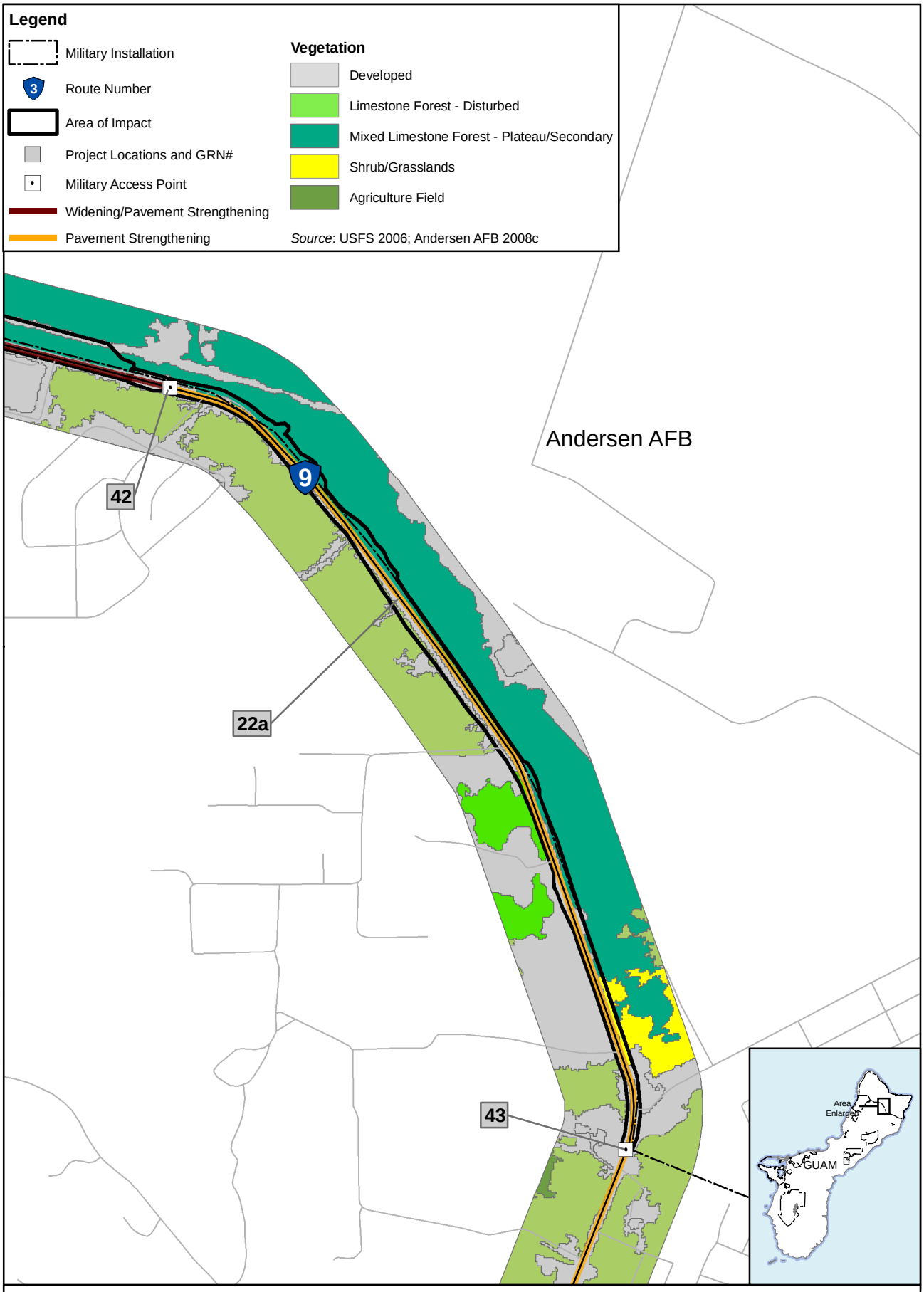


Figure 12.2-6
GRN Projects in the North Region Considered for Analysis - Map 4

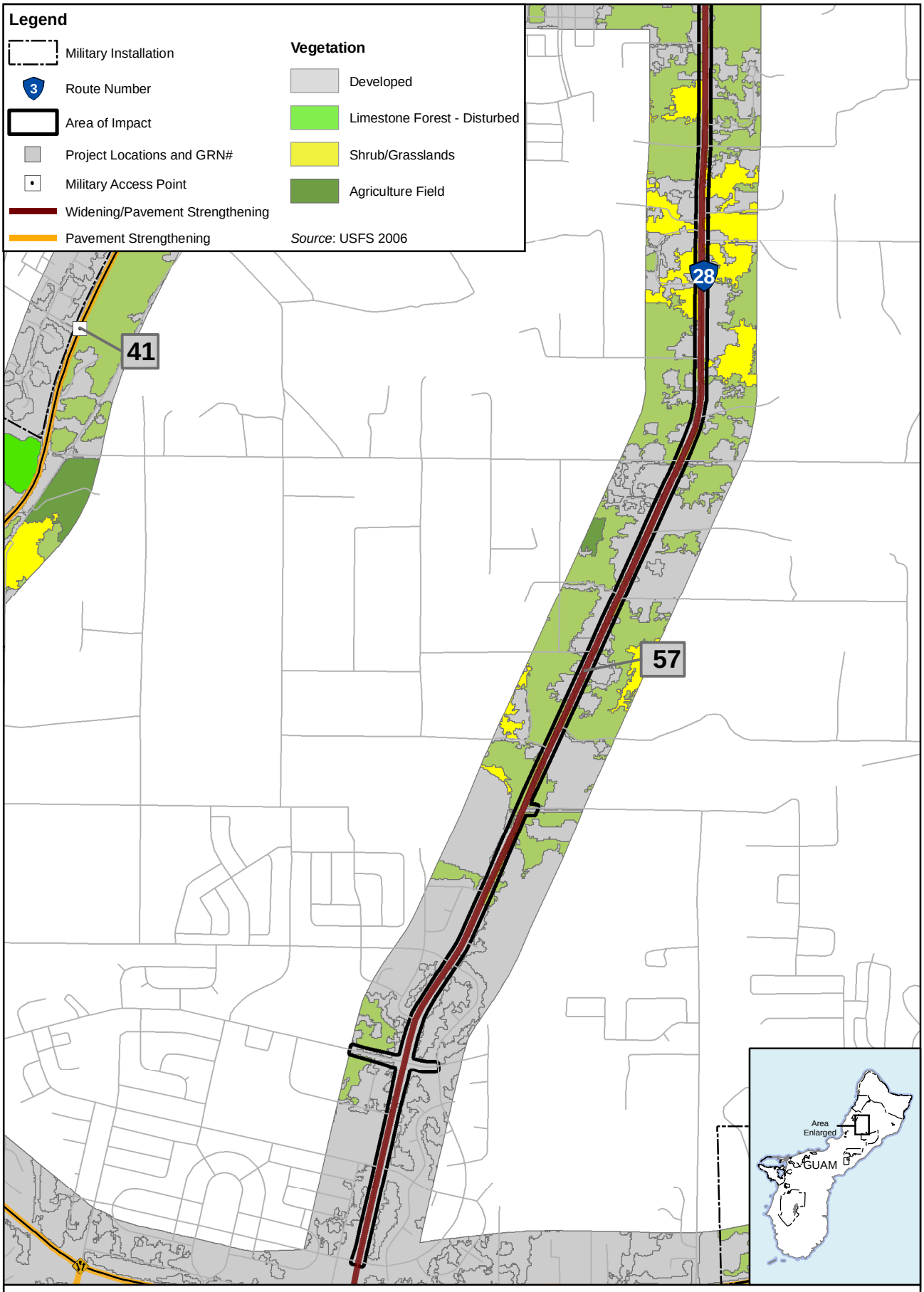


