CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

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Acronyms and Abbreviations

%	percent
CFR	Code of Federal Regulations
CJMT	Commonwealth of the Northern Mariana Islands Joint Military Training
CNMI	Commonwealth of the Northern Mariana Islands
DoN	Department of the Navy
EA	Environmental Assessment
EIS	Environmental Impact Statement
MSL	mean sea level
n.d.	no date
NEPA	National Environmental Policy Act
OEA	Overseas EA
OEIS	Overseas EIS
RTA	Range and Training Area
U.S.	United States

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CHAPTER 4 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter describes potential environmental consequences associated with implementing the proposed action and no-action and alternatives. In accordance with National Environmental Policy Act (NEPA) guidelines, the scope of the Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) was guided by emphasizing potentially significant issues and deemphasizing insignificant issues (40 Code of Federal Regulations [CFR] §1501.1[d]). The following topics provide an overview of Chapter 4 and are discussed below:

- Environmental Resource Sections
- Programmatic Analysis
- Section 4(f) Evaluation
- Summary of Impacts and Potential Mitigation Measures

Environmental Consequences

This chapter describes the environmental consequences that would potentially result from implementation of the alternatives described in Chapter 2, including the no-action alternative. This chapter also describes the analytical methodology used to develop the analysis.

4.1.1 Environmental Resource Sections

Consistent with the discussion of the affected environment (see Chapter 3, *Affected Environment*), this chapter is divided into 16 resource areas (Sections 4.2 through 4.17) to provide a framework for evaluating the impacts of each alternative. Each environmental resource section is divided into the following subsections.

4.1.2 Approach to Analysis

The *Approach to Analysis* section describes the methodology and impact assessment criteria used to identify and evaluate resource impacts in this EIS/OEIS.

4.1.3 Resource Management Measures

The *Resource Management Measures* section discusses applicable (1) avoidance and minimization measures and, (2) best management practices and standard operating procedures, and how they serve to lessen impacts to specific resources. Resource management measures include avoidance and minimization measures, best management practices, and standard operating procedures. Resource management measures would be incorporated into the proposed action and are common to all action alternatives.

Avoidance and minimization measures that further reduce environmental impacts are not necessarily required by law, regulation, or policy. However, they are incorporated into the site planning and design of the proposed action. Examples of avoidance and minimization include moving target locations, moving firing positions, adjusting engagement zones, limiting weapons deployment, adjusting High Hazard Impact Area boundaries, and adjusting use of tactical landing beaches.

Best management practices include standard operating procedures and commonly accepted practices routinely implemented by the Department of the Navy (DoN) in design, construction, and operations to provide for the safety of personnel and equipment, as well as aid with regulatory compliance. The EIS/OEIS impact analysis (Chapter 4) assumes that resource management measures are successfully incorporated into the proposed action. Best management practices and standard operating procedures are described in Appendix D, *Best Management Practices*.

4.1.4 Action Alternatives

Chapter 4 covers both the action and no-action alternatives. Each resource area includes analysis of impacts under the three Tinian action alternatives and the two Pagan action alternatives. The separate Tinian and Pagan presentations enable the unique characteristics of each island as well as distinct types of training venues to be clearly depicted. These separate presentations do not change the intent of the proposed action which is to establish Range and Training Areas (RTAs) on both Tinian and Pagan.

4.1.5 Construction and Operation Impacts

A separate discussion of the potential impacts resulting from both construction, and operational activities associated with implementation of the Tinian and Pagan action alternatives is provided. Some resource areas do not include discussion of either construction period or operations period impacts, as those activities are not applicable to the discussion. For example, there are no construction period impacts under Section 4.6, *Airspace*.

4.1.5.1 Impact Determination

A determination is made for each potential impact as to whether it would be significant or not, as appropriate. If the impact would be significant, a determination is made as to whether it could be mitigated to less than significant. If not, the consequences of the significant impacts are presented.

Significant Impacts

According to NEPA, a determination of significance requires consideration of both the context of the action and the intensity or severity of the impact (40 CFR § 1508.27).

4.1.5.2 Potential Mitigation Measures

For the purpose of this EIS/OEIS, mitigation measures are additional project-specific measures to actively minimize, rectify, reduce, or provide compensation for impacts identified through the NEPA environmental review process. Mitigation measures are implemented and monitored as practicable in addition to the avoidance and minimization measures, best management practices, and standard operating procedures that are included as part of the proposed action. Examples of potential mitigation measures include habitat restoration to mitigate for habitat removed during construction, and removal of existing non-native invasive species. Unlike resource management measures, which are incorporated into the proposed action, commitments to specific mitigation measures will be documented through the Record of Decision, a permit/approval, programmatic agreement or other formal agreement. Section 4.20 summarizes the impacts and potential mitigation measures for the Tinian alternatives and the Pagan alternatives analyzed in this EIS/OEIS. Table 4.20-1 and Table 4.20-2 provides a summary of the impacts for both construction and operation activities for the Tinian and Pagan alternatives.

4.1.6 No-Action Alternative

A discussion of impacts related to the no-action alternative is provided for each resource area as a basis of comparison of the potential environmental consequences of the proposed action alternatives. The discussions are presented in Sections 2.4.5, *Tinian No-Action Alternative* and 2.5.4, *Pagan No-Action Alternative.*

4.1.7 Programmatic Analysis

Section 4.18 provides a programmatic analysis of two additional projects that are not included within the proposed action: (1) relocation of the existing International Broadcasting Bureau (currently located on Tinian) and (2) construction and operation of a new dock and associated breakwater on Pagan. These two projects are presented and analyzed in a broader context than the proposed action analyzed in this EIS/OEIS.

4.1.8 Section 4(f) Evaluation

Section 4.19 provides a Section 4(f) evaluation of the Tinian International Airport improvements and associated historic properties. Section 4(f) of the Department of Transportation Act of 1966, codified in Federal law at 49 United States (U.S.) Code § 303, requires that the U.S. government endeavors to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites.

4.1.9 Summary of Impacts and Mitigations

Section 4.20 summarizes the potential impacts and mitigation measures identified in Sections 4.2 through 4.17.

4.2 GEOLOGY AND SOILS

Section 4.2 describes the potential impacts to geology and soils including changes to topography and slope stability; impacts to geological functions (i.e., ability for soil and rock to filter and transmit groundwater); the potential for increased risk of exposure to geologic hazards as a result of the proposed action; and changes in soil productivity, erosion, or soil runoff.

4.2.1 Approach to Analysis

The methodology for identifying and evaluating impacts to geology and soils involves establishing baseline conditions through review and evaluation of maps, reports, and other relevant data showing the location and known status of topographic features, geology (i.e., geologic units and geologic hazards), and soil types. This information is then correlated to elements of the proposed action and alternatives to determine potential effects. Known deposits of mineral resources to which access would potentially be constrained or eliminated by the proposed action are evaluated qualitatively for their relative importance and value in a regional context.

The analysis of potential impacts to geology and soils considers both direct and indirect impacts. Direct impacts result from physical soil disturbances or topographic alterations, while indirect impacts include risks to soil and erosion and the impacts to water and marine biological resources away from the construction/operation site.

Appendix F, *Geology and Soils Technical Memo*, provides a detailed characterization of the geology and soils in relationship to the proposed action and alternatives.

The impact assessment for geology and soils considers the following:

- Substantial alteration of the surrounding landscape
- Effects on important geologic features (including large-scale soil or rock removal)
- Effects to site drainage from filling karst features (e.g., sinkholes)
- Diminished slope stability
- A change to soil and/or bedrock conditions that would increase the vulnerability of people or property to a geologic hazard (e.g., seismic activity, flood, tsunami, liquefaction) and the probability that such a hazard could result in injury or property damage
- Physical disturbance that would substantially increase the rate of erosion and soil loss
- Physical disturbance that would substantially increase impervious surfaces
- Reduced amounts of productive soils

Potential project impacts are evaluated based on the degree of project-induced change in a particular factor (e.g., karst geology, soil erosion) relative to existing conditions, as well as by regulatory standards, where applicable. Potential impacts related to chemical constituents that may enter soil or groundwater are indirectly related to geology and soils, and are evaluated in Section 4.3, *Water Resources*, and Section 4.16, *Hazardous Materials and Waste*.

4.2.2 Resource Management Measures

Resource management measures applicable to geology and soils are provided below.

4.2.2.1 Avoidance and Minimization Measures

As discussed in Section 2.3, *Alternatives Development*, all beaches within the Military Lease Area were initially considered for amphibious training. A careful selection process was employed to determine where amphibious training with Amphibious Assault Vehicles could occur. Based on environmental criteria including analysis of bathymetry and coral cover, Unai Babui and Unai Chulu were both considered for Amphibious Assault Vehicle training. A detailed engineering analysis of construction alternatives was conducted for these two locations (see Appendix J, *Amphibious Beach Landing Site Engineering and Coastal Processes Analyses).* After careful consideration and input from resource agencies, it was determined that the tactical amphibious landing training beach requirements for Amphibious Assault Vehicle training could be met at one beach. Unai Chulu was chosen as the single beach for Amphibious Assault Vehicle landings because of its wider configuration in comparison to Unai Babui. Ultimately, Unai Babui was dismissed for Amphibious Assault Vehicle training to lessen environmental impacts and in accordance with input from resource management agencies, but it would still support training for Landing Craft Air Cushion vessels, small boat, and swimmer training.

4.2.2.2 Best Management Practices and Standard Operating Procedures

Best management practices and standard operating procedures that are applicable for geology and soils are listed below and described in Appendix D, *Best Management Practices*.

- Unified Facilities Criteria 3-310-04 (Department of Defense construction guidelines) would be employed when designing and constructing facilities and roadways in order to reduce geologic hazards associated with slope instability, seismic activity, and liquefaction (Department of Defense 2010).
- Project design and construction would minimize impacts to karst geology.
- Project design and construction would minimize erosion as required by the Commonwealth of the Northern Mariana Islands (CNMI) Earthmoving and Erosion Control Regulations.
- Engineering and drainage controls, such as silt fences, fiber rolls, gravel bag berms, mulch, and erosion control blankets would be used to avoid or minimize any potential slope instability, and changes to surface drainage resulting from the changes to the existing slopes would be avoided or minimized.
- Construction-specific stormwater management practices, such as retention ponds, swales, silt fences, fiber rolls, gravel bag berms, mulch, and erosion control blankets would be implemented to provide erosion and sediment control during the construction period. This would be done by employing on-site measures that reduce the flow and velocity of stormwater and minimize the transport of soils and sediment off-site, whenever possible.

- Operation-specific stormwater management would be accomplished through infrastructure improvements, such as retention ponds, that would manage the increased runoff associated with new impervious surfaces and minimize soil erosion in surrounding areas.
- Procedures, such as use of mulch, erosion control blankets, and preventative design measures would be in place to manage and maintain vegetation at the training and support facilities that would minimize soil erosion in surrounding areas.
- Operation-specific beach training protocols, such as use of non-mechanized methods (e.g., rakes or other hand tools) would be implemented upon initiation of the CNMI Joint Military Training (CJMT) amphibious training activities to restore beach topography as best possible.

To the extent applicable to federal projects, the CNMI Earthmoving and Erosion Control Regulations (Volume 15, Number 10, October 15, 1993) and the CNMI Environmental Protection Act (Public Law 3-23, 2 Northern Mariana Islands Commonwealth Code §§ 2601 to 2605) establish a permit process for construction activities; identify investigations and studies that are required prior to design and construction; and provide standards for grading, filling, and clearing.

4.2.3 Tinian

4.2.3.1 Tinian Alternative 1

4.2.3.1.1 Construction Impacts

Construction under Tinian Alternative 1 would involve ground disturbance, ranging from vegetation control to excavation, over approximately 1,902 acres (771 hectares). The discussion of construction impacts for Tinian Alternative 1 is divided into three parts: (1) Topography; (2) Geology; and (3) Soils. Appendix F, *Geology and Soils Technical Memo*, provides a detailed characterization of the topographic, geology, and soil disturbances that could occur as a result of construction activities under Tinian Alternative 1. Table 4.2-1 provides a summary of the ground disturbance, newly created impervious surface, slope, geologic units, soil conditions, prime farmland soils, and geologic hazards under Tinian Alternative 1. These topics are discussed further with relation to topography, geology, and soils following the table in this section.

4.2.3.1.1.1 Topography

Construction of the Tinian RTA support facilities, roads, related infrastructure, and training facilities associated with Tinian Alternative 1 would include clearing, grubbing, and grading; excavating (cut); and filling. Appendix F, *Geology and Soils Technical Memo,* summarizes the areas of ground disturbance.

Impacts resulting from changes to topography include slope instability and alteration of surface drainage patterns. These could occur when excavation and fill would take place to form level surfaces for support facilities, roads, infrastructure, and training facilities. Potential slope instability and changes to surface drainage resulting from the changes to the existing slopes would be avoided or minimized by using engineering design and controls identified in Section 4.2.2, *Resource Management Measures*. The following paragraphs describe the topographic disturbances associated with Tinian Alternative 1.

Table 4.2-1. Summary of Ground Disturbance, Slope, Geologic Units, Soil Conditions, Prime Farmland Soils, and Geologic Hazards Associated with Construction Under Tinian Alternative 1

Description	*Approximate Area of Ground Disturbance (acres)*	*Approximate Newly Created Impervious Surface (acres)*	*Elevation (feet)*	*Slope*	*Geologic Units*	*Soil Conditions*	*Approximate Prime Farmland Soils[1] in acres*	*Geologic Hazards*
Port Improvements	5	5	0 to 33	<1% to 2%	Mariana Limestone	Slow runoff; Slight erosion factor	None	Potential for liquefaction and tsunami inundation
Airfield Improvements	41	41	243 to 270	<1%	Mariana Limestone	Slow runoff; Slight erosion factor	None	Fault lines
Base Camp	257	30	254 to 279	1%	Mariana Limestone	Slow runoff; Slight erosion factor	None	Fault lines
Munitions Storage Area	38	8	235 to 259	1%	Mariana Limestone	Slow runoff; slight erosion factor	None	None
Road Improvements (includes Tracked Driver Vehicle Drivers Course and the Convoy Course)	299	299	0 to 314	Variable	Mariana Limestone, Tagpochau Limestone, Tinian Pyroclastics	Slow to rapid runoff; slight to severe erosion factors	None	Fault lines
Range Complex A	527	0	145 to 285	Variable	Mariana Limestone, Tagpochau Limestone, Tinian Pyroclastics	Slow to medium runoff; slight to medium erosion factors	205	Fault lines

Table 4.2-1. Summary of Ground Disturbance, Slope, Geologic Units, Soil Conditions, Prime Farmland Soils, and Geologic Hazards Associated with Construction Under Tinian Alternative 1

Description	*Approximate Area of Ground Disturbance (acres)*	*Approximate Newly Created Impervious Surface (acres)*	*Elevation (feet)*	*Slope*	*Geologic Units*	*Soil Conditions*	*Approximate Prime Farmland Soils[1] in acres*	*Geologic Hazards*
Range Complex B	47	47	125 to 290	1% to 11%	Mariana Limestone	Ponded, very slow, to medium runoff; slight to medium erosion factors	None	Fault lines
Range Complex C	80	80	85 to 310	1% to 11%	Mariana Limestone	Slow to rapid runoff; slight to severe erosion factors	14	Fault lines
Range Complex D	475	22	35 to 115	1% to 9%	Mariana Limestone	Slow to rapid runoff; slight to severe erosion factors	None	Fault lines
Military Lease Area-wide Training Facilities (includes Convoy Course engagement areas)	130	130	Variable	Variable	Beach Deposits, Alluvium, Colluvium, Marsh, Mariana Limestone and Tagpochau Limestone	Slow to rapid runoff; slight to severe erosion factors	1	Fault lines
Amphibious Training Area	3	0	0 to 15	5% to 15%	Beach Deposits	Slow runoff; slight to severe erosion factors	None	Potential for tsunami inundation
Total	**1,902**	**562**	**-**	**-**	**-**	**-**	**220**	**-**

Notes: [1]Prime farmland soils identified within the footprint of the facility.
Operational footprint is the same as construction footprint, except where noted otherwise.

Support Facilities. Construction or improvements made for support facilities (i.e., port improvements, airfield improvements, base camp, and Munitions Storage Area) would include ground disturbance. However, the near-level area where this work would take place does not have substantial grade changes such as steep hills or canyons that would have to be leveled or filled. Relatively minor changes in grade are anticipated to provide a buildable surface for constructing the support facilities.

Roadways and Utilities. Construction or improvements made for roadways and access trails would involve leveling and/or filling steeper natural slopes. The majority of road improvements would be along existing roads and pathways and would only involve leveling, widening and/or filling portions where conditions are not currently suitable to accommodate necessary vehicles. Utility improvements would generally be co-located with existing improvements for supporting facilities and roadways.

Training Facilities. As described in Section 2.4.1.2 and detailed in Appendix F, *Geology and Soils Technical Memo*, ground disturbance associated with Range Complex A would include clearing for range construction, target placement, and associated access roads and firebreaks around the High Hazard Impact Area. Construction or improvements made to create the various training facilities within Range Complex B, Range Complex C, and Military Lease Area-wide training facilities would be limited and localized to specific features of the individual training facilities. For example, for these range complexes, the earth-moving activities would be limited to small areas such as firing points and objectives or internal trails. These activities would involve leveling and/or filling steep natural slopes. Ground disturbance within Range Complex D would include vegetation clearing of large areas for the Landing Zone and Drop Zone but mostly on relatively flat areas previously cleared for the construction of North Field. Construction and improvements for the Convoy Course would largely be co-located with either existing roads or training courses; for engagement areas, there would be limited and localized clearance and earth moving activities.

Amphibious Training Areas. One amphibious landing area would be constructed at Unai Chulu. Heavy equipment and materials would be staged on land at this location. Refer to Section 4.10, *Marine Biology*, for discussion of construction impacts to coral, and coral reefs. Ground disturbance associated with the construction of the amphibious landing area would include a dredging volume of approximately 798,111 cubic feet (22,600 cubic meters) of earthen material. Grading would occur on the 656-foot (200-meter) location of the proposed landing ramp at a slope of 15 degrees. Construction or improvements made to create the amphibious landing area would include steel sheet pilings, temporary causeways, and access roads that would be removed following construction.

A Coastal Processes Report was conducted in support of this EIS/OEIS to assess possible impacts to Unai Chulu as a result of the development of the Amphibious Assault Vehicle landing area for details on this study see Appendix J, *Amphibious Beach Landing Site Engineering and Coastal Processes Analyses*. The assessment included a site investigation, a historical shoreline analysis, and modeling of waves and nearshore currents. The modeling analysis showed that the configuration of the offshore reef and the embayed shorelines at Unai Chulu combine to produce wave alignments at the shoreline that result in the formation of a beach. Model results comparing the existing condition with the Amphibious Assault Vehicle landing zone configuration suggest that the alteration of the nearshore bathymetry by dredging the Amphibious Assault Vehicle approach area and ramp should not significantly modify shoreline coastal processes and trigger erosion of the beaches. The limited spatial extent and volume of sand at

Unai Chulu suggests that the beach is vulnerable to either natural or man-made disturbances. Occasional large wave events could strip the beach nearly completely of sand, as occurs under existing conditions. The prevailing wave and current dynamics would act to rebuild the beach over time, although it is not known how quickly or to what degree.

Therefore, construction of the Amphibious Assault Vehicle landing area would not result in significant impacts to topography or the geologic processes of the beach because of the small amount of area being disturbed within the beach and the ability of prevailing wave and current dynamics to similarly alter beach topography over time.

Tinian Alternative 1 construction activities would occur in relatively flat areas and along existing roadways. This construction would not increase the potential for impacts to topography including major elevation changes, substantial alteration of the surrounding landscape, slope instability, or significant alteration of surface drainage patterns. Based upon the above analysis and implementation of the resource management measures identified in Section 4.2.2, construction of Tinian Alternative 1 would result in less than significant direct and indirect impacts to topography.