Figure 12.2-7
GRN Projects in the North Region Considered for Analysis - Map 5

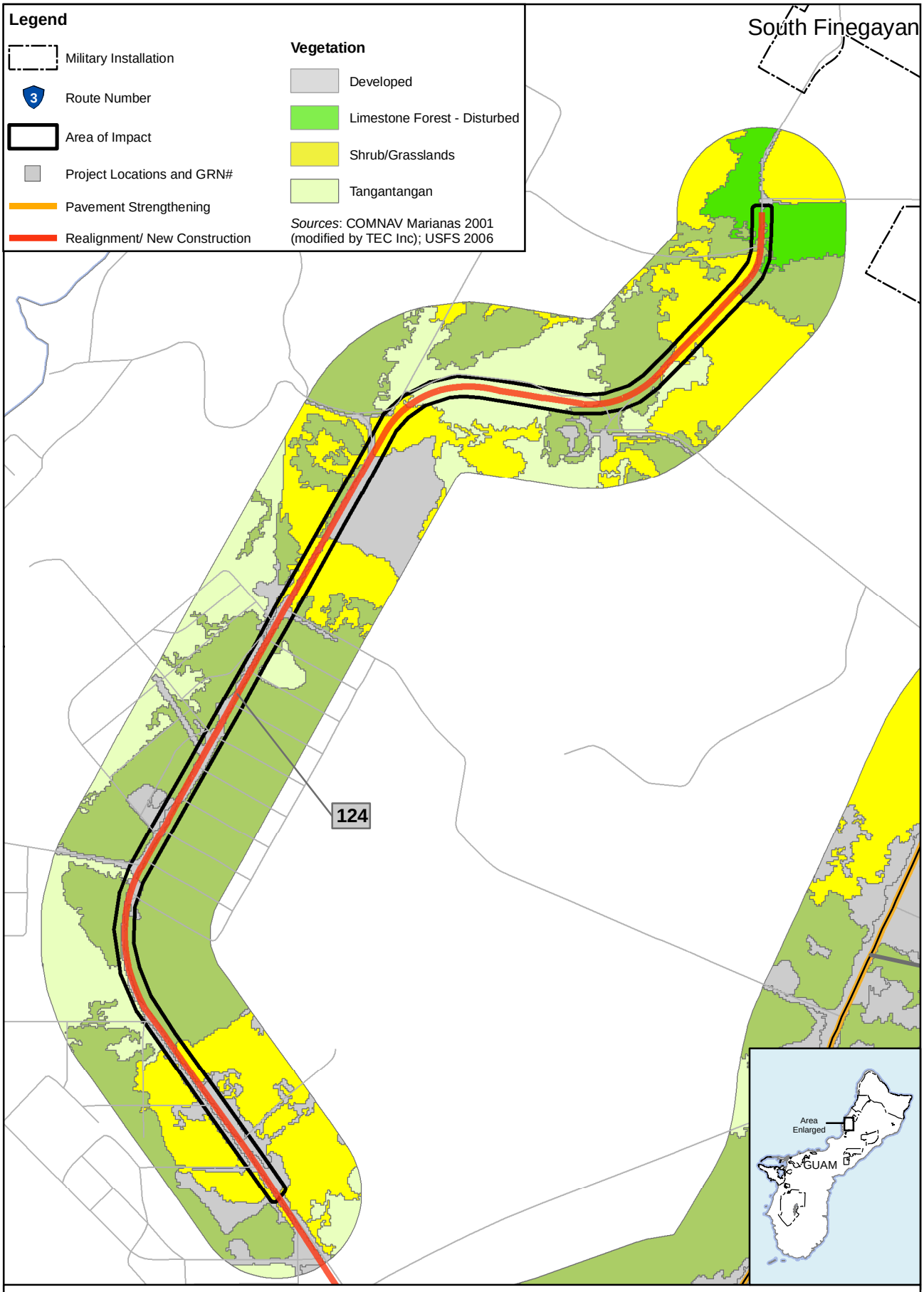


Figure 12.2-8
GRN Projects in the North Region Considered for Analysis - Map 6

Figure 12.2-9
GRN Projects in the Central Region Considered for Analysis - Route 15 Relocation

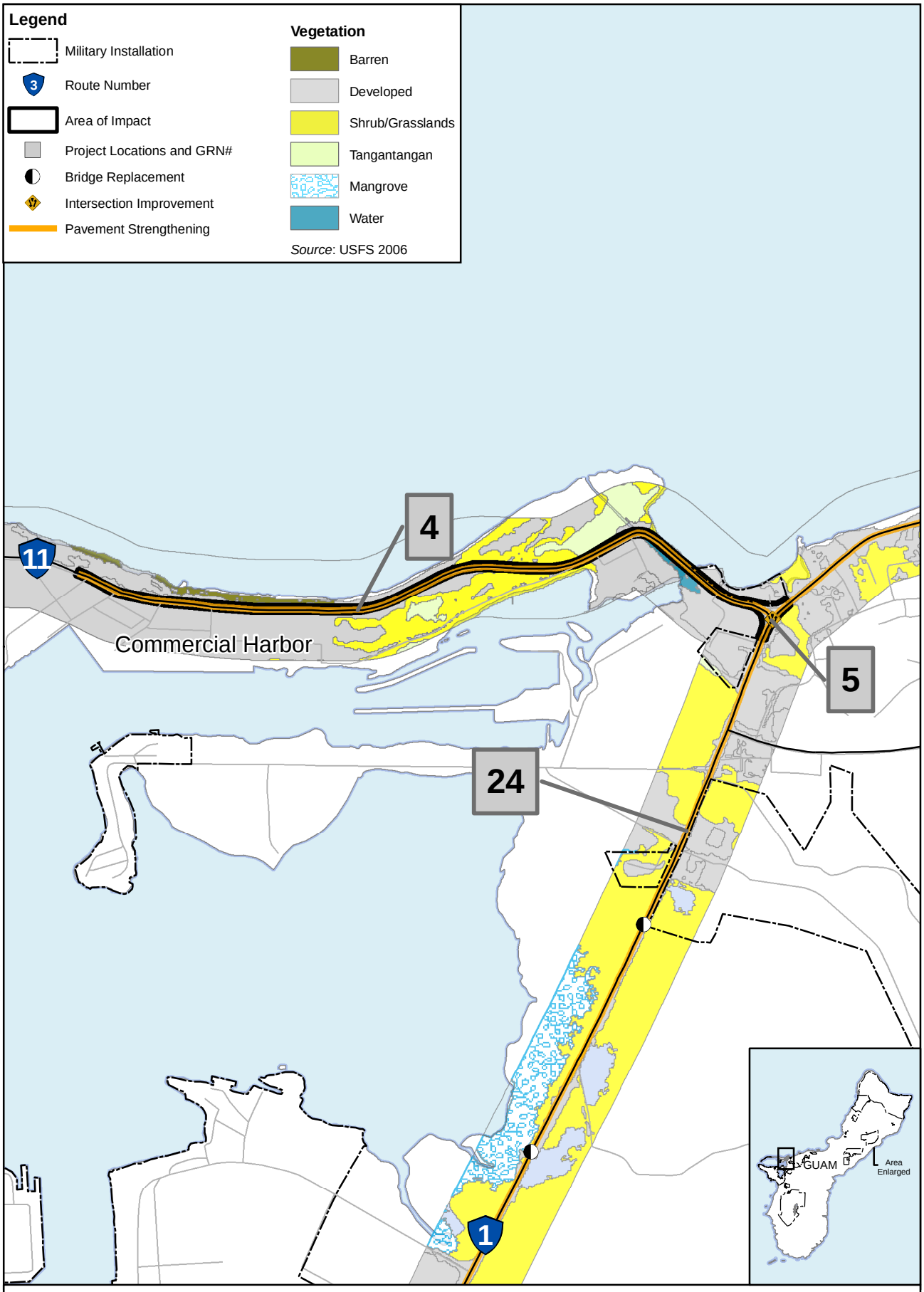


Figure 12.2-10
GRN Projects in the Apra Harbor Region Considered for Analysis

12.2.6.1 Alternative 1

Volume 6 Chapter 2.5 of this EIS/OEIS describes Alternative 1 for the proposed GRN and how they relate to alternatives associated with the proposed military buildup. As described earlier , GRN #9, 10, 22, 22A, 38A, 39A, 41, 42A, 57, and 124 were identified as having potential impacts to terrestrial biological resources within the North Region.

North

Vegetation

Direct impacts associated with these projects include clearing vegetation, primarily on the northern side of Route 9 and the western side of Route 3, and other road projects within the North Region. The vegetation community types subject to removal for each road project proposed for the North Region are listed in Table 12.2-15.

Impacts to vegetation would be less than significant because no primary limestone forest would be removed. Vegetation removed does provide habitat for wildlife and special-status species. These impacts are evaluated in subsequent sections.

Table 12.2-15. Potential Direct Impacts to Vegetation Communities with Implementation of Roadways Alternative 1

GRN #	*Limestone Forest, Disturbed ac (ha)*	*Mixed Limestone Forest-Plateau/ Secondary ac (ha)*	*Tangantangan (Leucaena) ac (ha)*	*Scrub Forest ac (ha)*	*Mixed Herbaceous Scrub ac (ha)*	*Developed Land ac (ha)*
Option A						
09 (North)	16 (6.5)	0	0	1.1 (0.4)	0	34 (14)
10 (North)	6.8 (2.8)	1.0 (0.4)	0	0.0	0	13 (5.3)
22 (North)	0.3 (0.1)	30 (12.1)	0	0.4 (0.2)	0	14 (5.7)
22A (North)	0	13 (5.3)	0	1.2 (0.5)	1.1 (0.4)	16 (6.5)
38A (North)	1.6 (0.7)	0	0	0	0	0
39A (North)	0	0	0	0	0	2.4 (1.0)
41 (North)	1.9 (0.8)	0	0	0	0.2 (0.1)	0.3 (0.1)
42A (North)	0	1.4 (0.6)	0	0	0	0.2 (0.1)
57 (North)	0	0	0	13 (5.3)	2.5 (1.0)	58 (23)
124 (North)	0.9 (0.4)	0	5.9 (2.4)	11 (4.5)	7.7 (3.1)	12 (4.9)
3 (Central)*	0	0	0	0	<0.1 (<0.1)	<0.1 (<0.1)
35 (Central)*	0	0	0	0	0.2 (<0.1)	0.2 (<0.1)
36 (Central)	30 (12.1)	0	5.5 (2.2)	8.2 (3.3)	2.4 (1)	16 (6.5)
Totals	58 (23.3)	46 (19)	11 (4.5)	35 (14)	14 (5.7)	166 (67)
Option B (identical to Option A except removing GRN #36 (Rt 15 realignment)						
Totals	28 (11)	46 (19)	5.9 (2.4)	27 (11)	12 (4.9)	150 (61)

Note: Impacts associated with bridge replacement projects, such as GRN # 3 (Agana Bridge) and GRN # 35 (Atantano, Fonte, Laguas, and Sasa Bridges), are shown in Table 12.2-17.