4.2.3.1.1.2 Geology

Geologic Units

Of the 1,902 acres (771 hectares) of total ground disturbance through construction activities associated with Tinian Alternative 1, approximately 1,563 acres (632 hectares) would occur over limestone formations (i.e., Mariana Limestone, Tagpochau Limestone) which are areas of high water infiltration (see Section 3.2, *Geology and Soils*). The disturbed area covers approximately 6.5 percent (%) of total limestone formations on Tinian. Impacts to limestone formations could affect the rock's ability to allow water to filter down to aquifers; however, soil compaction over these limestone formations would be minimized by limiting construction vehicles to the road/trail system such that these activities would not substantially change the overall ability of the limestone formations to recharge groundwater to underlying aquifers.

Many of the proposed facilities, roads, and infrastructure are underlain by permeable limestone (i.e., Mariana Limestone, Tagpochau Limestone) which contains karst features such as caves and sinkholes. Disturbance of these karst features could have potential long-term impacts to natural drainage systems and groundwater aquifers. Construction of support facilities, roads, infrastructure, or training facilities over a sinkhole could lead to structural failure (i.e., collapse of buildings, roads, or utility conduits). Therefore, prior to any construction activities, as indicated in Section 4.2.2, *Resource Management Measures*, engineering studies would be conducted to identify karst features in the project area. To the extent possible, impacts would be avoided by siting facilities and infrastructure away from these karst features. Furthermore, during the construction period, construction vehicles would primarily use designated roads and construction laydown areas to minimize the disturbance to karst features.

Based on the above analysis and implementation of resource management measures identified in Section 4.2.2, Tinian Alternative 1 construction activities would result in less than significant direct and indirect impacts to geologic units.

Geological Hazards

***Seismic Activity*.** Earthquakes are a type of seismic activity caused by movements of the earth's crust and originate at distances of zero to hundreds of miles underground (U.S. Geological Survey 2014). One surface manifestation of earthquakes is the displacement of the earth's crust commonly known as fault lines or ruptures. As shown in Figure 4.2-1, fault lines underlie portions of the proposed support facilities, roadways, infrastructure, and training facilities. To the extent practicable, construction directly on fault lines would be avoided. However, for those portions of the construction footprint which could not be moved to avoid fault lines, engineering designs would be employed to minimize potential effects from earth movement along fault lines. Buildings, facilities, and infrastructure would be designed, situated, and constructed in adherence to Unified Facility Criteria recommendations for seismic protection.

***Landslides*.** The majority of the proposed construction (i.e., base camp, airport improvements, Munitions Storage Area, port improvements, and most of the training and support facilities) would be located on relatively level ground and would not increase the risk of landslides. However, a few portions of the supporting infrastructure for roadways would be located in areas of high topographic relief which could increase the potential for landslides. Resource management measures such as engineering design for construction, erosion controls, and protective barriers would be employed to reduce the potential for landslides to occur as a result of construction.

***Liquefaction*.** Most of the Tinian Alternative 1 footprint is underlain by consolidated limestone bedrock that is not subject to liquefaction in the event of an earthquake. However, portions of the port improvements would be constructed near the coast on artificial fill materials or other unconsolidated materials that could fail due to liquefaction. An engineering study would be conducted for the site of the proposed port improvements prior to construction to evaluate subsurface conditions and determine design and construction procedures for seismic safety. Port improvements would also be constructed in adherence with Unified Facilities Criteria recommendations for seismic safety to minimize potential hazards associated with ground movement and liquefaction.

***Tsunami Inundation*.** Construction activities associated with Tinian Alternative 1 are largely located inland and would not remove a substantial topographic barrier that would increase the likelihood of tsunami inundation. Construction of an amphibious landing area at Unai Chulu would not increase the likelihood of tsunami inundation in that area because the remaining surrounding limestone shelf would continue to protect the shoreline and the landing area would not significantly change the wave behavior.

Based on the above analysis and implementation of resource management measures listed in Section 4.2.2, Tinian Alternative 1 construction activities would result in less than significant direct and indirect impacts due to geologic hazards.

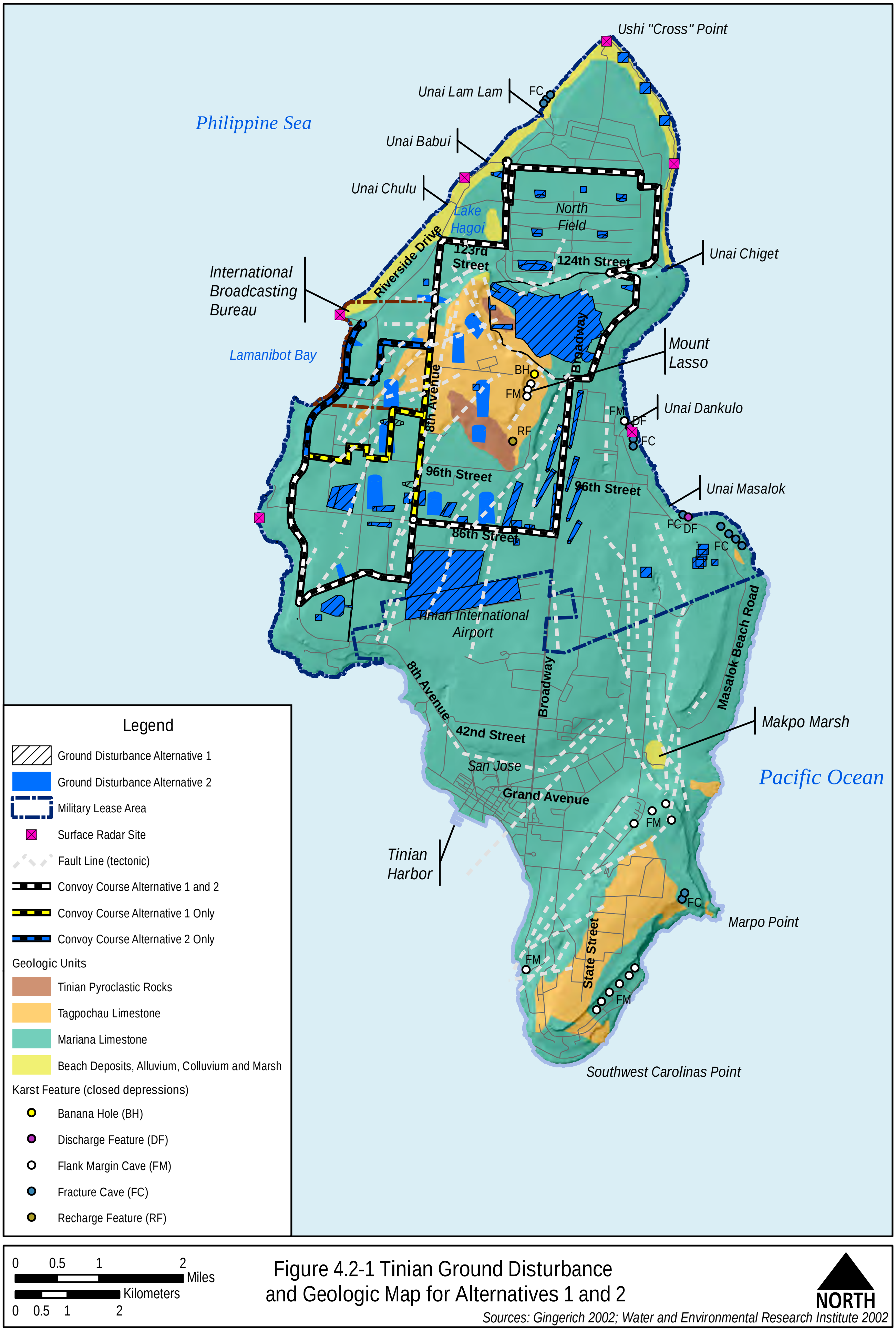

Figure 4.2-1 Tinian Ground Disturbance and Geologic Map for Alternatives 1 and 2

Sources: Gingerich 2002; Water and Environmental Research Institute 2002

4.2.3.1.1.3 Soils

Under Tinian Alternative 1, newly created impervious surface areas that would be constructed for the port improvements, base camp, Munitions Storage Area, airport improvements, road improvements, and training and support facilities for Tinian Alternative 1 would comprise approximately 562 acres (227 hectares) and represent less than 4% of the overall project footprint (i.e., Military Lease Area, airfield improvements, port improvements). This would create a minimal increase in stormwater runoff, as compared with existing conditions. Stormwater management through infrastructure improvements under Alternative 1 would include best management practices (e.g., retention ponds, swales, silt fences) to manage the increased runoff from impervious surfaces and minimize soil erosion in surrounding areas. Specific resource management measures include development and implementation of an erosion control measures, stormwater pollution prevention measures, and a stormwater management measures.

Construction-specific stormwater best management practices would be implemented to provide erosion and sediment control during the construction period (see Appendix D, *Best Management Practices*). These include employing on-site measures, such as retention ponds, swales, silt fences, fiber rolls, gravel bag berms, mulch, and erosion control blankets that reduce soil erosion and the flow and velocity of stormwater and minimize the transport of soils and sediment off-site. Roadway-specific best management practices would be used in the design and construction of the proposed access roads and vehicle training courses. Through compliance with the CNMI Earthmoving and Erosion Control Regulations and implementation of engineering controls and stormwater best management practices, construction activities would not substantially increase the rate of erosion and soil loss under Alternative 1.

Based on the above analysis and implementation of resource management measures identified in Section 4.2.2, Tinian Alternative 1 construction activities would result in less than significant direct and indirect impacts to soils.

Prime Farmland Soils

There are approximately 1,474 acres (597 hectares) of prime farmland soils on Tinian, with approximately 72% (1,054 acres [427 hectares]) located within the Military Lease Area. The Tinian Alternative 1 construction footprint includes approximately 220 acres (89 hectares) of area identified as prime farmland soils or 15% of the total prime farmland soils on the island. The majority of those soils (205 acres [83 hectares]) would not be permanently altered as a result of the construction activities that would primarily consist of vegetation clearance within Range Complex A. Therefore, implementation of Tinian Alternative 1 would result in less than significant direct and indirect impacts to prime farmland soils during the construction phase.

4.2.3.1.2 Operation Impacts

4.2.3.1.2.1 Support Facilities, Roadways, and Utilities

After construction is completed, ongoing operational activities are expected to involve only minor changes to topography, geology, and soils as a result of operational activities (e.g., maintenance, use) at support facilities, roadways, and utilities. These activities would not increase the potential for geologic hazards to occur.

4.2.3.1.2.2 Training Facilities

Impacts to topography, geologic units, and soils would occur as a direct result of operational training activities described in Section 2.4, *Tinian Alternatives*. In addition, maintenance activities (e.g., vegetation maintenance, vehicle and foot maneuvers, munitions use) could also impact soils.

Range Control would be responsible for maintaining access roads, configuring ranges and training areas, and maintaining training areas in usable condition. The training facilities would be managed in accordance with Marine Corps Order 3550.10, *Policies and Procedures for Range and Training Area Management* (DoN 2005). Additional resource management measures would include implementation of facilities management policies and procedures for controlling erosion such as maintaining vegetation, drainage ways, and turf on the ranges; and allowing vegetation to re-establish in the training and support facilities. Vegetation within objective areas (i.e., target location) would be maintained at a minimum of 6 inches (15 centimeters) above the ground surface, which would provide ground cover and root systems to hold soil in place.

Range Complex A. As described in Section 2.4, *Tinian Alternatives*, operational activities at Range Complex A would include the use of high explosives within the High Hazard Impact Area. Munitions would be thrown, fired at, or dropped on targets within the High Hazard Impact Area. Target placements would be located in areas of moderate to low slope and thus detonation of high explosives in these areas would not be expected to have an increase on the potential for landslides. In addition, these operational activities could create munitions impact craters within the upper 6 feet (2 meters) of the underlying geologic units (Army Corps of Engineers 1961) over a 527-acre (213-hectare) area. However, these operations would not substantially impact the overall function of the geologic units within the High Hazard Impact Area because these craters would be relatively shallow compared to the overall thickness of the limestone formation.

Operational activities would include ground combat training in conjunction with aviation support activities. This type of training would include the use of high explosive munitions. Earthquakes are caused by movements of the earth's crust and originate at distances of zero to hundreds of miles underground (U.S. Geological Survey 2014). To date, there is no evidence linking earthquake activity with the use of explosives by humans (U.S. Geological Survey 2014). Therefore, training activities would not increase the potential for seismic activity.

Soil erosion could occur within Range Complex A when lands are cleared and or disturbed on a regular basis and thus decrease overall soil productivity and inhibit plant growth in those areas. Approximately 205 acres (83 hectares) of prime farmland soils are located within the High Hazard Impact Area, resulting in these soils to likely be precluded from future agricultural uses. This represents a potential permanent loss of approximately 14% of Tinian's prime farmland soils due to the potential presence of unexploded ordnance and change in the character and productivity of the soil due to detonation of munitions, controlled burns for vegetation maintenance, and/or potential presence of munitions constituents (see Section 4.16, *Hazardous Materials and Waste*).

Range Complex B. As described in Section 2.4, *Tinian Alternatives*, within Range Complex B, personnel would move via vehicles (wheeled and tracked) along established roads and pathways and by foot over these same roads and pathways as well as open areas within the range complex. Personnel would employ their weapons systems aiming at target objective areas within the range complex. These activities would not create substantial changes to topography; alter the function of geologic units or soil productivity; or increase the potential for a geologic hazard to occur.

Range Complex C. Within Range Complex C, personnel would move primarily on foot to firing points where they would employ their weapons systems aiming at target objective areas within the range complex. These activities would not create substantial changes to topography; alter the function of geologic units or soil productivity; or increase the potential for a geologic hazard to occur except in the Multi-purpose Unknown Distance Range where approximately 14 acres (6 hectares) of prime farmland soils are located which will be permanently altered due to repeated heavy use which would alter soil productivity; therefore, they would be removed from use as prime farmland soils.

Range Complex D. Within Range Complex D, personnel would move on foot to firing points where they would employ their weapons systems aiming at target objective areas within the range complex. These activities would not create substantial changes to topography; alter the function of geologic units or soil productivity; or increase the potential for a geologic hazard to occur.

Military Lease Area-wide Training. As described in Section 2.4, *Tinian Alternatives,* some types of training would involve training assets that are distributed in areas other than Range Complexes A, B, C, and D. These training operations include Convoy Course training and Tracked Vehicle Driver's Course training, aviation activities, amphibious training, and foot maneuvering.

Convoy Course Training. Convoy Course training would involve movement of wheeled vehicles along the course and employment of weapons systems aimed at Convoy Course engagement areas adjacent to the course. These activities would not result in a substantial change in topography or function of the geologic units because training would be limited to established routes and engagement areas and thus not create additional impervious surfaces. These activities would not increase the potential for a geologic hazard to occur. Approximately 1 acre (0.4 hectare) of prime farmland soils located in a Convoy Course engagement area would be permanently altered due to repeated heavy use which would alter soil productivity; therefore, they would be removed from use.

Tracked Vehicle Driver's Course Training. Tracked Vehicle Driver's Course training would involve movement of tracked vehicles along the established course. These activities would not result in a substantial change in topography, function of the geologic units, or soil productivity because training would be limited to the established routes and thus not create additional impervious surfaces. These activities would not increase the potential for a geologic hazard to occur.

Aviation Activities. Aviation activities associated with the Tinian RTA would be limited to take offs and landings of fixed-wing aircraft from the Landing Zone at North Field and from Tinian International Airport; take offs and landings of rotor and tilt-rotor aircraft at Landing Zones within the Military Lease Area and Tinian International Airport; and aviation support training associated with Range Complexes A, B, C, and D. Unmanned aircraft systems (i.e., drones) would take off and land from Landing Zones as well as other open areas. Aviation activities would not create substantial changes to topography, alter the function of geologic units, or decrease soil productivity. These activities would not increase the potential for a geologic hazard to occur.

Amphibious Training. Wave and hydrodynamic modeling conducted for the amphibious landing ramp that would be constructed at Unai Chulu indicates that minimal changes in nearshore and along-beach current velocity and wave height would occur due to the operation of the ramp, and therefore would not result in substantial changes to beach topography (Appendix J, *Amphibious Beach Landing Site Engineering and Coastal Processes Analyses)*.

As described in Section 2.4, *Tinian Alternatives,* tactical amphibious training at Unai Chulu would involve Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, inflatable boats, and combat swimmers. This is the only location proposed for tactical Amphibious Assault Vehicle landings. At Unai Babui and Unai Masalok, tactical amphibious training would include Landing Craft Air Cushion vessels, inflatable boats, and combat swimmers. At Unai Lam Lam, tactical amphibious training would include inflatable boats and combat swimmers. At the Port of Tinian, administrative amphibious training would take place at the old boat ramp.

When landing and launching Amphibious Assault Vehicles, the tracks would come in contact with the ocean bottom to depths of up to 12 feet (4 meters) and this could potentially alter the underwater topography in the landing area. For this reason, landing and launching of Amphibious Assault Vehicles during training operations would be strictly limited to the amphibious landing area at Unai Chulu for tactical landings and the old boat ramp at the Port of Tinian for administrative landings. Use of these established landing areas during the landing and launching of Amphibious Assault Vehicles would not substantially alter coastal processes that could result in erosion of the nearshore topography.

Training involving Amphibious Assault Vehicles and/or Landing Craft Air Cushion vessels would disturb the sandy beaches at Unai Babui, Unai Chulu, and Unai Masalok similar to that from normal wave action during stormy conditions (DoN 2010a), resulting in localized disturbance of soils and beach substrates. The affected beaches consist of mixed sand and coral rubble that are resistant to compaction. Landing Craft Air Cushion vessels would be on “full cushion” (i.e., fully inflated) for beach landings and are designed not to compact the sand (DoN 2010a). Amphibious Assault Vehicles are tracked vehicles and, by design, distribute weight to minimize impacts to the beach (DoN 2010a). However, Amphibious Assault Vehicle operational impacts could lead to loss of beach sand through entrainment and transport of sand off the beach by the vehicles, and through abrasion and crushing of the beach sand. If this loss is greater than the rate of natural supply of sand to the beach, the beach could gradually erode over time. Because of the limited volume of sand, even small amounts of erosion could have noticeable impacts (Appendix J, *Amphibious Beach Landing Site Engineering and Coastal Processes Analyses)*. Training involving inflatable boats and combat swimmers would minimally disturb sandy beaches at Unai Babui, Unai Chulu, Unai Masalok, and Unai Lam Lam. After amphibious operations, beach topography would be returned to pre-training conditions to the extent possible using non-mechanized means such as hand-held tools. Because the vehicles would be operated to minimize impacts to beaches, and because beaches would be returned to the extent possible to their pre-training condition following the operation, long-term compaction of sand would not be expected to occur.

As part of all amphibious training, personnel and equipment would come and go from the beaches using designated routes. Amphibious Assault Vehicles would use the designated Tracked Vehicle Driver’s Course. Landing Craft Air Cushion vessels would on- and off-load equipment and personnel at the designated beaches (Unai Babui, Unai Chulu, Unai Masalok). Tracked vehicles would utilize the Tracked Vehicle Driver’s Course, wheeled vehicles on- and off-loaded from Landing Craft Air Cushion vessels would utilize designated roadways as well as the Tracked Vehicle Driver’s Course; and pedestrians on- and off-loaded from Landing Craft Air Cushion vessels would use the Tracked Vehicle Drivers Course, roadways, or foot paths. By using designated landing areas, courses, roadways, and pathways, amphibious training would not result in a substantial change in topography, geologic units, soil productivity, or result in an increase in the potential for geologic hazards to occur.