Wildlife

Based on observations during field visits and observations in other similar areas on Andersen AFB, NCTS Finegayan, and Andersen South (discussed in Volume 2, Section 10.1), the only native bird species likely to be present in the project areas are the yellow bittern and possibly the Pacific golden plover in open areas; both species are ubiquitous throughout Guam. Also abundant throughout Guam are the blue-

tailed skink, mutilating gecko, and mourning gecko found in the area.

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. Therefore, impacts to wildlife would be less than significant with implementation of Alternative 1 roadways.

Special-Status Species

The species potentially affected by the removal of habitat include the Mariana fruit bat, the Mariana crow, and the Guam Micronesian kingfisher. Table 12.2-16 lists the areas subject to removal of overlay refuge lands, essential habitat, and recovery zones for special-status species.

Mariana Fruit Bat. Specific designated habitat areas would be removed under Alternative 1 including Overlay Refuge and essential habitat for the fruit bat (Table 12.2-16).There would be no temporary direct impacts from noise and activity during construction at Andersen AFB to roosting and nesting activities of the Mariana fruit bat because construction would only occur during the daytime. Based on the removal of Overlay Refuge and essential habitat areas, there would be significant impacts to the fruit bat. This significant impact would be mitigated to less than significant with measures described in Volume 2, Section 10.2.2.

Mariana Crow. Specific designated habitat areas would be removed under Alternative 1, including Overlay Refuge and essential habitat for the crow (Table 12.2-16). The Mariana crow is not currently present in areas where these projects would occur so there would be no noise or disturbance impacts from construction. Based on the removal of habitat areas, there would be significant impacts to the Mariana crow. This significant impact would be mitigated to less than significant with measures described in Volume 2, Section 10.2.2.

Micronesian Kingfisher. Specific designated habitat areas would be removed under Alternative 1, including Overlay Refuge and essential habitat for the kingfisher (Table 12.2-16). Based on the removal of habitat areas, there would be significant impacts to the Micronesian kingfisher. This significant impact would be mitigated to less than significant with measures described in Volume 2, Section 10.2.2.

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. Only a very small portion of the Overlay Refuge habitat is scrub and shrublands that would be suitable for reintroduction of the rail. Because of minimal loss of habitat for a species not currently presnet, removal of these areas due to construction would result in a less than significant impact.

Pacific Slender-Toed Gecko. The gecko was found in recent surveys (NR Survey Report, in preparation) in northeastern NCTS Finegayan in a forested area. However, because the roadway impacts would be in or along adjacent disturbed areas, the species would be unlikely to be present in the project areas. Impacts would be less than significant.

The DoD is engaged in Section 7 ESA consultation with the USFWS Pacific Islands Field Office to avoid, minimize, or offset the potential direct and indirect impacts associated with Alternative 1. These measures are discussed below under “Potential Mitigation Measures”.

Table 12.2-16. Potential Direct Impacts to Special Status Species Habitat with Implementation of Roadways Alternative 1

GRN#	*EssentialHabitat – Bat and Kingfisher and Crow* ac (ha)*	*Recovery Zone– Crow* ac (ha)*	*Overlay Refuge ac (ha)*	*Overlay Unit Name*
Options A and B				
09 (North)	0.1 (0.04)	5.1 (2.1)	8.1 (3.3)	Navy (NCTS Finegayan)
10 (North)	5.3 (2.1)	5.3 (2.1)	8.1 (3.3)	Navy (NCTS Finegayan)
22 (North)	27 (11)	27 (11)	30 (12)	Andersen AFB
22A (North)	0.7 (0.3)	10 (4.0)	3.1 (1.3)	Andersen AFB
38A (North)	1.6 (0.6)	1.6 (0.6)	1.6 (0.6)	Navy (NCTS Finegayan)
39A (North)	2.4 (1.0)	2.4 (1.0)	2.4 (1.0)	Navy (NCTS Finegayan)
41A (North)	2.4 (1.0)	2.4 (1.0)	2.4 (1.0)	Navy (NCTS Finegayan)
42 (North)	1.7 (0.7)	1.7 (0.7)	1.7 (0.7)	Andersen AFB
Totals	**41 (17)**	**56 (23)**	**57 (23)**	**NA**

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

Indirect impacts associated with these projects may further degrade limestone forests that are important to species recovery efforts. The indirect impacts may include: increasing edge effect of limestone forests, thereby facilitating the further encroachment of aggressive non-native vines and herbaceous vegetation; possible facilitation of access to poachers into habitat areas for the Mariana fruit bat during construction phases; increased wildland fire risk in fine fuels due to construction activities (canopy fires are not expected in northern Guam) that would encourage non-native species encroachment; increased noise and activity levels during construction and operation; and displacement of ungulates (i.e., Philippine deer and feral pig), along with other invasive predators and pests (e.g., brown treesnake, feral cat, feral dog, rat, cane toad) into adjacent habitats. However, since roadways projects are along existing transportation corridors and heavily disturbed habitat, these impacts are expected to be less than significant with standard BMPs employed.

Central

Vegetation

Direct impacts associated with these projects include the proposed clearing of vegetation through the relocated Route 15 road corridor and five bridge replacements proposed for the Central Region. The vegetation community types subject to removal for each road project proposed for the Central Region are listed in Table 12.2-15. The proposed Route 15 relocation would clear areas that transition from disturbed limestone forest in the west to scrub forest towards the east of the proposed route. Some areas of the Andersen South parcel, especially the southeast and southwest corners of the parcel, contain mature vegetation canopy layers with some areas dominated by native species. Reconnaissance surveys in support of this EIS/OEIS and separate reconnaissance surveys conducted in support of the proposed Route 15 relocation indicate a high feral pig population, as evidenced by heavy damage to substrates, vegetation impacts, and numerous wallows.

Impacts to vegetation associated with the road improvements and bridge replacements would be less than significant because minimal primary limestone forest would be removed. Vegetation removed does provide habitat for wildlife and special-status species. These impacts are evaluated in subsequent sections.

Wildlife

Impacts to aquatic environments associated with the bridge replacements are shown in Table 12.2-17. The five bridge replacements are proposed to span crossings along Route 1 over the Agana River, Atantano River, Laguas River, Sasa River, and Fonte Rivers. These rivers are considered perennial (flowing water for all or most of the year). As shown in Table 12.2-17, construction activities associated with the five bridge replacements would temporarily remove a total area of approximately 1 ac (0.4 ha). Temporary direct impacts associated with construction activities include the potential for increased erosion associated with grading into the subsoil within and outside the stream channel and potential impacts to aquatic communities in the immediate area of the bridge replacement.

Table 12.2-17. Potential Direct Impacts to Special Status Species Habitat with Implementation of Roadways Alternative 1

GRN Project #	*Bridge Name*	*Potential Direct Impacts to Aquatic Habitats*[1]		*Potential Indirect Impacts to Freshwater Aquatic Habitats*[2]
		Square Feet	*Acres*	
3	Agana Bridge	5,777.1	0.13	Potential sedimentation along the 260 feet (80 m) streambed of the Agana River between Agana Bridge and the river terminus (between East Hagatna Beach and Paseo de Susana Park).
35	Atantano Bridge	5,286.6	0.12	Potential sedimentation along the 1,600 feet (480 m) streambed of the Atantano River between Atantano Bridge and the river terminus (Inner Apra Harbor).
	Fonte Bridge	11,920.0	0.27	Potential sedimentation along the 290 feet (90 m) streambed of the Fonte River between Fonte Bridge and and the river terminus (between West Hagatna Beach and the Governor's Complex).
	Laguas Bridge	5,801.0	0.13	Potential sedimentation inputs along the 1,600 feet (480 m) streambed of the Sasa River between Sasa Bridge and and the river terminus and 800 feet (240 m) streambed of the Laguas River to the river terminus. Both rivers flow through the Sasa Bay Marine Preserve, which supports the largest mangrove forested area within the Mariana Islands.
	Sasa Bridge	6,062.0	0.14	
	Total Area	**34,846.6**	**0.80**	**-NA-**

Note [1]: Stream channel widths were calculated by averaging the width of four cross-stream lines between observed ordinary high water marks (OHWM) for each bridge. Two upstream lines and two downstream lines were measured for each bridge.
The estimated area of direct impacts to potential waters of the U.S. was calculated by the following equation: (Stream channel width) x (Structure width) + (Assumed area of upstream channel modifications [30']) + (Assumed area of downstream channel modifications [30']).

Note [2]: Potential indirect impacts are considered temporary for construction activities. Mitigations (BMPs) are in development as a joint effort between GEPA , FHWA, and FHWA design contractors to minimize or avoid impacts during and after the construction phase. Examples of mitigative BMPs are included in CNMI and Guam Stormwater Management Manual (CNMI and Guam 2006).

Indirect impacts may occur further downstream outside of the immediate construction area and be prolonged in time. These indirect effects may include degradation of stream channel aquatic habitats and marine habitats supporting coral communities and fisheries. FHWA and GEPA have mandated standard operating procedures and BMPs specific to sediment control that accounts for storm water runoff and

other Guam-specific criteria for pollution prevention during construction and operation of the proposed roads. Hydraulic conveyance under the new bridge replacements would improve, which may benefit downstream stream segments, wetland areas and open water habitats by decreasing scour along the stream bank near the bridge replacements and decreasing sediment inputs into downstream freshwater and marine habitats. In summary, the bridge replacement would potentially impact approximately 1 ac (0.4 ha) of riverine aquatic habitats and indirectly impact aquatic habitats downstream; however, the impacts would be minimized through individual BMPs cooperatively developed by the FHWA and GEPA, the temporary nature of the impact, and possible improved hydraulic conveyance under the proposed bridge replacements. With the BMPs, impacts would be less than significant.