Foot Maneuvering. Foot maneuvering would occur over a wide area which would include established training courses, roadways, pathways, and trails as well as open areas. These activities would not result in a substantial change in topography or function of underlying geologic units, soil productivity, or result in an increase in the potential for geologic hazards to occur because pedestrian activities would have lesser impact to soil cohesion and vegetation.

Based on the analysis above and implementation of resource management measures identified in Section 4.2.2, Tinian Alternative 1 operations would result in less than significant direct and indirect impacts to topography and geology. Operations would result in a significant direct impact to prime farmland soils due to the permanent loss of 15% of Tinian's prime farmland soils, mostly within the High Hazard Impact Area.

4.2.3.2 Tinian Alternative 2

4.2.3.2.1 Construction Impacts

Construction impacts associated with Tinian Alternative 2 would be similar to those described for Tinian Alternative 1 (Section 4.2.3.1). Appendix F, *Geology and Soils Technical Memo*, provides a detailed characterization of the topographic, geologic, and soil disturbances that could occur as a result of construction activities under Tinian Alternative 2. Table 4.2-2 provides a summary of the ground disturbance, slope, geologic units, soil conditions, prime farmland soils, and geologic hazards associated with construction under Tinian Alternative 2. Figure 4.2-1 depicts the differences in ground disturbance between Tinian Alternative 1 and Tinian Alternative 2.

Impacts to geology and soils resulting from Tinian Alternative 2 construction activities would be similar to those described for Tinian Alternative 1 with the following exceptions:

- The land area associated with Tinian Alternative 2 construction activities is larger compared to Alternative 1, because Alternative 2 would include the southern Battle Area Complex and five additional engagement areas associated with the Convoy Course. Tinian Alternative 2 would thus disturb an additional 123 acres (50 hectares) or approximately 7% more than Tinian Alternative 1 for a total of 2,025 acres (820 hectares).
- The impervious surface areas that would be constructed for Tinian Alternative 2 would comprise approximately 785 acres (319 hectares), which is an 18% increase compared to Tinian Alternative 1 but is about 4% of the total land area within the Military Lease Area. The additional impervious surfaces in Tinian Alternative 2 are related to additional objective areas in the Battle Area Complex and associated Urban Assault Course, as well as the Convoy Course engagement areas which are considered impervious surfaces due to repeated use and compaction of the soils.
- Through construction activities, Tinian Alternative 2 would disturb approximately 115 acres (46 hectares) more of limestone formations than Tinian Alternative 1 for a total 1,678 acres (679 hectares). This represents a 0.5% increase compared with Tinian Alternative 1. This represents a total of 7% disturbance of these formations across Tinian.

Table 4.2-2. Summary of Ground Disturbance, Slope, Geologic Units, Soil Conditions, Prime Farmland Soils, and Geologic Hazards Associated with Construction Under Tinian Alternative 2

Description	*Approximate Area of Ground Disturbance (acres)*	*Approximate Newly Created Impervious Surface (acres)*	*Elevation (feet)*	*Slope*	*Geologic Units*	*Soil Conditions*	*Approximate Prime Farmland Soils[1] in acres*	*Geologic Hazards*
Port Improvements (Same as Alternative 1)	5	5	0 to 33	<1% to 2%	Mariana Limestone	Slow runoff; Slight erosion factor	None	Potential for liquefaction and tsunami inundation
Airfield Improvements (Same as Alternative 1)	41	41	243 to 270	<1%	Mariana Limestone	Slow runoff; Slight erosion factor	None	Fault lines
Base Camp (Same as Alternative 1)	257	30	254 to 279	1%	Mariana Limestone	Slow runoff; Slight erosion factor	None	Fault lines
Munitions Storage Area (Same as Alternative 1)	38	8	235 to 259	1%	Mariana Limestone	Slow runoff; slight erosion factor	None	None
Road Improvements (includes Tracked Driver Vehicle Drivers Course and the Convoy Course)	295	295	0 to 314	Variable	Mariana Limestone, Tagpochau Limestone, Tinian Pyroclastics	Slow to rapid runoff; slight to severe erosion factors	None	Fault lines
Range Complex A (Same as Alternative 1)	527	0	145 to 285	Variable	Mariana Limestone, Tagpochau Limestone, Tinian Pyroclastics	Slow to medium runoff; slight to medium erosion factors	205	Fault lines

Table 4.2-2. Summary of Ground Disturbance, Slope, Geologic Units, Soil Conditions, Prime Farmland Soils, and Geologic Hazards Associated with Construction Under Tinian Alternative 2

Description	*Approximate Area of Ground Disturbance (acres)*	*Approximate Newly Created Impervious Surface (acres)*	*Elevation (feet)*	*Slope*	*Geologic Units*	*Soil Conditions*	*Approximate Prime Farmland Soils[1] in acres*	*Geologic Hazards*
Range Complex B (Same as Alternative 1)	47	47	125 to 290	1% to 11%	Mariana Limestone	Ponded, very slow, to medium runoff; slight to medium erosion factors	None	Fault lines
Range Complex C	157	157	85 to 310	1% to 11%	Mariana Limestone	Slow to rapid runoff; slight to severe erosion factors	25	Fault lines
Range Complex D (Same as Alternative 1)	475	22	35 to 115	1% to 9%	Mariana Limestone	Slow to rapid runoff; slight to severe erosion factors	None	Fault lines
Military Lease Area-wide Training Facilities (includes Convoy Course engagement areas)	180	180	Variable	Variable	Beach Deposits, Alluvium, Colluvium, Marsh, Mariana Limestone and Tagpochau Limestone	Slow to rapid runoff; slight to severe erosion factors	None	Fault lines
Amphibious Training Area (Same as Alternative 1)	3	0	0 to 15	5% to 15%	Beach Deposits	Slow runoff; slight to severe erosion factors	None	Potential for tsunami inundation
Total	**2,025**	**785**	-	-	-	-	**230**	-

Notes: [1]Prime farmland soils identified within the footprint of the facility.
Operational footprint is the same as construction footprint, except where noted otherwise.

- Through construction activities, Tinian Alternative 2 would disturb approximately 10 acres (4 hectares) more of prime farmland soils, as compared to Tinian Alternative 1, for a total of 230 acres (93 hectares). This represents an increase of approximately 1% as compared to Tinian Alternative 1. As described for Tinian Alternative 1, most of the identified prime farmland soils in the proposed action area would not be permanently altered as a result of construction activities.

Tinian Alternative 2 would follow the same resource management measures as those described in Section 4.2.2. The very small increase in the amount of on-land construction, limestone formation disturbance, soil disturbance, and earthwork does not change the effectiveness of the resource management measures at avoiding or minimizing adverse impacts.

Based on the above analysis and implementation of resource management measures, Tinian Alternative 2 construction activities would result in less than significant impacts to topography, geology, and soils.

4.2.3.2.2 Operation Impacts

Impacts resulting from Tinian Alternative 2 operations would be similar to those described under Tinian Alternative 1. However, the addition of a southern Battle Area Complex and associated Urban Assault Course, as well as five additional engagement areas associated with the Convoy Course, results in a larger area used for foot and vehicle maneuvers and training. Implementation of Tinian Alternative 2 would also follow the same resource management measures as described in Section 4.2.2. The small acreage increase located proximate to areas already contemplated for training and sharing their same physical characteristics does not change the impact conclusions described for Tinian Alternative 1.

As described under construction impacts for Tinian Alternative 2, approximately 230 acres (93 hectares) of prime farmland soils would be included in the footprint of Tinian Alternative 2. Only a small portion of the identified prime farmland soils in the Tinian Alternative 2 footprint would represent temporary losses, and would be available for agricultural production after the duration of military use has ended. However, approximately 205 acres (83 hectares) of prime farmland soils would be located within the High Hazard Impact Area for Tinian Alternative 2, resulting in these soils to likely be precluded from future agricultural uses. This represents a potential permanent loss of approximately 14% of Tinian's prime farmland soils due to the potential presence of unexploded ordnance and change in the character and productivity of the soil. Compared with Tinian Alternative 1, approximately 11 acres (4 hectares) of additional prime farmland soils are located within Range Complex C that are associated with the additional objective areas under Tinian Alternative 2; this results in a total of 25 acres (10 hectares) of prime farmland soils associated with Range Complex C for Tinian Alternative 2. These prime farmland soils would be permanently altered due to repeated heavy use which would alter soil productivity; therefore, they would be removed from use. In total, approximately 230 acres (93 hectares) of prime farmland soils would be lost to future use under Tinian Alternative 2 which is approximately 16% of Tinian's total prime farmland soils. The loss of these prime farmland soils for future use is considered a significant impact to prime farmland soils under operations.

Based on the above analysis and implementation of resource management measures described in Section 4.2.2, Tinian Alternative 2 operations would result in less than significant direct and indirect impacts to topography and geology. Tinian Alternative 2 would result in a significant direct impact to prime farmland soils due to the permanent loss of 16% of Tinian's prime farmland soils within the Military Lease Area.

4.2.3.3 Tinian Alternative 3

4.2.3.3.1 Construction Impacts

Construction impacts for Tinian Alternative 3 would be similar to those described under Section 4.2.3.1, *Tinian Alternative 1*. Appendix F, *Geology and Soils Technical Memo*, provides a characterization of the topographic, geologic, and soil disturbances that could occur as a result of construction activities under Tinian Alternative 3. Table 4.2-3 provides a summary of the ground disturbance, slope, geologic units, soil conditions, prime farmland soils, and geologic hazards associated with construction under Tinian Alternative 3. Figure 4.2-2 depicts the differences in ground disturbance between Tinian Alternative 1 and Tinian Alternative 3.

Impacts resulting from Tinian Alternative 3 construction activities would be similar to those described for Tinian Alternative 1 with the following exceptions:

- Slightly more on-land construction would take place for Alternative 3 as compared with Alternative 1 because Alternative 3 would include the southern Battle Area Complex and five additional engagement areas associated with the Convoy Course; however, it would not include the northern Battle Area Complex and thus impact less acreage than Tinian Alternative 2 which has two Battle Area Complexes. Tinian Alternative 3 would disturb approximately 101 acres (41 hectares) or about 5% more than Tinian Alternative 1 for an approximate total of 2,002 acres (811 hectares).
- The impervious surface areas that would be constructed for the port improvements, base camp, Munitions Storage Area, airport improvements, and training and support facilities for Tinian Alternative 3 would comprise a total of approximately 763 acres (309 hectares) or approximately 15% more impervious surface than Tinian Alternative 1, approximately 4% of the total land area within the Military Lease Area. The additional impervious surfaces associated with Tinian Alternative 3 that are not part of Tinian Alternative 1 are located in the Convoy Course engagement areas which would become impervious as a result of repeated use.
- Through construction activities, Tinian Alternative 3 would disturb approximately 93 acres (38 hectares) more of limestone formations than Tinian Alternative 1 for a total 1,656 acres (670 hectares). This represents a 0.5% increase in disturbance of these formations as compared to Tinian Alternative 1 for a total of 7% disturbance of these formations across Tinian.
- Through construction activities, Tinian Alternative 3 would temporarily disturb approximately 10 acres (4 hectares) more prime farmland soil, as compared to Tinian Alternative 1, for a total of 230 acres (93 hectares). This represents an increase of approximately 1% compared to Tinian Alternative 1 and represents 16% of the total prime farmland soils across Tinian.

Tinian Alternative 3 would follow the same resource management measures as those described in Section 4.2.2. The very small difference in the amount of on-land construction, limestone formation disturbance, soil disturbance, and earthwork would not change the effectiveness of the resource management measures at avoiding or minimizing adverse impacts.

Table 4.2-3. Summary of Ground Disturbance, Slope, Geologic Units, Soil Conditions, Prime Farmland Soils, and Geologic Hazards Associated with Construction Under Tinian Alternative 3

Description	*Approximate Area of Ground Disturbance (acres)*	*Approximate Newly Created Impervious Surface (acres)*	*Elevation (feet)*	*Slope*	*Geologic Units*	*Soil Conditions*	*Approximate Prime Farmland Soils[1] in acres*	*Geologic Hazards*
Port Improvements (Same as Alternative 1)	5	5	0 to 33	<1% to 2%	Mariana Limestone	Slow runoff; Slight erosion factor	None	Potential for liquefaction and tsunami inundation
Airfield Improvements (Same as Alternative 1)	41	41	243 to 270	<1%	Mariana Limestone	Slow runoff; Slight erosion factor	None	Fault lines
Base Camp (Same as Alternative 1)	257	30	254 to 279	1%	Mariana Limestone	Slow runoff; Slight erosion factor	None	Fault lines
Munitions Storage Area (Same as Alternative 1)	38	8	235 to 259	1%	Mariana Limestone	Slow runoff; slight erosion factor	None	None
Road Improvements (includes Tracked Driver Vehicle Drivers Course and the Convoy Course)	295	295	0 to 314	Variable	Mariana Limestone, Tagpochau Limestone, Tinian Pyroclastics	Slow to rapid runoff; slight to severe erosion factors	None	Fault lines
Range Complex A (Same as Alternative 1)	527	0	145 to 285	Variable	Mariana Limestone, Tagpochau Limestone, Tinian Pyroclastics	Slow to medium runoff; slight to medium erosion factors	205	Fault lines

Table 4.2-3. Summary of Ground Disturbance, Slope, Geologic Units, Soil Conditions, Prime Farmland Soils, and Geologic Hazards Associated with Construction Under Tinian Alternative 3

Description	*Approximate Area of Ground Disturbance (acres)*	*Approximate Newly Created Impervious Surface (acres)*	*Elevation (feet)*	*Slope*	*Geologic Units*	*Soil Conditions*	*Approximate Prime Farmland Soils[1] in acres*	*Geologic Hazards*
Range Complex B (Same as Alternative 1)	47	47	125 to 290	1% to 11%	Mariana Limestone	Ponded, very slow, to medium runoff; slight to medium erosion factors	None	Fault lines
Range Complex C (Same as Alternative 2)	157	157	85 to 310	1% to 11%	Mariana Limestone	Slow to rapid runoff; slight to severe erosion factors	25	Fault lines
Range Complex D	453	0	35 to 115	1% to 9%	Mariana Limestone	Slow to rapid runoff; slight to severe erosion factors	None	Fault lines
Military Lease Area-wide Training Facilities (includes Convoy Course engagement areas) (Same as Alternative 2)	180	180	Variable	Variable	Beach Deposits, Alluvium, Colluvium, Marsh, Mariana Limestone and Tagpochau Limestone	Slow to rapid runoff; slight to severe erosion factors	None	Fault lines
Amphibious Training Area (Same as Alternative 1)	3	0	0 to 15	5% to 15%	Beach Deposits	Slow runoff; slight to severe erosion factors	None	Potential for tsunami inundation
Total	**2,003**	**763**	**-**	**-**	**-**	**-**	**230**	

Notes: [1]Prime farmland soils identified within the footprint of the facility.
Operational footprint is the same as construction footprint, except where noted otherwise.

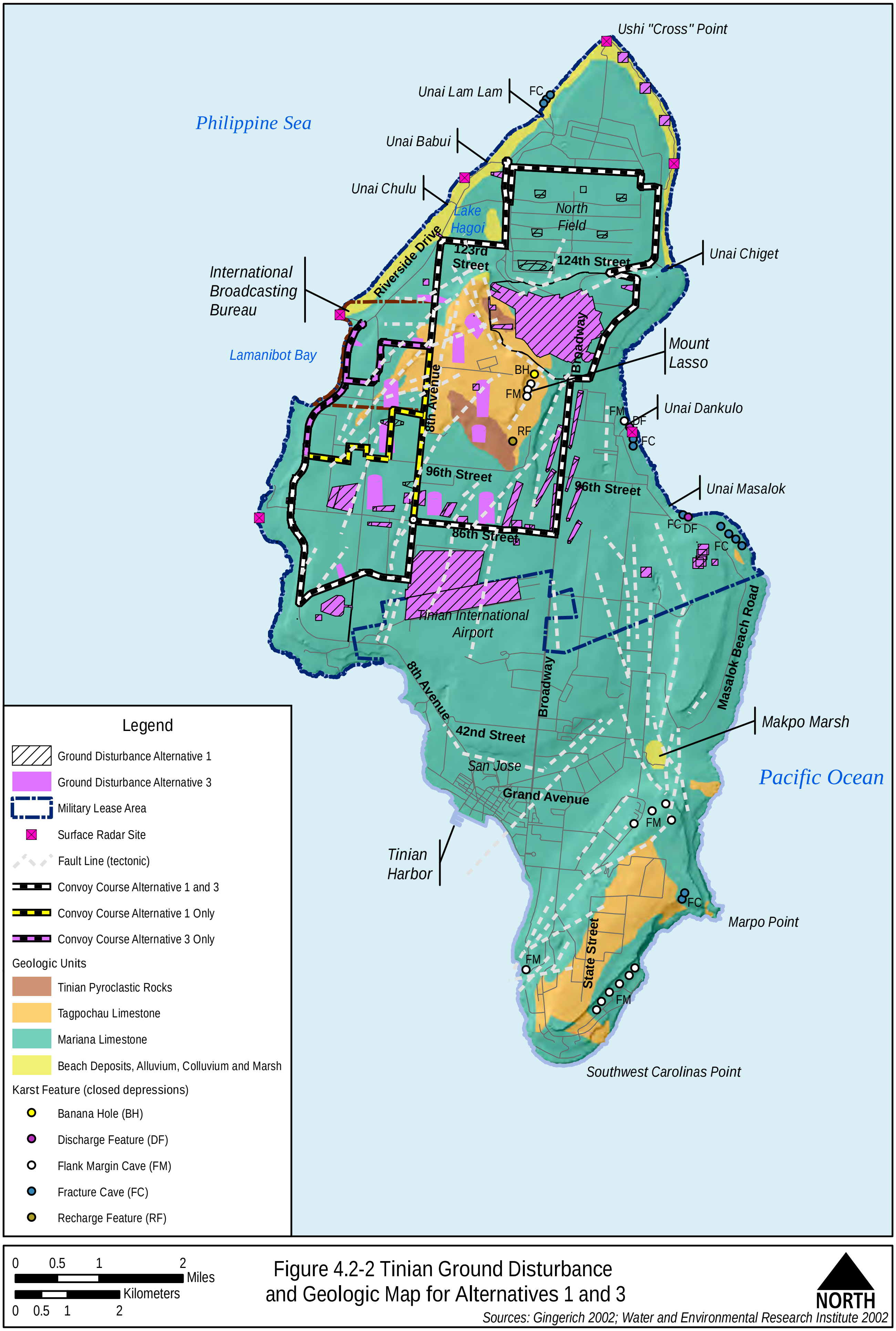

Figure 4.2-2 Tinian Ground Disturbance and Geologic Map for Alternatives 1 and 3

Sources: Gingerich 2002; Water and Environmental Research Institute 2002

Based on the above analysis and the implementation of resource management measures, construction under Tinian Alternative 3 would result in less than significant impacts to topography, geology, and soils.

4.2.3.3.2 Operation Impacts

Impacts resulting from Tinian Alternative 3 operations would be similar to those described under Tinian Alternative 1. Tinian Alternative 3 would also follow the same resource management measures as described in Section 4.2.2. The only difference is that operational activities would take place over a slightly larger area for Tinian Alternative 3 as compared with Tinian Alternative 1. The small acreage increase located proximate to areas already contemplated for training and sharing their same physical characteristics does not change the impact conclusions described for Tinian Alternative 1.