Based on observations during field visits and observations in other similar areas on Andersen AFB, NCTS Finegayan, and Andersen South (discussed in Volume 2, Section 10.1), the only native bird species likely to be present in the inland project areas are the yellow bittern and Pacific golden plover. At the bridge crossings near the coast various migratory birds are likely to utilize the area, and tidal influences (e.g. exposed tidal mudflats) and estuarine banks provide seasonal foraging and loafing habitat. Annual migrants to Guam that might be found there are Pacific golden plover, greenshank, Mongolian plover, gray-tailed tattler, whimbrel, ruddy turnstone, and cattle egret (COMNAV Marianas 2008, Eggleston 2009, NR Survey Report in preparation). A recent field survey of the proposed bridge crossings (NR Survey Report in preparation) did not record any native bird species. The species likely to regularly use the area, particularly near roadways, would be species ubiquitous on Guam.

During recent surveys conducted in support of this EIS/OEIS, three native reptile species were found within the forested areas at Polaris Point: Pacific blue-tailed skink, mourning gecko, and mutilating gecko (NR Survey Report in preparation). Native land hermit crabs and coconut crabs are present on the base in coastal and estuarine areas (COMNAV Marianas 2008). The presence of these species is unknown in the BRSA.

Proposed construction activities would displace these species of 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 area impacted does not expand greatly from presently disturbed areas and would be very small in comparison to the total habitat available. In addition, most species known to be present are abundant in surrounding areas (with the possible exception of the coconut crab). Overall, impacts to wildlife would be less than significant with implementation of Alternative 1 roadways.

Special-Status Species

Construction within the Central Region does not require the removal of essential habitat for the Mariana fruit bat, Mariana crow, or Guam Micronesian kingfisher; areas designated as Mariana crow recovery zones, or Overlay Refuge. The shrub/grassland habitat that would be removed is potential habitat for reintroduction of the Guam rail in the future, but the areas removed have no special habitat designation. Direct impacts to special-status species in the Central Region would be less than significant.

Potential indirect impacts associated with these projects that could include increasing edge effects for invasive species, displacement of ungulates, increased noise and activity levels, and wildland fire risk are expected to be less than significant because these projects are along existing roadway corridors and heavily disturbed habitat.

Apra Harbor

There were no projects proposed for the Apra Harbor Region identified as having potential to impact terrestrial biological resources under Alternative 1. Therefore, there would be no significant impacts to terrestrial biological resources (vegetation communities, wildlife resources, and special-status species) associated with Alternative 1.

South

There were no projects proposed for the South Region identified as having potential to impact terrestrial biological resources under Alternative 1; therefore, there would be no significant impacts to terrestrial biological resources (i.e., vegetation communities, wildlife resources, and special-status species) associated with Alternative 1 implementation.

Potential Mitigation Measures

Impacts to vegetation communities and special-status species habitat resulting from proposed roadway projects would be mitigated with a suite of protection and conservation measures for all impacts on Guam described in this EIS/OEIS. See Volume 2, Section 10.2.2 for a description of these measures.

Impacts to freshwater aquatic environments would be mitigated with actions that avoid or minimize direct and/or indirect effects associated with during the construction and operational phases of each roadway project. These mitigation measures are in development as part of a cooperative effort between GEPA, FHWA, and DPW. As part of this effort, each GRN project would have specific mitigation measures that cater to the individual project type and environemental context (e.g. adjacency to sensitive ecological areas, slope of surrounding terrain). The specific mitigative actions would be completed as the GRN project designs near completion. The CNMI and Guam Stormwater Management Manual (CNMI and Guam 2006) provides examples of BMPs that would be included in the planning, design, and construction for all proposed road improvement projects. A Storm Water Runoff Drainage System Plan is required for a Building Permit by the Guam DPW when the area to be graded is more than 5,000 square feet (464 square meters) or a proposed cut or fill is greater than 5.0 ft (1.5 m) in height. This stormwater plan would describe the potential impacts and proposed mitigation associated runoff and drainage.

12.2.6.2 Alternative 2 (Preferred Alternative)

Volume 6, Chapter 2, of this EIS describes Alternative 2 for the proposed GRN and how this alternative relates to the alternatives associated with the proposed military buildup. Alternative 2 differs from Alternative 1 in the way that NCTS Finegayan would be utilized. Proposed road projects under Alternative 2 are the same as the proposed road projects under Alternative 1, with the exception of military access point locations at NCTS Finegayan and Andersen AFB. These military access point projects that are included as part of Alternative 2 (GRN # 38, 39, and 41) would have the same direct and indirect impacts as those military access point projects included as part of Alternative 1 (GRN # 38A, 39A, and 41A); therefore, impacts to terrestrial biological resources of Alternative 2 are similar to Alternative 1 for each region.