As described under construction impacts for Tinian Alternative 3, approximately 230 acres (96 hectares) of prime farmland soils would be included in the footprint of Tinian Alternative 3. Only a small portion of the identified prime farmland soils in the Tinian Alternative 3 footprint would represent temporary losses, and would be available for agricultural production after the duration of military use has ended. However, approximately 205 acres (83 hectares) of prime farmland soils would be located within the High Hazard Impact Area for Tinian Alternative 3, resulting in these soils to likely be precluded from future agricultural uses. Compared with Tinian Alternative 1, approximately 11 acres (4 hectares) of additional prime farmland soils are located within Range Complex C that are associated with the additional objective areas under Tinian Alternative 3; this results in a total of 25 acres (10 hectares) of prime farmland soils associated with Range Complex C for Tinian Alternative 3. These prime farmland soils will be permanently altered due to repeated heavy use which would alter soil productivity; therefore, they would be removed from use. In total, approximately 230 acres (93 hectares) of prime farmland soils would be lost to future use under Tinian Alternative 3 which is approximately 16% of Tinian's total prime farmland soils. The loss of these prime farmland soils for future use is considered a significant impact to prime farmland soils under operations.

Based on the above analysis, Tinian Alternative 3 operations would result in less than significant direct and indirect impacts to topography and geology. Tinian Alternative 3 operations would result in a significant direct impact to prime farmland soils due to the permanent loss of 16% of Tinian's prime farmland soils within the Military Lease Area.

4.2.3.4 Tinian No-Action Alternative

Activities during the periodic military non-live-fire training exercises on Tinian in the Military Lease Area would have short-term and minor effects on geology and soils due to vehicle and troop movements. The military operations on the four ranges proposed in the 2010 Record of Decision in the Guam and CNMI Military Relocation EIS (DoN 2010b) would not significantly change the topography, effect geologic units, increase the potential for soil erosion and sedimentation, or intensify risks from geologic hazards (see Table 3.2-2; DoN 2010c). Other military training in the Mariana Islands Range Complex does not overlie Tinian's main potable water supply, so soil compaction during training activities would not affect infiltration of surface water into the groundwater (see Table 3.1-2; DoN 2010a and Section 4.3, *Water Resources*). Training activities would not alter the functions of the geologic units or soils. Therefore, the no-action alternative would result in less than significant impacts to geology and soils on Tinian.

4.2.3.5 Summary of Impacts for Tinian Alternatives

Table 4.2-4 provides a comparison of the potential impacts to geology and soils resources for the three Tinian alternatives and the no-action alternative.

Table 4.2-4. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Geology and Soils	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Topography	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Geology	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Soils	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Prime Farmland Soils	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*

Legend: *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.2.4 Pagan

4.2.4.1 Pagan Alternative 1

4.2.4.1.1 Construction Impacts

Proposed development and construction activities associated with Pagan Alternative 1 would involve approximately 764 acres (310 hectares) of ground disturbance as described below. The discussion of construction impacts for Pagan Alternative 1 is divided into three parts: (1) Topography; (2) Geology; and (3) Soils. Table 4.2-5 provides a summary of the ground disturbance, newly created impervious surface, elevation, slope, geologic units, and geologic hazards under Pagan Alternative 1. The discussion of construction period impacts to topography, geology, and soils is provided in the section below.

4.2.4.1.1.1 Topography

Construction of the training and support facilities, military training trails, and related infrastructure associated with Pagan Alternative 1 would include clearing, grubbing, and grading; excavating (cut); and filling. Appendix F, *Geology and Soils Technical Memo*, summarizes the areas of ground disturbance.

Potential slope instability and changes to surface drainage resulting from the changes to the existing slopes would be avoided or minimized by using resource management measures identified in Section 4.2.2 and described in Appendix D, *Best Management Practices*. The following paragraphs generally describe the topographic disturbances associated with Pagan Alternative 1.

Airfield Clear Zone. Approximately 484 acres (196 hectares) would require 100% vegetation clearance to 6 inches (15 centimeters) in height in order to create an airfield clear zone around the 41-acre (17-hectare) expeditionary airfield. It would also encompass the 42-acre (17-hectare) expeditionary base camp/bivouac area. The ground disturbance for these facilities is described below.

- Grading and removal of lava rock (basalt) at the airfield (approximately 41 acres [17 hectares]). Construction methods used to remove the lava rock would include use of explosive charges to discretely break apart the lava rock into manageable pieces. Heavy equipment would be used to remove the rock materials for use as gravel and fill materials at other locations. Approximately 615,000 cubic yards (470,000 cubic meters) of lava rock would be removed under the construction activities associated with the airfield.
- Grading and vegetation clearance the expeditionary base camp/bivouac area (approximately 42 acres [17 hectares]).
- Construction of a concrete berm and pad for the Forward Arming and Refueling Point and a concrete pad for the Hot Cargo Pad would be completed.

Military Training Trails. Approximately 22 miles (35 kilometers) of existing all-terrain vehicle trails would be widened, cleared, and graded only where necessary to create 14-foot (4-meter)-wide military training trails (approximately 39 acres [16 hectares]) to accommodate vehicle traffic.

Some training facilities would have a reduced infiltration rate due to the compaction associated with the proposed training activity and may contribute to increased stormwater flows. Therefore, as a conservative estimate, these areas are included in construction impacts as impervious surface.

Table 4.2-5. Summary of Ground Disturbance, Slope, Geologic Units and Geologic Hazards Associated with Construction under Pagan Alternative 1

Description	*Approximate Area of Ground Disturbance (acres)*	*Approximate Newly Created Impervious Surface (acres)*	*Elevation (feet)*	*Slope*	*Geologic Units*	*Geologic Hazards*
Expeditionary Base Camp/ Bivouac Area	42	42	0 to 200	<1% to 5%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Airfield	41	41	0 to 200	<1% to 5%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Military Training Trails	37	37	0 to 400	<1% to >31%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Unpaved route between the Airfield and the Munitions Storage Area	7	7	0 to 250	<1% to 5%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Unpaved Access Roads	2	2	0 to 400	Variable	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Munitions Storage Area	35	10	25 to 100	<1%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
North Range Complex	216	216	0 to 400	<0% to 31%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Northern High Hazard Impact Target Areas (Mount Pagan)	319	0	0 to 1,870	<1% to 5%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Isthmus High Hazard Impact Target Area	64	0	0 to 1,700	<1 to 31+%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Total	**764**	**355**	-	-	-	-

Note: Operational footprint is the same as construction footprint, except where noted otherwise.

Munitions Storage Area. Grading and clearing for a Munitions Storage Area would be completed (approximately 10 acres [4 hectares]) and concrete pads and fencing would be constructed. Unpaved gravel access routes between the Munitions Storage Area and the airfield would be cleared and graded (10 acres [4 hectares]). Total ground disturbance during the construction phase would be 35 acres (14 hectares).

North Range Complex. Training facilities within the North Range Complex including Landing Zones, Field Artillery Indirect Fire Range and Mortar Range firing positions, and a Field Artillery Direct Fire Range firing position (216 acres [88 hectares]) would be cleared and graded.

In addition, approximately 319 acres (130 hectares) inside the northern High Hazard Impact Area have been identified for target placement. Targets are generally located in relatively flat (10-20% slopes), sparsely vegetated areas of barren lava flow which would not require grading or clearing. However, two target placements are located in areas with forest vegetation which would require some vegetation clearance. The target boxes are assumed to be pervious surfaces.

Approximately 64 acres (26 hectares) inside the isthmus High Hazard Impact Area would be cleared for target placement and firebreaks. The target area is located across a section of the isthmus with an average slope of 23%. The target boxes are assumed to be pervious surfaces.

South Range Complex. The South Range Complex would not require any construction footprint.

Impacts resulting from changes to topography (e.g., slope instability and alteration of surface drainage patterns) could occur when excavation and fill activities take place to form level surfaces for RTA facilities and military training trails. Although the overall Pagan Alternative 1 construction footprint encompasses different elevations across the northern part of the island (see Chapter 2, *Proposed Action and Alternatives*, Figure 2.5-6), most of the earth work would occur in areas of modest elevation changes. The most extensive construction with potential for impacts to topography would be associated with the improvements for the airfield and expeditionary base camp/bivouac area. However, this work would take place on the surface of the near-level existing grass airfield. The removal of the lava from the airfield footprint would require a substantial change in topography in a limited area (i.e., on the airfield); however, no substantial grade changes (e.g., excavation of steep hills or fill of canyons) would be required within the expeditionary base camp/bivouac area. For this reason, moderate changes in grade are anticipated to provide a buildable surface for improving the airfield and constructing the expeditionary base camp/bivouac area under Pagan Alternative 1.

Resource management measures would be used to minimize any potential slope instability and changes to surface drainage. As described in Section 2.5.1.1, construction would occur in short phases over an 8 to 10 year period, which would reduce the amount of soil disturbance and erosion that would occur at any given time, allowing vegetation to re-establish and re-stabilize soils in construction-disturbed areas.

Construction outside of the expeditionary base camp and airfield for the Pagan Alternative 1 would be very limited and localized to specific components (e.g., firing points and targets) within the High Hazard Impact Areas and Live-Fire Maneuver Area and military training trails. In the small areas where construction would involve levelling/filling steeper natural slopes, impacts to slope stability would be avoided or minimized by using resource management measures described in Section 4.2.2. Construction activities associated with Pagan Alternative 1 would not involve large-scale cut and fill work in areas of major elevation changes and therefore would not substantially alter the surrounding landscape, reducing slope stability, or alter surface drainage patterns.

Based on the analysis presented above and the implementation of resource management measures, Pagan Alternative 1 construction activities would result in less than significant direct and indirect impacts to topography.

4.2.4.1.1.2 Geology

Geologic Units

The construction footprint associated with Pagan Alternative 1 is located in an area of lava and ash deposits, with limited portions of the shoreline supporting raised reef deposits. Additionally, there is an estimated 13.1 million tons (11.9 million metric tons) of commercial grade pozzolan, a material used as an additive to strengthen concrete (Ding and Wilson 2007). Construction activities under Pagan Alternative 1 would disturb portions of the pozzolan deposit and other geologic units. However, these disturbances would be limited in aerial extent and most would be temporary, resulting in no loss of function of the geologic unit.

Based on the analysis above and the resource management measures identified in Section 4.2.2, Pagan Alternative 1 construction activities would result in less than significant impacts to geologic units.

Geologic Hazards

Pagan is located in an active seismic zone and is home to two active volcanos. As a result, in the potential for geologic hazards such as seismic activity (i.e., earthquakes, fault ruptures), volcanic activity, landslides, and potential tsunami inundation exists.

Seismic Activity. Seismic activity on Pagan is related to its close proximity to the Mariana Trench subduction zone and volcanic activity on the island. There would be no permanent buildings under the Pagan alternatives and therefore adherence to Unified Facility Criteria recommendations for seismic protection would not apply. Most of the Pagan Alternative 1 footprint is underlain by consolidated volcanic rock that would not be subject to liquefaction in the event of an earthquake. Surface level construction activities would not interfere with these geological processes and would not increase the risk of seismic activity.

Volcanic Activity. Construction activities would occur primarily on the northern portion of Pagan, in the immediate vicinity of Mount Pagan, an active volcanic vent. Volcanic activity occurs when there are changes to the density of magma or pressure surrounding magma deep within the earth. Surface level construction activities would not interfere with these geological processes and would not increase the risk of volcanic activity.

Landslides. The majority of the proposed construction (i.e., the airfield and expeditionary base camp/bivouac area) would be located on relatively level ground. As such, land-disturbing activities in association with construction of these facilities are not likely to increase the risk of landslides. However, some components of the training and support facilities (e.g., military training trails) would be located in areas of high topographic relief resulting in some potential for slope instability. This potential would be reduced through the use of standard engineering practices. Clearance of targets in the High Hazard

Impact Areas would not involve any changes in topography – only vegetation clearance for target placement.

Tsunami Inundation

Construction activities associated with Pagan Alternative 1 are largely located inland. Construction of military training trails near the coast would not remove a substantial topographic barrier that would increase the likelihood of tsunami inundation.

Pagan Alternative 1 construction activities would not significantly increase the potential for geologic hazards. Therefore, Pagan Alternative 1 would result in less than significant direct and indirect impacts with respect to geologic hazards.

4.2.4.1.1.3 Soils

As part of construction, approximately 764 acres (310 hectares) would be disturbed under Pagan Alternative 1. Construction and future repeated use for training would result in approximately 355 acres (144 hectares) of newly created impervious surfaces. There is a potential for increased erosion, compaction, and soil loss from physical disturbance caused by construction activity and changes to existing topography. However, project design and construction would incorporate best management practices (see Appendix D, *Best Management Practices*) to minimize erosion as required by CNMI Earthmoving and Erosion Control Regulations, including construction-specific stormwater best management practices. These practices would be implemented to provide erosion and sediment control during the construction period. This would be done by employing on-site measures that would reduce the flow and velocity of stormwater runoff and minimize the transport of soils and sediment off-site, whenever possible. Best management practices would be used in the design and construction of the proposed military training trails. Through compliance with the CNMI Earthmoving and Erosion Control Regulations and implementation of stormwater best management practices, construction activities would not substantially increase the rate of erosion and soil loss under Pagan Alternative 1.

Based on the analysis above and the implementation of resource management measures, Pagan Alternative 1 would result in less than significant direct and indirect impacts to soils.

4.2.4.1.2 Operation Impacts

Under Pagan Alternative 1, use of high explosive munitions (i.e., naval gunfire, ground-based artillery, inert aviation ordnance) in the northern and isthmus High Hazard Impact Areas would impact topography. The use of high-explosive munitions on ground targets in the two High Hazard Impact Areas could trigger localized rockslides/landslides. In the northern High Hazard Impact Area, targets are generally located on relatively flat, sparsely vegetated areas of the lava field, with some exceptions. The target area in the isthmus High Hazard Impact Area would be located across a 64-acre (26-hectare) area on a steep-sloped isthmus (15% slope). Small scale rockslides could occur as a result of high explosive munitions landing in the target area. Outside of the two High Hazard Impact Areas, ongoing training and maintenance activities would not involve alteration of topography other than minor excavation or filling (e.g., repairs to military training trails).

In addition, detonations of high-explosive munitions in the two High Hazard Impact Areas would create munitions impact craters within the upper 6 feet (2 meters) of the underlying geologic unit (Army Corps of Engineers 1961). These impact craters would be limited to the target areas and would not substantially alter the function of the geologic units.

Most of the Pagan Alternative 1 footprint is underlain by consolidated volcanic rock that would not be subject to liquefaction in the event of an earthquake. In addition, there would not be a change to soil and/or bedrock conditions that would increase vulnerability to seismic activity. Earthquakes are caused by movements of the earth's crust, and originate at distances of tens to hundreds of miles underground. There is no evidence linking earthquake activity with the use of explosives (U.S. Geological Survey 2014).

Impacts to soils would occur as a direct result of training and maintenance activities (e.g., vegetation maintenance, vehicle and foot maneuvers, and ordnance use). The impervious surface areas associated with Pagan Alternative 1 would include approximately 355 acres (144 hectares). The increase of impervious surface would be relatively small compared to the overall land area and would create a minimal increase in runoff as compared with existing conditions. Stormwater management through infrastructure improvements associated with Pagan Alternative 1 would include best management practices to manage the increased runoff from the new impervious surfaces and minimize soil erosion in surrounding areas.

Vehicle and foot maneuver areas in the North Range Complex would be limited to proposed military training trails or areas easily accessible due to relatively flat terrain and lack of vegetation (i.e., barren lava). Maneuver areas in the South Range Complex would be limited to accessible pathways within densely vegetated areas.

Targets would be established over approximately 319 acres (130 hectares) in the northern High Hazard Impact Area. A total of eight targets are proposed in an array around Mount Pagan, three to the northeast and five to the south and southwest. Size of the target areas varies from 5 acres (2 hectares) to 135 acres (55 hectares). Slopes on the target areas range between 5% and 25%. Six of the eight targets would be located on barren ground or barren lava where there would be minimal soil or vegetation cover. However, a total of approximately 91 acres (37 hectares) at two of the proposed high explosive targets would be located in forested areas. Within the northern High Hazard Impact Area stormwater runoff would continue to follow the natural drainage patterns. Soil erosion associated with operations within the northern High Hazard Impact Area is expected to be limited because targets have relatively low slopes and are largely devoid of soil cover (i.e., barren lava field). Best management practices would be utilized in areas that require vegetation clearance to prevent soil erosion during storm events.

A single target area would be established over approximately 64 acres (26 hectares) in the isthmus High Hazard Impact Area. The target area is underlain by weathered volcanic material (i.e., clay material). Soil erosion associated with operations within the isthmus High Hazard Impact Area is expected to be limited because targets are largely devoid of soil cover (i.e., barren lava). Best management practices would be utilized in areas within the isthmus High Hazard Impact Area that require vegetation clearance to prevent soil erosion during storm events. In the isthmus High Hazard Impact Area, stormwater runoff controls would not be practicable due to the steep topography. Although the average slope of the target area within the isthmus High Hazard Impact Area would be approximately 30%, the areas around the plateau are steep; therefore, some localized soil erosion could occur during heavy rainfall events but will not result in significant impacts to soil erosion. Soil-laden stormwater runoff could flow through the vegetation in the cleared area around the targets and eventually into vegetated areas on the steep slopes of the isthmus and into the nearshore waters.

Areas disturbed by operational activities on hillsides would erode much faster than on flat ground, as stormwater runoff would have greater erosive energy as it moves downhill. Soil compaction, disturbance, and movement would be minimized by limiting the use of wheeled and tracked vehicles to established military training trails or accessible open areas and limiting ordnance expenditures to target areas within the established range complexes.

Range Control would be responsible for maintaining support facilities, training facilities, and military training trails. The training and support facilities would be managed in accordance with Marine Corps Order 3550.10, *Policies and Procedures for Range and Training Area Management*, which is designed to ensure safe, efficient, effective, and environmentally sustainable use of ranges (DoN 2005). Procedures would be implemented for managing stormwater; controlling erosion; maintaining vegetation, drainage ways, and turf within the RTA; and restricting vehicle and foot maneuver activities to designated areas. Range military training trails would be maintained to minimize erosion. Vegetation would be allowed to re-establish at the training and support facilities to minimize the potential for soil erosion. Periodic vegetation maintenance would occur as necessary.

Pagan Alternative 1 operations would not significantly increase the potential for impacts to topography, geologic units, geologic hazards, and soils. Therefore, Pagan Alternative 1 operations would result in less than significant direct and indirect impacts to topography, geologic units, geologic hazards, and soils.

4.2.4.2 Pagan Alternative 2

4.2.4.2.1 Construction Impacts

Construction activities associated with Pagan Alternative 2 would use the same construction methods as those described for Pagan Alternative 1 and would take place in the same general topography, geology, and soils. Geologic hazards would also be similar to those described under Pagan Alternative 1. The primary difference is that Pagan Alternative 2 would have no isthmus High Hazard Impact Area and the northern High Hazard Impact Area would be smaller than that for Pagan Alternative 1. In addition, there would be two additional Landing Zones and one less mortar firing position resulting in 68 acres (28 hectares) less ground disturbance. Under Pagan Alternative 2, the same area of the northern High Hazard Impact Area would be improved for target placement as described under Pagan Alternative 1. A summary of ground disturbance for Pagan Alternative 2 is provided below in Table 4.2-6.

Pagan Alternative 2 would also follow the same construction resource management measures as those described for Pagan Alternative 1 (see Section 4.2.2). The difference in the amount of on-land construction, soil disturbance, and earthwork would not change the effectiveness of the construction resource management measures at avoiding or minimizing adverse impacts to geology and soils.

Pagan Alternative 2 construction activities would not significantly increase the potential for impacts to topography, geologic units, geologic hazards, and soils. Therefore, construction activities associated with Pagan Alternative 2 would result in less than significant direct and indirect impacts to topography, geologic units, geologic hazards, and soils.

Table 4.2-6. Summary of Ground Disturbance, Slope, Geologic Units and Geologic Hazards Associated with Construction under Pagan Alternative 2

Description	*Approximate Area of Ground Disturbance (acres)*	*Approximate Newly Created Impervious Surface (acres)*	*Elevation (feet)*	*Slope*	*Geologic Units*	*Geologic Hazards*
Expeditionary Base Camp/ Bivouac Area (Same as Alternative 1)	42	42	0 to 200	<1% to 5%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Airfield (Same as Alternative 1)	41	41	0 to 200	<1% to 5%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Military Training Trails (Same as Alternative 1)	37	37	0 to 400	<1% to >31%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Unpaved route between the Airfield and the Munitions Storage Area	7	7	0 to 250	<1% to 5%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Unpaved Access Roads (Same as Alternative 1)	2	2	0 to 400	Variable	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Munitions Storage Area (Same as Alternative 1)	35	10	25 to 100	<1%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
North Range Complex	213	213	0 to 400	<0% to 31%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Northern High Hazard Impact Target Area (Same as Alternative 1 [Mount Pagan])	319	0	0 to 1,870	<1% to 5%	Sedimentary Deposits and volcanic rocks (lava and ash)	Potential for seismic activity and tsunami inundation
Total	**696**	**347**	-	-	-	-

Note: Operational footprint is the same as construction footprint, except where noted otherwise. The isthmus High Hazard Impact Area is not included in Pagan Alternative 2.

4.2.4.2.2 Operation Impacts

Pagan Alternative 2 operational activities would be similar to those described under Pagan Alternative 1. The main difference with Pagan Alternative 2 is that there would be more area for ground maneuver training due to a smaller northern High Hazard Impact Area and the absence of the isthmus High Hazard Impact Area (areas where maneuver would not be allowed due to the presence of unexploded ordnance). Due to the larger maneuver area, there would be more surface area potentially affected by vehicle and foot maneuvers. Target placements within the northern High Hazard Impact Area would be the same under both alternatives but there would be no target placements in the South Range Complex.

Pagan Alternative 2 would follow the same resource management measures as those described for Pagan Alternative 1 (see Section 4.2.2). The differences in the size of the High Hazard Impact Area and vehicle maneuver areas and number of vehicle maneuvers would not change the effectiveness of the resource management measures in preventing and minimizing adverse impacts to geology and soils.

Pagan Alternative 2 operations would not significantly increase the potential for impacts to topography, geologic units, geologic hazards, and soils. Therefore, Pagan Alternative 2 operations would result in less than significant direct and indirect impacts to topography, geologic units, geologic hazards, and soils.

4.2.4.3 Pagan No-Action Alternative

Potential activities on Pagan under the no-action alternative would include the continuation of periodic visits to the island by small eco-tourism cruises, scientific surveys, and military non-live-fire training related to search and rescue. Ocean going vessels would periodically moor offshore with small boats bringing small groups of people ashore. Helicopters or small planes may transport visitors to and from the island. In all cases, known activities associated with the no-action alternative would have minor effects on geology and soils on Pagan.

4.2.4.4 Summary of Impacts for Pagan Alternatives

Table 4.2-7 provides a comparison of the potential impacts to geology and soils resources for the two Pagan alternatives and the no-action alternative.

Table 4.2-7. Summary of Impacts for Pagan Alternatives

Resource Area	*Pagan (Alternative 1)*		*Pagan (Alternative 2)*		*No-Action Alternative*	
Geology and Soils	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Topography	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Geology	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Soils	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*

Legend: *LSI* = less than significant impact.

4.3 WATER RESOURCES

Section 4.3 describes impacts to water resources as a result of the proposed action. It presents the analysis for the potential of the proposed action and its alternatives to alter drainage patterns, decrease water recharge rates, or adversely affect water quality. In general, potential impacts to water resources can cause changes to water quality and water supply, increased flooding, and concerns for erosion and sedimentation associated with stormwater runoff. The impacts of water resources on terrestrial and aquatic ecosystems are addressed in Section 4.9, *Terrestrial Biology* and Section 4.10, *Marine Biology*, respectively. Potential impacts to water supply and hydrology are addressed in Section 4.14, *Utilities*.

4.3.1 Approach to Analysis

This analysis considers information from the technical studies and surveys conducted for the CJMT EIS/OEIS and factors and conditions that can potentially affect water resources.

4.3.1.1 Surface Water

Surface water concerns include impacts to surface water features, drainage alterations, flood protection, and water quality degradation. Threats to surface water features include increased pollutant loads and loss of surface water area (dredge/fill alterations). Effects were assessed relative to the potential impacts from area loss where the proposed action may directly involve the fill or excavation of surface water features. Indirect impacts to surface water features were also assessed if the proposed action would potentially alter (i.e., divert or restrict) water circulation into/from surface waters features, and/or potentially involve the release of pollutants into these ecosystems. Potential impacts to surface water quantity during construction and operation were analyzed by examining changes in drainage patterns and runoff rates associated with alterations to topography/groundcover and increased impervious area. Loss of functionality in surface water features (i.e., ecosystem health and circulation) is assessed in Section 4.9, *Terrestrial Biology*.

In areas prone to flooding, construction of buildings and roads were evaluated relative to flood risks and hazards, such as inundation and erosion. Effects that also contribute to increasing flood flows (e.g., impermeable surface increases and reduced natural infiltration) were also addressed in this assessment. Topographic changes from grading and re-contouring of natural slopes were analyzed for their potential contribution to altering existing drainage patterns and potentially exacerbating flood hazards.

4.3.1.2 Groundwater

Groundwater concerns include potential impacts to groundwater quality and quantity associated with construction activities and training operations, such as the handling, use, and potential discharge (e.g., munitions constituents, spills, leaks, and deposition) of pollutants from materials and equipment. Once introduced to the ground surface, such contamination has the potential to impact groundwater quality through percolation. The availability of adequate groundwater resources may be impacted from increased impervious area, decreased infiltration potential, and increased groundwater consumption as a result of the proposed action. These issues were evaluated relative to construction and operation activities that could potentially affect groundwater recharge by altering the infiltration ability, and natural filtering qualities of area soils, as well as possibly introducing pollutants to groundwater resources through percolation, both of which would potentially decrease groundwater quality and availability.

4.3.1.3 Nearshore Waters

The nearshore water impact analysis focused on both potential impacts to water quality and the placement of permanent fill (e.g., structures or fill) in nearshore waters as a result of the proposed action. The potential impacts to nearshore water quality during construction and training operations were evaluated with respect to dredge/fill activities, training activities, potential chemical releases, munitions constituents deposition, and improper stormwater management that could lead to increases in or accidental direct discharges of pollutants and sediment laden stormwater runoff into nearshore waters. These activities and materials could result in localized turbidity; decreased water clarity and quality (e.g., reduced dissolved oxygen, photosynthetic potential, and increased nutrient load); or benthic siltation of marine resources that could individually or collectively impact the ecological health of the nearshore environment.

4.3.2 Resource Management Measures

Resource management measures applicable to water resources are provided below.

4.3.2.1 Avoidance and Minimization Measures

- **No Training Areas.** The U.S. military would implement training restrictions for surface water features on Tinian. Lake Hagoi and the two Bateha sites remain designated by the U.S. military as “No Training Areas.” Within these “No Training Areas,” ground disturbance and vegetation removal of any kind will be prohibited during construction. “No Training Area” restrictions will be implemented upon initiation of CJMT training activities on Tinian.
- **Amphibious Assault Vehicle Landings.** As discussed in Section 2.3, all beaches within the Military Lease Area were initially considered for amphibious training. A careful selection process was employed to determine where amphibious training with Amphibious Assault Vehicles could occur. Based on environmental criteria including analysis of bathymetry and coral cover, Unai Babui and Unai Chulu were both considered for Amphibious Assault Vehicle training. A detailed engineering analysis of construction alternatives was conducted for these two locations (see Appendix J, *Amphibious Beach Landing Site Engineering and Coastal Processes Analyses*). After careful consideration, it was determined that the tactical amphibious landing training beach requirements for Amphibious Assault Vehicle training could be met at one beach. Unai Chulu was chosen as the single beach for Amphibious Assault Vehicle landings because of its wider configuration in comparison to Unai Babui. Ultimately, Unai Babui was dismissed for Amphibious Assault Vehicle training but it would still support training for Landing Craft Air Cushion vessels, small boat, and swimmer training.

Potential operational impacts would be minimized or avoided through the proper design and implementation of stormwater management practices, which would include the use of Low Impact Development best management practices for the proposed action. Low Impact Development provides a sustainable stormwater management system, in an environmentally conscious manner. A pre-versus-post development hydrologic analysis would be performed to provide a basis of design for monitoring and controlling the quality and quantity of stormwater runoff generated from the proposed action. Permanent stormwater management facilities would include a combination of natural and engineered features such as retention/detention ponds that control the volume, direction, and rate of stormwater runoff (i.e., minimize or eliminate hydromodification), filter out pollutants, and facilitate groundwater recharge through increased infiltration; with a focus on mimicking pre-development hydrology to the maximum extent feasible, while protecting water resources from pollutants. Hydrologic analysis would follow the *CNMI Stormwater Management Manual, Department of Defense Guidance, and Navy Low Impact Development* criteria, as described in the *Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects* under Section 438 of the Energy Independence and Security Act (U.S. Environmental Protection Agency 2009).

4.3.2.2 Best Management Practices and Standard Operating Procedures

Best management practices and standard operating procedures that are applicable for water resources are listed below and described in Appendix D, *Best Management Practices*.

- **Properly closed existing groundwater wells.** To the extent that unused wells are encountered, the U.S. military will properly close existing unused (production or monitoring) wells within the Military Lease Area to protect the groundwater resources.
- **Erosion control measures.** The erosion control measures such as retention ponds, swales, silt fences, fiber rolls, gravel bag berms, mulch, and erosion control blankets would be implemented during construction and operations to eliminate and/or minimize nonpoint source pollution in surface waters due to sediment.
- **Clean Water Act National Pollutant Discharge Elimination System Program.** A Stormwater Management Plan and Stormwater Pollution Prevention Plan would be prepared and implemented in compliance with the CNMI Stormwater Management Manual. Best management practices could include:
    - Avoidance and/or minimization of soil disturbing and earth moving work during the wet season.
    - Limiting in-water construction activities to period around low tide.
    - Temporary soil stabilization (such as mulch and erosion control blankets).
    - Temporary perimeter and sediment control (such as silt fences, fiber rolls, gravel bag berms, and sediment traps).
    - Management and covering of material, waste, and soil stockpiles when not in use.
    - Storage of fuels and hazardous materials with proper secondary containment, and establishment of designated vehicle and equipment maintenance and fueling areas.
    - Management of spills and leaks from vehicles and equipment through inspections and use of drip pans, absorbent pads, and spill kits.

The Stormwater Pollution Prevention Plans are based on construction plans and drawings and will specifically identify these best management practices, inspection frequency, and water sampling to be performed throughout the construction phase for protection of water quality.

Ranges would be managed in accordance with current Marine Corps range management policies and procedures. The proposed RTAs on Tinian and Pagan would be managed in accordance with Marine Corps Order 3550.10, *Policies and Procedures for Range and Training Area Management* (DoN 2005). The Marine Corps would utilize the Range Environmental Vulnerability Assessment program, in compliance with Department of Defense Instruction 4715.14 *Operational Range Assessment*, to assess the potential impacts to human health and the environment from live-fire training operations (Department of Defense 2005). Department of Defense Instruction 4715.14 *Operational Range Assessment* requires the establishment and implementation of procedures to assess the potential environmental impacts of military munitions use on operational ranges and determine whether there has been a release or substantial threat of release of munitions constituents to an off-range area as well as a determination if the release of munitions constituents creates an unacceptable risk to human health or the environment. Operational ranges that are addressed under the Range Environmental Vulnerability Assessment program include target/impact areas, firing positions, small arms ranges, and training and maneuver areas. The Range Environmental Vulnerability Assessment program also assesses areas with historical munitions use within operational range boundaries. The Range Environmental Vulnerability Assessment program does not evaluate future ranges or ranges that are covered under a separate program (e.g., cleanup of closed ranges under the Munitions Response Program, permitted Open Burning/Open Detonation sites under the Resource Conservation and Recovery Act).

The Range Environmental Vulnerability Assessment would be implemented on all live-fire operational ranges after they have been in use for a minimum of 1 year to provide a snapshot of the current environmental conditions of operational ranges as well as a detailed assessment of potential munitions constituent migration from operational ranges to off-range areas. Reevaluations would occur at a minimum every five years. The munitions constituents evaluated under the Range Environmental Vulnerability Assessment program include high explosives (e.g., trinitrotoluene, royal demolition explosive, high melting explosive from munitions items containing high explosives), perchlorate (from propellant in rocket fuels), and lead (from small arms). The analyses would include the development of a range Conceptual Site Model that uses physical, hydrologic, geographic, and operational range data to characterize current environmental conditions at the range and identify whether people or endangered/threatened animal species, could potentially be impacted by munitions constituents (chemical components of munitions) migrating from operational range activities via surface water, sediment, or groundwater and to identify potential pathways for munitions constituents to reach humans and sensitive animal species. Key factors that influence the potential for the migration of munitions constituents including range design/layout, physical and chemical characteristics of the area, and current/past maintenance operations would also be evaluated under the Range Environmental Vulnerability Assessment program.

The results of the Range Environmental Vulnerability Assessments would determine if additional actions are necessary. These additional actions may include environmental sampling, characterization of physical properties, implementing best management practices, and/or conducting a risk assessment.

4.3.3 Tinian

4.3.3.1 Tinian Alternative 1

4.3.3.1.1 Construction Impacts

A comprehensive drainage and Low Impact Development study is being prepared for Tinian. Under Tinian Alternative 1, construction would require ground-disturbing activities that would include vegetation clearing and grubbing, grading, and excavation activities, all of which would increase the potential for erosion and sedimentation from exposed earth. In addition, an amphibious landing ramp at Unai Chulu would be constructed which would require in-water work. Improvements to an existing public boat ramp at the Port of Tinian may be required to support continued or increased military use, but would not require in-water construction or fill. Tinian RTA development and construction is generally described in Section 2.4, *Tinian Alternatives*, and summarized in Section 4.2, *Geology and Soils;* a detailed evaluation is presented in Appendix F, *Geology and Soils Technical Memo*. Impacts to coastal processes, coral, and coral reefs are described in Section 4.10, *Marine Biology*.

The anticipated stormwater management system would include improvements to address both stormwater quantity and quality. The stormwater quantity would be managed through the use of directional flow controls (i.e., vegetated swales and grading) to maintain the pre-development flow patterns and through the use of detention/retention ponds downstream of new impervious surfaces to maintain the pre-development flow rates.

Stormwater quality would be addressed in conjunction with groundwater recharge to provide appropriate treatment and infiltration of rainwater/stormwater throughout the proposed development in order to maintain and protect the quality of the groundwater resources. The treatment would be provided via small scale structural devices and landscape treatments integrated into the proposed master plan to capture and treat stormwater at or near its source. The Low Impact Development best management practices would be selected based on land use and known pollutants and combined into treatment trains that applied downstream of the pollutant generating facilities to provide pollutant removal prior to discharge to downstream conveyances.

Findings from the comprehensive drainage and Low Impact Development study would be used to inform the final design of the proposed stormwater management system. The majority of these proposed stormwater facilities are expected to occur within and adjacent to the base camp, Munitions Storage Area, airport improvements, and port improvements where impervious surfaces and/or potential pollutant generating facilities are proposed. Additional water quality controls would be located throughout the live-fire ranges to address munitions concerns and along access roads to address transportation of sediment, including improvements adjacent to surface and coastal waters. Proposed stormwater features associated with each of the improvement areas is provided below.

- **Base Camp:** Up slope stormwater flows would be redirected around the proposed base camp improvements where feasible, limiting the internal stormwater facility sizes. On-site flows generally flow southwesterly across the base camp. Frequent, low volume, low intensity surface stormwater flows would be directed to Low Impact Development best management practices treatment devices/trains for capture, treatment, and infiltration. These small scale integrated Low Impact Development devices would be selected and strategically located across the entire base camp site to address the pollutants anticipated from each land use/facility and to meet groundwater recharge requirements. Overflow from these devices during higher volume, higher intensity storm events would be routed via vegetated swales and culverts to detention ponds located within the base camp boundary, downstream of new impervious areas. The ponds would restrict discharge flows to pre-development rates for the 25-year 24-hour design storm and provide additional groundwater recharge. The ponds would also include high level controlled overflow weirs (dams created to reduce, but not stop the flow of water) directing excessive runoff during rainfall events beyond the 25-year design storm towards downstream receiving conveyance systems.

- **Munitions Storage Area:** The Munitions Storage Area contains a minimal amount of new impervious area and ground disturbance consisting primarily of access roads and storage pads. As a result, the stormwater management facilities would be minimal, including roadside channels, culverts, and Low Impact Development features for water quality and groundwater recharge adjacent to and downstream of pads, with some small detention ponds to mitigate additional runoff rates from proposed impervious surfaces. The stormwater runoff occurs in a westerly direction, therefore, stormwater facilities would be placed westerly of the proposed improvements.
- **Tinian International Airport:** The airport improvements would generate a substantial volume of stormwater runoff due to the high quantity of new impervious surfaces. As a result, detention ponds would be designed to accommodate this volume to maintain pre-development hydrology to downstream receiving conveyance systems. The direction of flow is southwesterly; therefore, proposed stormwater facilities would be located southwesterly of the proposed impervious areas. Runoff from paved surfaces would flow across filter strips and bio-retention swales prior to comingling with other surface runoff. Pre-treated sheet flow and shallow channelized flow would then be directed to larger vegetated swales to convey stormwater to detention ponds, which would provide extended detention for both water quantity and quality including groundwater recharge. Additional inline pre-treatment, if required, may be provided within conveyance system including baffle boxes, hydrodynamic separators, and/or additional bio-retention. High level overflow would be provided with the same intent as used for the base camp.
- **Port of Tinian:** The port improvements would generate a significant volume of stormwater runoff for the relatively small facility size because nearly all improvements proposed are impervious. Structural best management practices and perimeter Low Impact Development features would be utilized to intercept and treat runoff from pavement areas before stormwater is routed to detention ponds. Stormwater runoff would flow in a southerly direction towards the harbor and Philippine Sea; therefore, stormwater ponds would be located just south of the improvements/impervious surfaces. Treated discharge and high level overflow would be directed southwesterly away from existing boat ramps and public areas, towards natural points of discharge into the Philippine Sea.
- **Unai Chulu amphibious landing ramp:** As described in Section 4.2.3.1.1, *Construction Impacts* (for Geology and Soils), a Coastal Processes Assessment was completed to assess the potential impacts of construction of Unai Chulu to coastal processes. The Coastal Processes Report (Appendix J, *Amphibious Beach Landing Site Engineering and Coastal Processes Analyses*)

concluded that construction of the proposed Amphibious Assault Vehicle landing ramp would not significantly modify shoreline coastal processes and trigger erosion of the beaches. Post-development stormwater management would mainly focus on a combination of natural and engineered features (i.e., Low Impact Development) that control the volume and rate of stormwater runoff and filter out pollutants.

- **Range Complex A:** Grading within the High Hazard Impact Area consists of the perimeter road, roadside drainage swale, and live hand grenade range pits. Drainage facilities would include conveyance swales, culverts, and linear detention ponds to control flow rates. Stormwater flow would be split with a high point located at the south central portion of the High Hazard Impact Area. Half of the potential stormwater runoff would flow internally to the High Hazard Impact Area in a northwesterly direction toward the Mahalang Complex, while the remainder of the High Hazard Impact Area would flow easterly.
- **Range Complex B:** Grading associated with the Range Complex B is primarily limited to the Tracked Vehicle Driver's Course and the small arms ranges. With minimal impervious surfaces and grade changes, drainage improvements would be focused on capturing munitions constituents as part of the range management program. Additional conveyance swales and minor detention ponds would be utilized as needed to maintain pre-development flows.
- **Range Complex C:** The grading associated with the Range Complex C primarily consists of range access roads, the Multi-purpose Automated Unknown Distance Range, and limited grading for access and objective operations for the Infantry Platoon Battle Course and associated Urban Assault Courses. Drainage improvements would be minimal primarily consisting of channelized conveyance and flow control via culverts and spreader swales. Low Impact Development would be utilized in conjunction with other range management practices to provide treatment, control munitions constituents and protect water resources.
- **Range Complex D:** No grading or drainage improvements are proposed at North Field.