Potential Mitigation Measures

The mitigation measures for Alternative 2 are the same as those for Alternative 1.

12.2.6.3 Alternative 3

Volume 6, Chapter 2, of this EIS/OEIS describes Alternative 3 for the proposed GRN and how this alternative relates to the alternatives associated with the proposed military buildup. Alternative 3 differs

from Alternative 1 and 2 in the way that NCTS Finegayan would be utilized, as well as other federal parcels. The land use differences require a different configuration of the proposed GRN military access point configurations. Proposed road projects under Alternative 3 are the same as the proposed road projects under Alternative 1, except that Alternative 3 includes GRN #38, 47, 48, 49, 63, and 74, and it excludes GRN #19, 20, 31, 38A, 39A, 41A, and 124. GRN # 47, 48 and 49 are associated with new access to Barrigada (Navy and Air Force); however, these projects would occur in previously disturbed areas of no value to special status species or wildife. Further, indirect impacts associated with increased impervious cover (e.g. runoff during the construction phase of the projects) would not degrade these habitats. Gate locations for Alternative 3 are the same for Alternative 1, except that NCTS Finegayan Main Gate and commercial gate locations (GRN # 38 and 39) are in different locations than the Main Gate and commercial gate locations in Alternative 1 (GRN #38A and 39A). The GRN # 38 and 39 locations would have the same direct and indirect impacts as GRN # 38A and 39A. Therefore, impacts to terrestrial biological resources of Alternative 3 are similar to Alternative 1 for each region.

Potential Mitigation Measures

The mitigation measures for Alternative 3 are the same as those for Alternative 1.

12.2.6.4 Alternative 8

Volume 6 Chapter 2, of the EIS/OEIS describes Alternative 8 for the proposed GRN and how this alternative relates to the alternatives associated with the proposed military buildup. Alternative 8 differs from Alternative 1 in the way that NCTS Finegayan would be utilized, as well as other federal parcels. Proposed road projects under Alternative 8 are the same as the proposed road projects under Alternative 1, with the exception of the military access point location at Barrigada (Air Force). This gate location project included as part of Alternative 8 (GRN # 49A) would have the same direct and indirect impacts as the military access point project included as part of Alternative 3 (GRN # 49); therefore, impacts to terrestrial biological resources of Alternative 8 are similar to Alternatives 1 and 3 for each region.

Potential Mitigation Measures

The mitigation measures for Alternative 8 are the same as those for Alternative 1.

12.2.6.5 Firing Range Option

The alternatives described in Volume 2 Chapter 2, for the relocation include the Main Cantonment action alternatives with either a Firing Range Option A or B. Option A would require the realignment of Route 15 (GRN #36), while Option B does not require realignment of Route 15; therefore, by choosing Option B, the impacts associated with proposed road projects within the Central Region study area to terrestrial biological resources would not occur.

12.2.6.6 Summary of Impacts

Table 12.2-18 summarizes the potential impacts of each alternative.

Table 12.2-18. Summary of Potential Impacts to Terrestrial Biological Resources, Roadway Projects

Alternative 1	*Alternative 2**	*Alternative 3*	*Alternative 8*
Vegetation			
LSI • There would be no removal of primary limestone forest	LSI • There would be no removal of primary limestone forest	LSI • There would be no removal of primary limestone forest	LSI • There would be no removal of primary limestone forest
Wildlife			
LSI • Less than significant impacts to wildlife	LSI • Less than significant impacts to wildlife	LSI • Less than significant impacts to wildlife	LSI • Less than significant impacts to wildlife
Special-Status Species			
SI-M • Significant direct impact due to the removal of recognized essential habitat for 3 endangered species and Overlay Refuge, mitigated to less than significant	SI-M • Significant direct impact due to the removal of designated essential habitat for 3 endangered species and Overlay Refuge, mitigated to less than significant	SI-M • Significant direct impact due to the removal of designated essential habitat for 3 endangered species and Overlay Refuge, mitigated to less than significant	SI-M • Significant direct impact due to the removal of designated essential habitat for 3 endangered species and Overlay Refuge, mitigated to less than significant

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less Than Significant Impact.
*Preferred Alternative.

There would be no removal of primary limestone forest habitat, therefore impacts to vegetation would be less tha significant. Wildlife species that are are documented as present are common species and the proposed roadway improvements would not affect populations of these species so impacts would be less than significant. The removal of essential habitat for ESA-listed species in the North Region would be a significant impact, mitigated to less than significant. The encroachment would also remove habitat from the Refuge Overlay units on Finegayan and Andersen AFB.