4.3.3.1.1.1 Surface Water Resources

Lake Hagoi is located in northern Tinian, west of the proposed Battle Area Complex (Range Complex D). The Bateha isolated wetlands are outside of the proposed boundaries of Range Complex C and no training facilities or other improvements are proposed within 1,500 feet (450 meters). Lake Hagoi and the Bateha isolated wetlands have been designated a "No Training Area," where no construction activities are proposed. Therefore, as a result of the separation of these surface waters from construction activities and use of best management practices, the existing topography would be maintained and construction activities associated with Tinian Alternative 1 would result in no direct or indirect impacts to Lake Hagoi or the Bateha isolated wetlands. Surface waters on Tinian are shown in Figure 4.3-1.

Figure 4.3-1
Tinian Alternative 1
Surface Waters and Flood Zones

Sources: DoN 2010, DoN 2013

The majority of the Mahalang Complex, approximately 92% of the complex (22 out of 24 mapped depressions), is located within the proposed Range Complex A, High Hazard Impact Area. Construction activities within Range Complex A include a perimeter road/firebreak, grenade range with grenade pits, and fencing. Proposed construction of the Hand Grenade Range and Grenade Launcher Range within the western portion of the High Hazard Impact Area would remove two ephemeral ponds (labeled MC2 and MD3), totaling less than 0.5 acre (0.2 hectare) of the Mahalang Complex. As described in Section 3.3, *Water Resources*, MC2 is not considered a wetland and MD3 is considered an isolated wetland (see the *Wetland Survey Report* in Appendix L). Although Tinian Alternative 1 construction activities would result in direct impacts to these two surface water features, the remainder of the Mahalang Complex would not be impacted by construction; therefore, construction activities associated with Tinian Alternative 1 would result in less than significant direct impacts to the Mahalang Complex.

Low-lying areas, including areas surrounding the surface water features, could be subject to flooding during heavy rainfall events. Small areas near the proposed base camp, along the proposed Tracked Vehicle Driver's Course and Convoy Course, and within Tinian RTA are within depressions that could be subject to a greater flooding hazard. Nearshore areas may also be subject to flooding and wave hazards during extreme storm and tidal events. Construction work would follow the CNMI erosion control requirements and utilize best management practices such as limiting ground disturbance during wet weather, minimizing compaction of native soils, and through use of temporary diversions and sedimentation basins that direct stormwater away from construction areas to minimize potential erosion and transportation of sediment and pollutants to downstream conveyance and surface waters. Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, construction activities associated with Tinian Alternative 1 would result in less than significant direct and indirect impacts from flooding hazards. Flood zones are shown in Figure 4.3-1.

Drainage throughout most of Tinian is internal (underground), and water generally percolates downward into porous limestone rock (Doan et al. 1960). With the natural drainage of the porous limestone rock and through the implementation of erosion control practices including perimeter controls, construction scheduling, tracking pads, minimizing disturbance and sedimentation basins (as detailed in Appendix D, *Best Management Practices*), stormwater runoff impacted by construction activities is not anticipated to discharge to surface water features and would not affect surface water quality. Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, construction activities associated with Tinian Alternative 1 would result in less than significant indirect impacts to surface water quality.

4.3.3.1.1.2 Groundwater Resources

Existing groundwater wells, the proposed notional well fields, groundwater elevations, and the general direction of groundwater flow are shown in Figure 4.3-2. The increase in residents living on Tinian during the construction phase (i.e., temporary construction workers) may result in an increased dependence on the Commonwealth Utilities Corporation's potable water system. This would require increased pumping from Maui Well #2 and could result in temporary increased chloride levels as a result of saltwater intrusion (the movement of saline water into freshwater aquifers). However, this increase would be limited to the duration of construction and the modest increase in pumping over and above current levels is expected to result in less than significant impacts to groundwater in the Makpo Valley sub-watershed.

Figure 4.3-2
Tinian Alternative 1
Groundwater Wells, Elevation, and Flow Direction

A proposed well field has been identified north and east of the airport. New wells are required to support construction activities and operations associated with the proposed action. The new well sites would be selected to minimize negative impacts to groundwater quantity and quality resulting from increased extraction. New well sites would be established in compliance with *CNMI Well Drilling and Well Operation Regulations* (CNMI Division of Environmental Quality 2005). These regulations include well seal and construction specifications, pump testing, water quality analysis, and designated wellhead setback distances from potential sources of contamination. Testing and monitoring would be performed prior to production at each new well site.

The pumping of groundwater from the proposed new military wells could potentially cause saltwater intrusion by reducing the thickness and lateral limits of the fresh water lens, reducing the quality of groundwater in the Military Lease Area. However, this impact would be limited to the duration of construction and due to the size of the freshwater basal lens (i.e., availability of groundwater) impacts are expected to be minimal.

Improperly abandoned existing wells in the Military Lease Area could provide a preferential flow path for runoff from the RTA; therefore, encountered unused wells (production or monitoring will properly close existing unused (production or monitoring) wells within the Military Lease Area to protect the groundwater resources.

Best management practices that would be implemented during construction to protect groundwater resources include capture and treatment of pollutant laden stormwater with Low Impact Development devices; restricting untreated stormwater runoff from entering depressional areas and surface waters; limiting use of heavy equipment in areas that support groundwater recharge; proper abandonment (closure) of historic groundwater wells, and proper management of spills and leaks of hazardous materials and waste. Based on the general direction of groundwater flow (shown in Figure 4.3-2), pollutants unintentionally released from construction sites or proposed facilities within the Military Lease Area would not flow to the public water system well (i.e., Maui Well #2). Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, Tinian Alternative 1 construction activities would result in less than significant direct and indirect impacts to groundwater resources.

4.3.3.1.1.3 Nearshore Water Resources

General Construction Activities in Coastal Areas

The majority of the construction activities would take place inland and away from the nearshore environment. However, some construction activities would take place near the shore including port improvements, portions of road improvements, some surface radars and an amphibious beach landing area. Construction activities could result in the accidental release of pollutants (e.g., petroleum, oils, and lubricants) resulting in impacts to nearshore water quality. However, accidental release of pollutants would be rare, and best management practices would be followed to reduce the likelihood of an accidental release or spill occurring. Any spills that do occur would be cleaned up immediately. With the implementation of pollutant prevention best management practices, including construction scheduling only during ideal conditions, sediment traps to control stormwater flowing through and from the work area, vehicle tracking pads, silt fencing and floating turbidity barriers, construction impacts to nearshore waters are not anticipated. Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, land-based construction activities under Tinian Alternative 1 would result in less than significant direct and indirect impacts to nearshore water resources.

In-Water Work at Tactical Amphibious Landing Beach

An amphibious landing ramp would be constructed at Unai Chulu to create a safe landing surface for training operations. In-water construction at Unai Chulu would result in direct impacts to nearshore waters. Construction activities would disturb sediment and increase turbidity and thus impact water quality, clarity, and dissolved oxygen levels. Best management practices, including isolating the in-water construction area with floating turbidity barriers, would be utilized to capture sediment and debris caused by in-water construction activities.

An assessment was completed to assess the potential impacts of construction of Unai Chulu to coastal processes. The *Coastal Processes Report* included in Appendix J concluded that construction of the proposed amphibious landing ramp would not significantly modify shoreline coastal processes or trigger erosion of the beaches. Best management practices would be in place to monitor and minimize impacts to nearshore water resources that may result from the construction of the underwater landing areas. Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, in-water construction activities under Tinian Alternative 1 would result in less than significant direct and indirect impacts to nearshore water resources.

4.3.3.1.2 Operation Impacts

The post-development stormwater management system would maintain pre-development hydrology and reduce flooding hazards to downstream facilities and new infrastructure, including the base camp facilities, Munitions Storage Area, port facilities, and airport facilities. Tinian Alternative 1 training and maintenance operations may result in impacts to localized natural hydrology/drainage systems with potential impacts to surface water, groundwater, and nearshore waters. Newly constructed impervious surfaces (primarily associated with the proposed base camp area, airfield improvements, Munitions Storage Area, port improvements, and limited roadway improvements), vegetation removal and control, foot-trails created during training maneuvers, and off-road vehicle use may alter natural drainage courses. Vegetation maintenance, foot-trails, and use of vehicles off-road may cause erosion and increased sediment in stormwater runoff, which would be minimized through the use of strategically selected and located erosion control techniques and devices.

Newly created impervious surfaces would be created at the port, base camp, airport, Munitions Storage Area, roadways, and at some of the training facilities (see Section 2.4.1.2, *Construction and Improvements*). The proposed impervious surfaces along with a brief summary of operational facilities are provided for each improvement area below.

- **Base Camp:** The base camp area would include a variety of hardscaping as part of the support facilities, new roads, vehicle wash racks with effluent treatment ponds and wash-water recycling system, a package wastewater treatment plant, wastewater disposal field, Low Impact Development features, and stormwater detention basins. Wastewater would be treated prior to disposal via leach field, minimizing potential impacts to groundwater quality. Vegetated roadside swales would convey runoff while providing water quality treatment, and minimize erosion and sediment runoff from gravel/stabilized roads.

- **Munitions Storage Area:** The Munitions Storage Area includes eight munitions storage magazines, a maintenance facility in addition to the entry control gate, access roads, and storage facilities. The proposed improvements also include Low Impact Development features for water quality, vegetated swales for stormwater conveyance, and stormwater detention basins.
- **Port of Tinian:** Port improvements would include a vehicle inspection area; cargo inspection and holding area; vehicle wash-down area with effluent treatment pond and wash-water recycling system; and stormwater detention basins. The stormwater management system would be maintained to ensure proper function and to prevent release of pollutants to downstream receiving waters.
- **Tinian International Airport:** The Tinian International Airport improvements include significant impervious areas such as the aircraft parking ramps, hot fuel pits, and aircraft taxi lanes. The proposed improvements also include Low Impact Development features for water quality, vegetated swales for stormwater conveyance, and stormwater detention basins.

Following the completion of construction, vegetation within the Tinian RTA would be allowed to reestablish or managed at allowable heights. The preservation and reestablishment of vegetation would minimize the potential for erosion and sediment runoff. The height of vegetation would be managed in certain portions of the RTA, including objective areas, fire breaks, roadway/trail alignments, firing points, Landing Zones, Drop Zones, target areas, and Observation Posts. Because root systems and ground cover would be maintained, these areas would remain anchored and not pose a significant source of erosion. Controlled burning may be used to manage vegetation within Range Complex A, which could create temporary increases in soil erosion during periods of vegetation grow in.

4.3.3.1.2.1 Surface Water Resources

New wells would be developed in the Military Lease Area for U.S. military use outside the Makpo Valley sub-watershed. None of the identified surface waters are near the notional locations of the new wells.

Lake Hagoi is located west of the proposed Range Complex D, northern Battle Area Complex (see Figure 4.3-1). Lake Hagoi and surrounding areas have been designated a “No Training Area,” where no training activities or target areas are proposed. As a result, no direct or indirect impacts from training or munitions are anticipated. The majority of the Mahalang Complex is located within the Range Complex A, with the exception of a small portion on the western border of the High Hazard Impact Area. The High Hazard Impact Area would not be utilized during Maneuver Area (Light Forces) training thus protecting the portion of the Mahalang Complex within Range Complex A, not already permanently impacted during construction, from potential direct impacts associated with foot traffic. The Bateha isolated wetlands are located within the proposed Range Complex C (see Figure 4.3-1). However, the isolated wetlands have been designated a “No Training Area.” No training facilities, targets objective areas, or other improvements (i.e., roads) are proposed in the vicinity (i.e., within 1,500 feet [500 meters]) of the Bateha isolated wetlands. Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, Tinian Alternative 1 operations would result in no direct impacts to Lake Hagoi or the Bateha isolated wetlands.

Training operations in the High Hazard Impact Area, including controlled burning of vegetation and use of high explosives and other munitions, may result in indirect impacts to the remaining surface water features of the Mahalang Complex because half of the potential stormwater runoff from the High Hazard Impact Area would flow in a northwesterly direction toward the Mahalang Complex. Stormwater runoff can erode and transport contaminated soil and leachable munition constituents. Munitions constituents from operation of the Tinian RTA contain potentially leachable compounds that can impact water quality if not managed properly. Low Impact Development features would be utilized to control stormwater runoff from the Tinian RTA and water quality controls would be located throughout the live-fire ranges to address munitions concerns. With proper range management and the implementation of the Range Environmental Vulnerability Assessment program, Tinian Alternative 1 operations would result in less than significant indirect impacts to surface water quality. Reevaluations would occur at a minimum every 5 years.

Without proper stormwater management controls, increased impervious areas would increase the amount of runoff and the potential for downstream flooding. Development in the floodplain may also result in potential damage to facilities within low lying areas from inundation during high runoff storm events. Some of the proposed improvements east of the base camp, along the Tracked Vehicle Driver's Course and Convoy Course, and within the Tinian RTA are proposed within the Federal Emergency Management Agency "100-year flood zone" and may be subject to flood hazards. However, with the implementation of avoidance and minimization measures such as low impact training within high risk areas, along with monitoring and adaptive management of range operations and proper maintenance of the stormwater management facilities, runoff rates and erosion would be controlled and flooding hazards would be minimized. Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, Tinian Alternative 1 operations would result in less than significant impacts from flooding hazards.

4.3.3.1.2.2 Groundwater Resources

Newly constructed impervious surfaces could alter infiltration characteristics within the project footprint, but in many cases, the impacted acreage is relatively small and potentially adverse effects would be mitigated through increased infiltration through other means within the development, meeting the required groundwater recharge rates and resulting in no net impact. In cases such as the airport improvements with significant increases in impervious areas, additional infiltration galleries would be used, after treatment, and within vegetated areas to capture, retain, and infiltrate larger volumes of stormwater to recharge groundwater resources.

Additional groundwater extraction would occur due to the proposed action that could affect groundwater availability and quality. New potable extraction wells (same wells established during construction) would be utilized in the Military Lease Area for U.S. military use to prevent overextending the existing Makpo Valley well (i.e., Maui Well #2). This change in source would result in no impacts to the municipal water supply. The new well sites would be selected to minimize negative impacts to groundwater quantity and quality resulting from increased extraction. The pumping of groundwater from the proposed new military wells to support military operations could potentially cause saltwater intrusion (the movement of saline water into freshwater aquifers) by reducing the thickness and lateral limits of the fresh water lens, thus reducing the quality of groundwater in the Military Lease Area during operations. However, this impact is not expected to be significant because the pumping would be limited to periods when training exercises occur and because of the size and recharge characteristics of the freshwater basal lens (i.e., availability of groundwater).

Munitions constituents could affect groundwater quality through percolation of leachable compounds. The accidental release of other pollutants associated with the use and maintenance of vehicles and septic leachate from the wastewater leach field also has the potential to impact groundwater quality. Impacts to the public water system (i.e., Maui Well #2 in the Makpo Valley sub-watershed), are not anticipated based of the separation distance and direction of general groundwater flow (see Figure 4.3-2). Groundwater resources located along the northern and eastern portions of the High Hazard Impact Area would have the greatest potential to be affected. Those are the areas where the surface soils are moderately permeable, shallow rocky clays, and/or moderately deep to deep clay (see Appendix F, *Geology and Soils Technical Memo*, for details). However, the risk of munitions constituent contamination to groundwater is expected to be less than significant because of: (1) limited existence of basal groundwater in the High Hazard Impact Area, (2) relatively deep soil formation in the gentler sloping areas, (3) the depth to groundwater (i.e., greater than 200 feet [60 meters]), and (4) proper range management and the implementation of the Range Environmental Vulnerability Assessment program.

Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, Tinian Alternative 1 operations would result in less than significant impacts to groundwater resources.

4.3.3.1.2.3 Nearshore Waters

Groundwater could potentially carry munitions constituents from training facilities to nearshore waters through the porous limestone, affecting nearshore water quality. These impacts would be minimized by employment of resource management measures described in Section 4.3.2.

Unai Chulu, Unai Babui, Unai Lam Lam, and Unai Masalok are proposed tactical amphibious landing beaches (see Figure 4.3-1). Training at amphibious landing beaches could include combat swimmer training and landing of rigid-hulled inflatable boats at all four beaches. Landing Craft Air Cushion vessels would land at Unai Chulu, Unai Babui, and Unai Masalok. Amphibious Assault Vehicles would land at Unai Chulu only. Amphibious Assault Vehicles are tracked vehicles that would come ashore at Unai Chulu and cross the beach to access the Tracked Vehicle Driver's Course.

Rigid-hulled inflatable boats, Landing Craft Air Cushion vessels, and Amphibious Assault Vehicles are powered by diesel engines and must be operated with petroleum-based products. The use of these products creates a possibility of accidental discharge of pollutants into the nearshore waters, but impacts would be minimized by personnel awareness (visual observations) and by implementing standard spill response procedures. In addition, the Amphibious Assault Vehicles track mechanism is lubricated with water repellant grease that would have a negligible impact on water quality (Marine Corps Forces Reserve 2014).

Operation of Landing Craft Air Cushion vessels and Amphibious Assault Vehicles would result in temporary increase in suspended sediment and turbidity (suspension of sand in the water column) in localized areas when approaching the shore, resulting in a temporary impact to water quality. Observations from Landing Craft Air Cushion operations at Unai Chulu (Department of Defense 1999) documented that the sediment plumes generated by these vehicles are likely not qualitatively different from naturally occurring turbidity during periods of storm-generated waves that routinely occur on

Tinian. When the Landing Craft Air Cushion vessel is stationary, water displacement is similar to a small wave, localized, and of short duration.

The landing of amphibious and small craft vehicles on beaches could affect nearshore water quality through increased turbidity, erosion, sediment transport, and accidental discharge of pollutants. However, these impacts would be temporary in nature and only occur during training activities. Accidental release of pollutants would be rare, and best management practices would be followed to reduce the likelihood of an accidental release or spill occurring. Any spills that do occur would be cleaned up immediately. Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, Tinian Alternative 1 operations would result in less than significant impacts to nearshore water resources.

4.3.3.2 Tinian Alternative 2

Tinian Alternative 2 construction activities and operations would have similar impacts to water resources as those identified under Tinian Alternative 1 (see Section 4.3.3.1, *Tinian Alternative 1*). The main difference that would affect water resources is that the southern Battle Area Complex and associated Urban Assault Course would be constructed and operated within the present location of the International Broadcasting Bureau and other portions of Range Complex C (Figure 4.3-3). The Bateha isolated wetlands are located within the proposed southern Battle Area Complex (Range Complex C).

4.3.3.2.1 Construction Impacts

Tinian Alternative 2 construction impacts to water resources would be similar to those identified under Tinian Alternative 1. Construction of the training facilities and support facilities (buildings, roads, and related infrastructure) associated with the Tinian Alternative 2 would require ground-disturbing activities similar to but slightly greater than those under Tinian Alternative 1. The Bateha isolated wetlands and surrounding areas would not be included in any construction footprint (i.e., objectives, access roads, pathways). Therefore, Tinian Alternative 2 construction of activities would result in no impacts to Lake Hagoi or the Bateha isolated wetlands; less than significant direct and indirect impacts to the Mahalang Complex (as described under Tinian Alternative 1); and less than significant direct and indirect impacts from flooding hazards and to surface water quality, groundwater resources, and nearshore waters.

4.3.3.2.2 Operation Impacts

Impacts to water resources from Tinian Alternative 2 operations would be similar to those identified under Tinian Alternative 1. The Bateha isolated wetlands and surrounding areas would be included in Range Complex C; however, they have been designated a “No Training Area,” where no training activities or object areas are proposed. Therefore, Tinian Alternative 2 operations would result in no impacts to Lake Hagoi or the Bateha isolated wetlands and less than significant direct and indirect impacts to the Mahalang Complex (as described under Tinian Alternative 1); and less than significant direct and indirect impacts from flooding hazards and to surface water quality, groundwater resources, and nearshore waters.

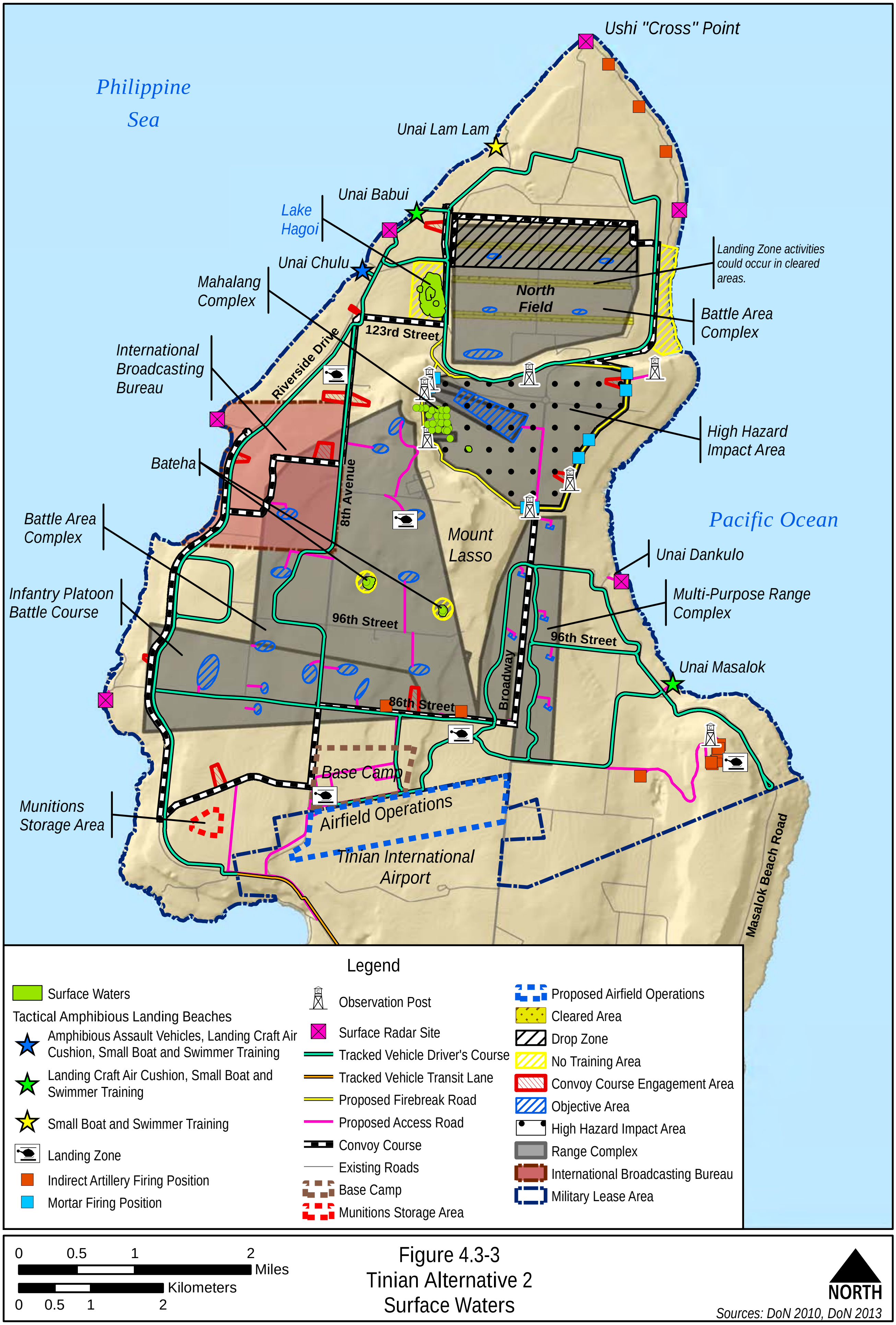

Figure 4.3-3
Tinian Alternative 2
Surface Waters

4.3.3.3 Tinian Alternative 3

Tinian Alternative 3 construction activities and operations would have similar impacts to water resources as those identified under Tinian Alternative 1. The main differences that would affect water resources are that Range Complex D would not include a northern Battle Area Complex and associated Urban Assault Course at North Field, and Range Complex C would include a southern Battle Area Complex and associated Urban Assault Course. The Bateha isolated wetlands are located within the proposed southern Battle Area Complex (Range Complex C), as shown in Figure 4.3-4.

4.3.3.3.1 Construction Impacts

Tinian Alternative 3 construction impacts to water resources would be similar to those identified under Tinian Alternative 1. Construction of the training facilities and support facilities (buildings, roads, and related infrastructure) associated with the Tinian Alternative 3 would require ground-disturbing activities similar to but slightly greater than those under Tinian Alternative 1. The Bateha isolated wetlands and surrounding areas would not include any construction footprint (i.e., objectives, access roads, pathways). This alternative would minimize construction activities at Range Complex D. Therefore, Tinian Alternative 3 construction would result in no impacts to Lake Hagoi or the Bateha isolated wetlands; less than significant direct and indirect impacts to the Mahalang Complex (as described under Tinian Alternative 1); and less than significant direct and indirect impacts from flooding hazards and to surface water quality, groundwater resources, and nearshore waters.

4.3.3.3.2 Operation Impacts

Impacts to water resources resulting from Tinian Alternative 3 operations would be similar to those identified under Tinian Alternative 1. The Bateha isolated wetlands have been designated a "No Training Area," where no training activities or objective areas are proposed. Therefore, Tinian Alternative 3 operations would result in no impacts to Lake Hagoi or the Bateha isolated wetlands and less than significant direct and indirect impacts to the Mahalang Complex (as described under Tinian Alternative 1); and less than significant direct and indirect impacts from flooding hazards and to surface water quality, groundwater resources, and nearshore waters.

4.3.3.4 Tinian No-Action Alternative

The periodic non-live-fire military training exercises that occur in the Military Lease Area on Tinian consist of troop maneuvering, ground vehicle movements, and helicopter and fixed-wing aircraft operations. These military training exercises are short term with limited activities on Tinian and would result in less than significant impacts to water resources on Tinian. As included in the Guam and CNMI Military Relocation EIS (DoN 2010a), military training on the four live-fire training ranges would introduce minor increases in stormwater runoff with introduction of more impervious surfaces along with potential for surface water and localized groundwater contamination because of the increase in training activities (see Table 4.2-1; DoN 2010a). Training in the Mariana Islands Range Complex would not introduce any long-term degradation of stormwater, groundwater, surface waters, or wetlands (see Table 3.3-13; DoN 2010b). Significant impacts would be avoided by implementing best management practices. Therefore, the no-action alternative would result in less than significant impacts to surface water, groundwater, and nearshore waters.

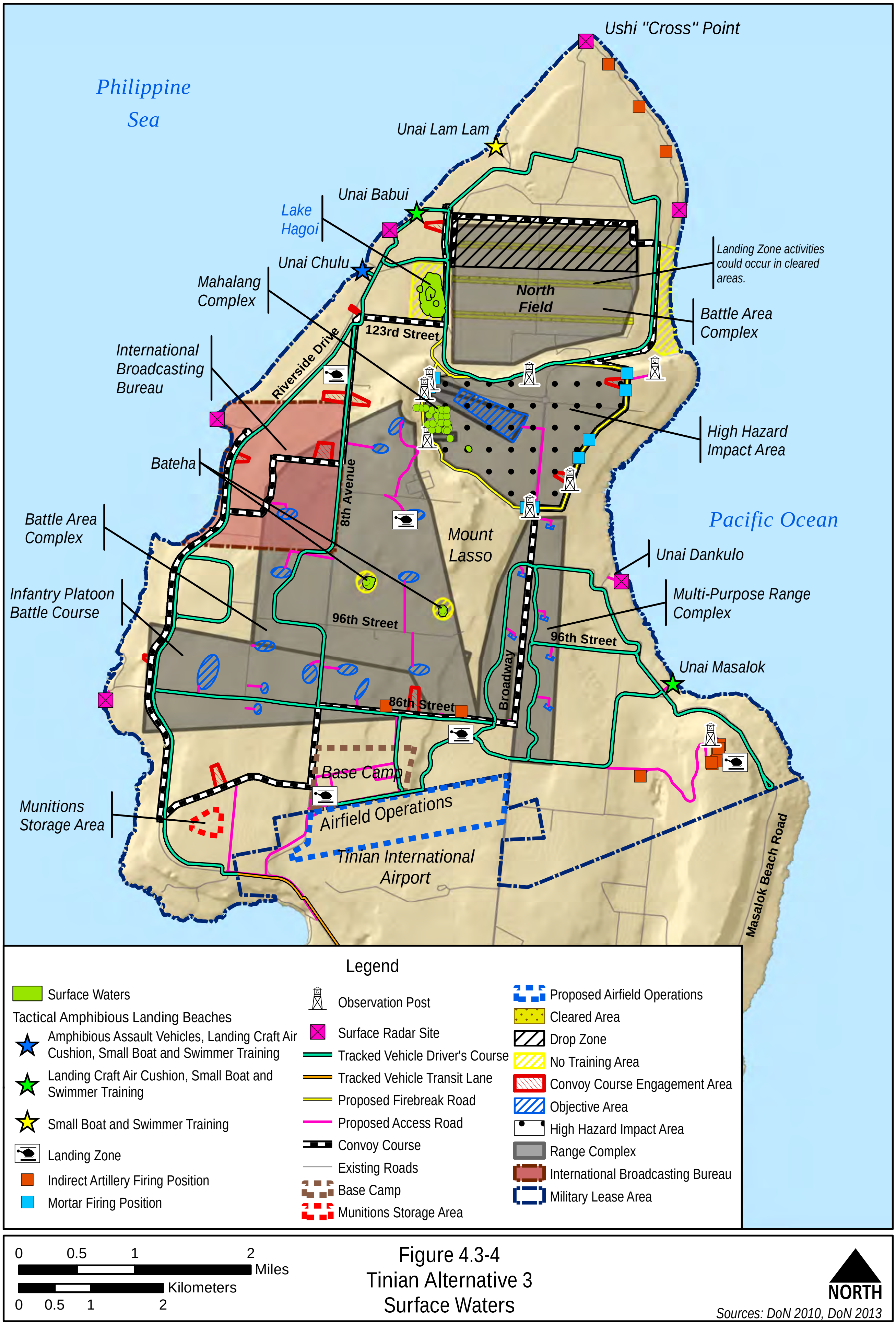

Figure 4.3-4
Tinian Alternative 3
Surface Waters

4.3.3.5 Summary of Impacts for Tinian Alternatives

Table 4.3-1 provides a comparison of the potential impacts to water resources for the three Tinian alternatives and the no-action alternative.

Table 4.3-1. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Water Resources	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Surface Water Resources	*NI (Lake Hagoi, Bateha isolated wetlands) LSI (Mahalang Complex) LSI (flooding hazards and surface water quality)*	*NI (Lake Hagoi, Bateha isolated wetlands) LSI (Mahalang Complex) LSI (flooding hazards and surface water quality)*	*NI (Lake Hagoi, Bateha isolated wetlands) LSI (Mahalang Complex) LSI (flooding hazards and surface water quality)*	*NI (Lake Hagoi, Bateha isolated wetlands) LSI (Mahalang Complex) LSI (flooding hazards and surface water quality)*	*NI (Lake Hagoi, Bateha isolated wetlands) LSI (Mahalang Complex) LSI (flooding hazards and surface water quality)*	*NI (Lake Hagoi, Bateha isolated wetlands) LSI (Mahalang Complex) LSI (flooding hazards and surface water quality)*	*LSI*	*LSI*
Groundwater Resources	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Nearshore Water Resources	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*

Legend: *NI* = no impact; *LSI* = less than significant impact.

4.3.4 Pagan

4.3.4.1 Pagan Alternative 1

4.3.4.1.1 Construction Impacts

A comprehensive drainage and Low Impact Development study is currently underway for Pagan. Under Pagan Alternative 1, development and construction would occur in the level area surrounding the existing airfield, along the military training trails, and within the proposed High Hazard Impact Areas for target placement.

The anticipated stormwater management system would include improvements to address both stormwater quantity and quality. The stormwater quantity would be managed through the use of directional flow controls (i.e., vegetated swales and grading) to maintain the pre-development flow patterns and through the use of detention/retention ponds downstream of new and reduced impervious surfaces to maintain the pre-development flow rates.

The improvements on Pagan are primarily expeditionary in nature with minimal additional impervious surfaces proposed. Some training facilities would have a reduced infiltration rate due to the compaction associated with the proposed training activity and may contribute to increased stormwater flows. Therefore, these areas are considered in the stormwater analysis and associated facilities are included in construction. The proposed grading and drainage improvements would also be minimal and focused on strategic placement of vegetated swales and small detention ponds for conveyance and flow control along with specific Low Impact Development and best management practices to address water quality for pollutant generating facilities.

- **Airfield and Bivouac Area:** Airfield and bivouac improvements are proposed in the same area as an existing airfield and within a relatively flat valley. Minimal earthwork would be required, with the exception of removal of the lava flow from the 1981 eruption that has covered the eastern half of the former grass airfield. The airfield would require compaction which may reduce surface water infiltration. As a result, stormwater that does not infiltrate would flow westerly along the airfield and bivouac area through bio-retention swales for treatment and infiltration, and to detention ponds for additional infiltration and flow rate control into downstream receiving conveyance systems towards the Philippine Sea.
- **Munitions Storage Area:** The five small proposed pads for biosecurity, assembly, and storage would include a minimal amount of new impervious area and require minimal grading and drainage improvements.
- **Military Training Trails:** Many of the proposed trails follow existing trail alignments. Widening and stabilization of these trails would occur. New trail alignments would require additional slope cut, fill, and stabilization. All trails would be all-weather surfaces using local materials as a compacted granular base. Drainage culverts or protected low water crossings are anticipated to maintain hydrology, slope stabilization, and trail function. The military training trails would be pervious and thus are not anticipated to increase runoff volumes or adversely affect hydrology. Therefore, the trail would require minimal volume controls for stormwater runoff. The focus would be on stabilization and erosion control to maintain trail usability and prevent transportation of sediment downstream.

- **Landing Zones:** Numerous landing zones are proposed at locations throughout the north half of the island along military trails and firing positions. Nominal vegetation clearing and minimal grading is anticipated at each site, with natural drainage patterns being preserved. No impervious areas or permanent improvements are proposed at these sites.
- **Beach Landings:** The beach landing areas would not include any construction improvements (i.e., grading, drainage, or permanent improvements).
- **Target Areas:** Minor localized disturbances are anticipated for construction and maintenance of target structures throughout the northern and isthmus High Hazard Impact Areas. Minimal grading, clearing, and drainage is anticipated for these improvements. Small retention swales would be located down-gradient of targets to capture and retain target and munitions constituents in compliance with a range management plan.

4.3.4.1.1.1 Surface Water Resources

No in-water construction is proposed under Pagan Alternative 1. Laguna Sanhiyon is located outside of the northern High Hazard Impact Area, and Laguna Sanhalom is surrounded by the northern High Hazard Impact Area. Surface Water Resources on Pagan are shown in Figure 4.3-5. Because of increased exposed surface area and soil disturbance activities associated with construction activities (i.e., military training trails, target placements), the potential for erosion and sedimentation would be greater during the construction period. Construction-specific best management practices (such as temporary erosion control practices, perimeter controls, construction scheduling, tracking pads, minimizing disturbance, and sedimentation basins) would be implemented to reduce indirect impacts (e.g., sediment and pollutant-laden runoff) to Laguna Sanhalom from construction of military training trails and target placement areas.

New impervious surfaces would be limited to the munitions storage pads; however, other improvements such as expeditionary airfield, expeditionary base camp/bivouac area, access trails and military training trails may take on impervious characteristics in some areas due to high levels of compaction and repeated use. The areas anticipated to reduce infiltration would be minimal, and would not alter surface drainage or flood patterns significantly as high porosity in surrounding areas would compensate. Construction activities could result in the accidental release of pollutants that could affect surface water quality through percolation and stormwater runoff. However, accidental release of pollutants would be rare, and best management practices would be followed to reduce the likelihood of an accidental release or spill occurring. Any spills that do occur would be cleaned up immediately. Storage and maintenance of construction equipment and supplies is anticipated to occur away from surface waters to reduce potential for impacts. In addition, sediment basins, silt fence, tracking pads, filter strips and other forms of temporary erosion control would be utilized to mitigate adverse effects to surface water resources resulting from construction activities.

Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, Pagan Alternative 1 construction activities would result in less than significant impacts to surface water resources.

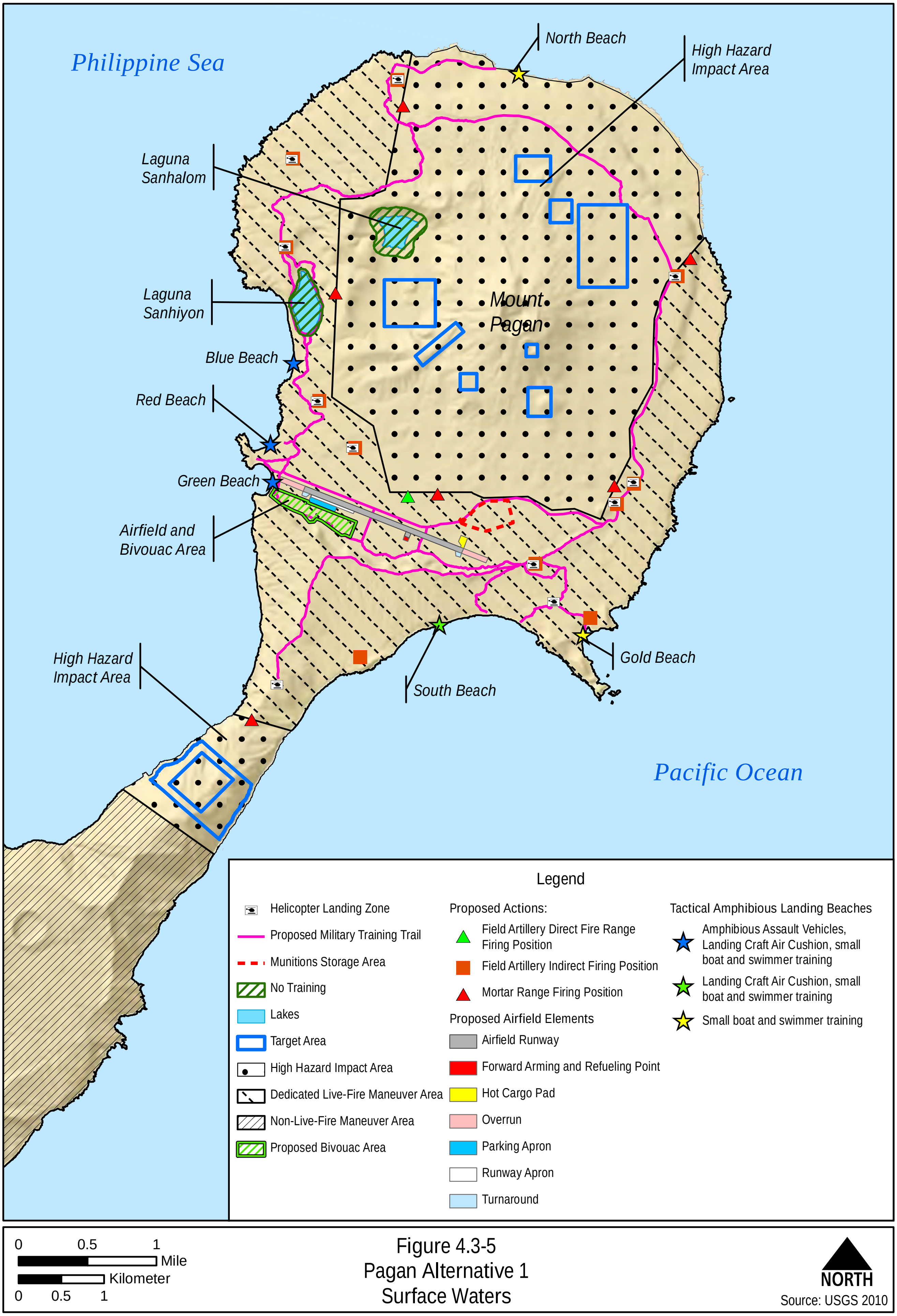

Figure 4.3-5
Pagan Alternative 1
Surface Waters

4.3.4.1.1.2 Groundwater Resources

Groundwater is not planned to be used during construction. Instead, temporary reverse osmosis of seawater would be used to provide potable water during construction. The accidental release of other pollutants associated with the use and maintenance of construction vehicles could also impact groundwater. However, accidental release of pollutants would be rare, and best management practices would be followed to reduce the likelihood of an accidental release or spill occurring. Any spills that do occur would be cleaned up immediately. Silt fence, sediment basins, turbidity barriers, tracking pads, filter strips, and other forms of temporary erosion/sedimentation control would be utilized to mitigate adverse effects to groundwater resulting from construction activities. Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, Pagan Alternative 1 construction activities would result in less than significant impacts to groundwater resources.

4.3.4.1.1.3 Nearshore Water Resources

No in-water construction is proposed under Pagan Alternative 1. Potential short-term impacts related to land-based construction include erosion, sedimentation, turbidity, decreased water clarity, and accidental discharge of pollutants. The accidental release of pollutants associated with the use and maintenance of vehicles could also impact nearshore waters. However, accidental release of pollutants would be rare, and best management practices would be followed to reduce the likelihood of an accidental release or spill occurring. Any spills that do occur would be cleaned up immediately. Storage and maintenance of construction equipment and supplies is anticipated to occur away from nearshore waters to reduce potential for impacts. In addition, best management practices including silt fence, turbidity barriers, tracking pads, filter strips, and other forms of temporary erosion/sedimentation control would be utilized to minimize impacts to nearshore waters resulting from construction activities. Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, Pagan Alternative 1 construction activities would result in less than significant impacts to nearshore water resources.

4.3.4.1.2 Operation Impacts

Pagan Alternative 1 training and maintenance operations may result in impacts to surface waters, groundwater resources, and nearshore waters. Groundwater is not planned to be used during operations. Instead, temporary reverse osmosis of seawater would be used to provide potable water during operations.

4.3.4.1.2.1 Surface Water Resources

Laguna Sanhiyon is located adjacent to proposed military training trails. The proposed trail to the west of the lake would be located on the sand bar that separates the lake from the ocean. During windy conditions and high tides, waves occasionally over the top of the sand bar. Use of vehicles on this trail would be limited to emergencies. During a rare emergency event, sediment and hydrocarbon runoff from military vehicles using the training trail could impact Laguna Sanhiyon water quality.

Much of the proposed material used on trails throughout Pagan will include crushed lava from lava flow across the air strip. This angular material will be crushed to appropriate size for use as road base and surface with minimal quantities of fine particles, reducing the likelihood of being easily transported by stormwater runoff. Additional protection from sediment laden runoff resulting from military trail use would be provided through the use of vegetated swales and stormwater velocity dissipaters and other best management practices at crossings. High porosity of surface soils and geology limit the volume of surface stormwater runoff, further decreasing the likelihood of transportation of sediment.

Stormwater runoff from the northern High Hazard Impact Area could transport munitions constituents to Laguna Sanhalom and Laguna Sanhiyon either as surface runoff or sub-surface conveyance, resulting in indirect water quality impacts to those surface waters. Target placement has been selected so that stormwater runoff potentially transporting munition constituents would drain away from the lakes, with the following target placement exceptions: the two targets due west of Mount Pagan, which would potentially drain to Laguna Sanhalom via surface flow and to both Laguna Sanhalom and Laguna Sanhiyon via sub-surface flow. Stormwater runoff can erode and transport contaminated soil and leachable munition constituents. Munitions constituents from operation of the Pagan RTA contain potentially leachable compounds that can impact water quality if not managed properly. Low Impact Development features would be utilized to control stormwater runoff from the Pagan RTA and water quality controls would be located throughout the live-fire ranges to address munitions concerns. The distance between the two targets sited up gradient of Laguna Sanhalom and Laguna Sanhiyon on Mount Pagan within the High Hazard Impact Area is greater than 1,150 feet (350 meters) horizontally, reducing likelihood of transportation of munitions constituents via surface stormwater runoff. However, the potential for transportation of munitions constituents to the surface waters does exist based on the target location relative to the surface waters and as a result of the nature of the fractured surface geology and potential for sub-surface flow. Whether by intense rainfall events or by sub-surface conveyance there is the potential for future impacts. As a result of the target placement up gradient of the surface waters and military trail adjacent to Laguna Sanhiyon, Pagan Alternative 1 operations could result in impacts to surface water resources. Best management practices including filter strips, bio-retention, vegetated swales, and other forms of permanent erosion/sedimentation control practices would be utilized to minimize impacts to surface waters resulting from operation activities. Monitoring and adaptive management plans would identify if conditions change and concerns arise, allowing early intervention to reduce potential impacts to the surface water resources. Through creation of downstream catch areas to prevent direct runoff from transporting pollutants via overland flow directly to surface waters and proper range construction and management and the implementation of the Range Environmental Vulnerability Assessment program, Pagan Alternative 1 operations would result in less than significant impacts to surface water resources.

Low-lying areas, including areas surrounding Laguna Sanhalom, Laguna Sanhiyon, and shoreline areas, could be subject to flooding during high wind, high tide, and storm surge events. Proposed operational activities are not anticipated to increase flooding hazards; therefore, Pagan Alternative 1 operations would result in no impacts with regards to flooding.

4.3.4.1.2.2 Groundwater Resources

Surface runoff within the areas of target placements in each of the High Hazard Impact Areas is expected to be moderate due to the relative flatness of the target areas and the underlying soil/rock conditions. Once the water passes through the rooting zone of the soils (primarily associated with the isthmus High Hazard Impact Area) or through course, highly permeable lava rock (associated with the northern High Hazard Impact Area) it would percolate to the groundwater aquifer system several hundred feet below. Risk of contamination to groundwater from munitions constituent in the northern

High Hazard Impact Area on Mount Pagan is possible, however, would be somewhat reduced by: (1) the possibly limited existence of a basal groundwater lens in the area and (2) dilution from rapidly percolating waters migrating radially toward the coast. The High Hazard Impact Area on the isthmus was mapped as containing "generally meager to small quantities of fair to poor quality water" (Corwin et al. 1957). There is not likely to be a substantial groundwater resource in this area. Based upon the above analysis and the implementation of resource management measures in Section 4.3.2, Pagan Alternative 1 operations would result in less than significant impacts to groundwater resources.

4.3.4.1.2.3 Nearshore Water Resources

The landing of amphibious and small craft vehicles on beaches, beach and amphibious training maneuvers, and the use of Amphibious Assault Vehicles could impact nearshore water quality. Potential impacts include erosion, sedimentation, turbidity, decreased water clarity, and accidental discharge of pollutants. The accidental release of other pollutants associated with the use and maintenance of vehicles could also impact nearshore water quality. However, accidental release of these pollutants would be rare and only occur as a result from the failure of a materials-handling best management practice, and any spills would be cleaned up immediately.

Stormwater runoff from High Hazard Impact Areas could also transport munitions constituents to nearshore waters resulting in indirect water quality impacts. Targets in the northern High Hazard Impact Area and most of the isthmus High Hazard Impact Area would be placed away from coastal cliff lines on relatively flat terrain that is visible from the firing positions. However, proposed targets on the steep slopes along the isthmus High Hazard Impact Area are close enough to the coast that dislodged rock, soil, or target material could fall into the nearshore waters below.

Constituents associated with target material that falls into nearshore waters are not expected to substantially impact nearshore water quality. When metals are exposed to seawater, they begin to slowly corrode, a process that creates a layer of corroded material between the seawater and metal. This layer of corrosion removes the metal from direct exposure to the corrosiveness of seawater, a process that further slows movement of the metals into the adjacent sediments and water column. This is particularly true of aluminum. Elevated levels of metals in sediments would be restricted to a small zone around the metal, and any release to the overlying water column would be diluted. In a similar fashion, as materials become covered by marine life, the direct exposure of the material to seawater decreases and the rate of corrosion decreases. Dispersal of these materials in the water column is controlled by physical mixing and diffusion, both of which tend to vary with time and location. Consequently, impacts to nearshore marine water quality would be minimal. Furthermore, a recent study conducted by the U.S. Marine Corps sampled sediments and water quality for 26 different constituents related to munitions at several U.S. Marine Corps training ranges. Metals included lead and magnesium. These areas were also used for bombing practice. No munitions constituents were detected above screening values used at these ranges (DoN 2010c).

Potential indirect impacts would be minimized (reduced) through the implementation of a stormwater management system, which would include the use of integrated management practices (Low Impact Development/best management practices), for the proposed development. The post-development stormwater management system for Pagan Alternative 1 would be developed and Low Impact Development features would be utilized to control stormwater runoff from the Pagan RTA. Best management practices could include filter strips, bio-retention, vegetated swales and other forms of permanent erosion/sedimentation control and management practices. Proper range management and implementation of a Range Environmental Vulnerability Assessment program would reduce potential impacts to water quality. Reevaluations would occur at a minimum every 5 years. Based upon the above analysis and the implementation of resource management measures in Section 4.3.2 Pagan Alternative 1 operations would result in less than significant impacts to nearshore water resources.

4.3.4.2 Pagan Alternative 2

Pagan Alternative 2 construction and training activities would have similar impacts to water resources as those identified under Pagan Alternative 1 (Figure 4.3-6). The main differences that would affect water resources are the northern High Hazard Impact Area would be smaller and the isthmus High Hazard Impact Area would not be constructed.

4.3.4.2.1 Construction Impacts

Under Pagan Alternative 2, development and construction would occur in largely the same areas as under Pagan Alternative 1. However, there would be differences in the number of firing positions associated with the Mortar Range (total of five; one less than Pagan Alternative 1), the number of landing zones (total of 13; 2 more than Pagan Alternative 1), and there would no target areas on the isthmus because the isthmus High Hazard Impact Area would not be constructed. The South Range Complex would consist of maneuver area and would not involve construction improvements. Impacts to water resources under Pagan Alternative 2 construction would be similar to those identified under Pagan Alternative 1. Therefore, Pagan Alternative 2 construction activities would result in less than significant impacts to water resources.

4.3.4.2.2 Operation Impacts

Impacts to water resources resulting from Pagan Alternative 2 training activities would be similar to those identified under Pagan Alternative 1 but would not include the potential impacts to nearshore water quality associated with the isthmus High Hazard Impact Area. Therefore, Pagan Alternative 2 operations would result in less than significant impacts to surface water, groundwater, and nearshore water resources.

4.3.4.3 Pagan No-Action Alternative

Limited activities would occur on Pagan under the no-action alternative. There would be no live-fire military training. As described in the Chapter 2, the no-action alternative would assume the continued infrequent and low impact events of periodic eco-tourism and scientific survey visits. Military activities would consist of periodic and low impact search and rescue training. The no-action alternative would continue to have less than significant impacts.

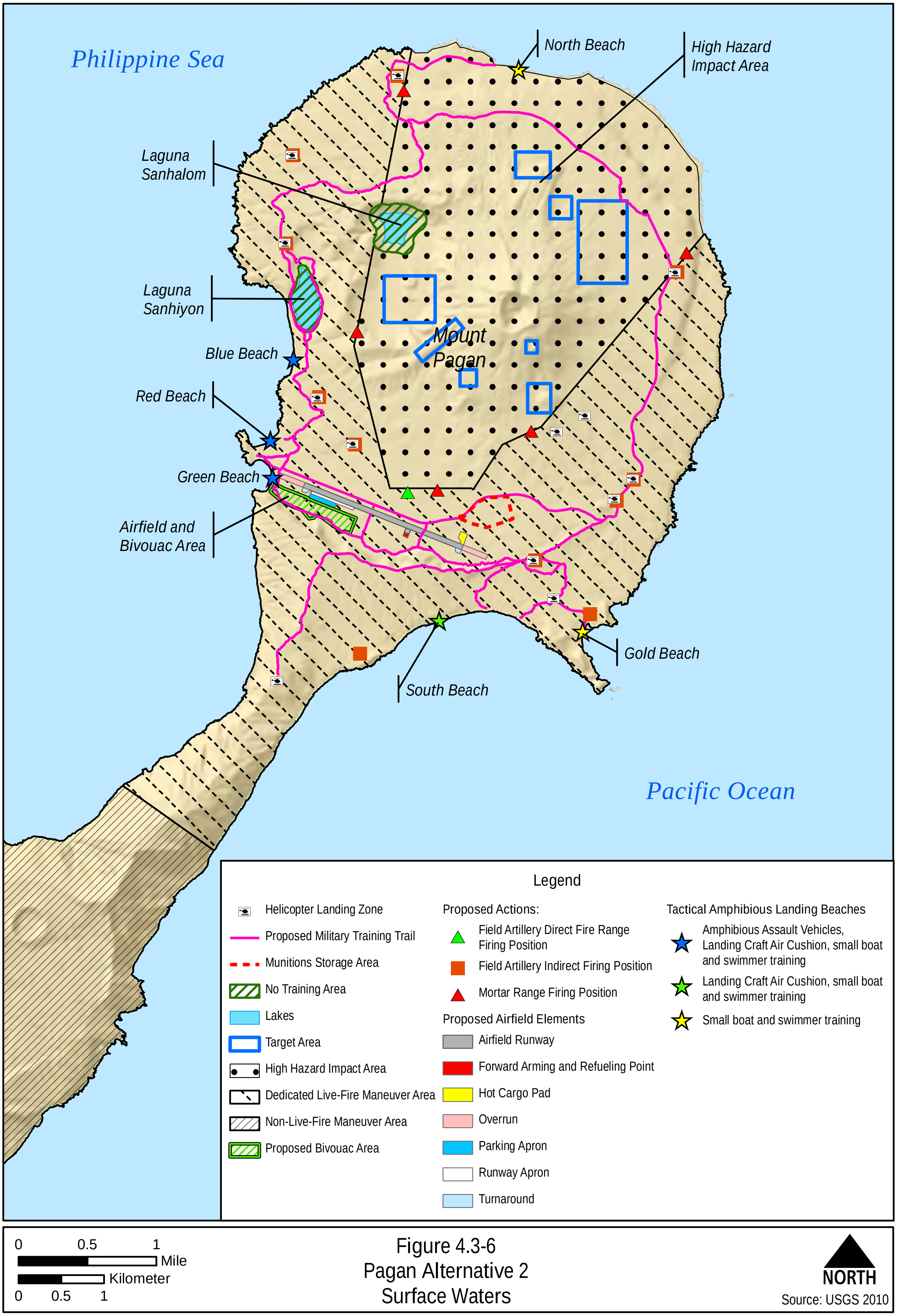

Figure 4.3-6
Pagan Alternative 2
Surface Waters

4.3.4.4 Summary of Impacts for Pagan Alternatives

Table 4.3-2 provides a comparison of the potential impacts to water resources for the two Pagan alternatives and the no-action alternative.

Table 4.3-2. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Water Resources	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Surface Water Resources	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Groundwater Resources	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Nearshore Water Resources	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*

Legend: *LSI* = less than significant impact.

4.4 AIR QUALITY

Section 4.4 addresses the potential impacts to air quality as a result of the proposed action. Air quality can be affected by air pollutants produced by mobile sources, such as vehicular traffic, aircraft, or non-road equipment used for construction activities, and by fixed or immobile facilities, referred to as "stationary sources." Stationary sources can include combustion and industrial stacks and exhaust vents. The impact analysis includes an incremental emissions analysis of criteria air pollutants associated with the following construction and operation activities:

- Construction equipment and vehicle emissions during RTA and supporting facilities construction
- Land training, inclusive of associated weapon firing and vehicle usage
- Amphibious training
- Air support and training
- Operations for transporting military training personnel
- Supporting equipment emissions within the base camp and training ranges
- Barge and equipment operations for solid waste transfer

Greenhouse gas emissions associated with the above activities occur locally; however, their impacts are both global in scale and cumulative over time. Therefore, greenhouse gas emissions have been calculated and are presented in this section, but their impacts are assessed in Chapter 5, *Cumulative Impacts*.

4.4.1 Approach to Analysis

The air quality impact analysis estimates emissions that would occur from proposed construction and operational activities. These emissions are compared against the thresholds established in the Clean Air Act's Prevention of Significant Deterioration program, to evaluate the extent of potential air quality impacts.

Air quality impacts associated with the proposed construction activities result from both construction equipment and vehicle exhaust, as well as from fugitive dust generated by earth moving activities. Emission sources associated with operational activities include: aircraft during landing, take-off, and cruising below 3,000 feet (914 meters) above ground level; marine vessels; vehicles; support equipment; use of ordnance; and mobile sources associated with interim solid waste transfer operations. The proposed training facilities would also generate fugitive dust emissions if training operations occur within areas of exposed soil.

Both Tinian and Pagan are considered unclassified and in attainment for all criteria pollutants. Because no regulatory de minimis emission thresholds have been established for an attainment area and the proposed alternatives would occur in areas that are considered to be in attainment, the "major stationary source" definition (250 tons [227 metric tons] per year or more of air pollutants that are subject to regulations under the Clean Air Act) from the Prevention of Significant Deterioration program applicable in an attainment area was selected as a comparable significant impact threshold for this EIS/OEIS. This threshold only applies to criteria pollutants and is not applicable to greenhouse gas emissions in terms of carbon dioxide. There is no specific impact threshold for carbon dioxide. The potential impacts of greenhouse gas emissions, including carbon dioxide, are discussed in Chapter 5, *Cumulative Impacts*.

More detailed information on methodology for determining air quality impacts related to the proposed action, including annual emission calculations, is presented in Appendix G, *Air Quality Technical Memo*.

4.4.1.1 Construction

Air quality impacts were evaluated based on the construction and ground disturbance activities described in Chapter 2, *Proposed Action and Alternatives*. Criteria pollutants and carbon dioxide emissions were calculated based on the equipment type, the duration of equipment use, and anticipated manpower, detailed in Appendix G, *Air Quality Technical Memo*.

Construction equipment and manpower requirements were based on the data contained in 2003 *RSMeans Facilities Construction Cost Data* (RSMeans 2002) and 2011 *RSMeans Facilities Construction Cost Data* (RSMeans 2010). It was assumed for emission estimating purposes that construction activities would start in 2017 and continue through 2027.

Construction equipment emissions were calculated based on estimated hours of equipment use and the emission factor assigned to the equipment, as provided by the U.S. Environmental Protection Agency in the NONROAD emission factor model (U.S. Environmental Protection Agency 2008). National default model inputs for off-road construction equipment and vehicles, average equipment horsepower values, and equipment power load factors were also obtained from the U.S. Environmental Protection Agency model (U.S. Environmental Protection Agency 2008).

Because the operational activity data presented in RSMeans' cost data books are generated based on the overall length of time equipment is onsite, an equipment actual running time factor (i.e., actual usage factor) was employed to estimate equipment emissions. The usage factor for each equipment type was obtained from Federal Highway Administration's *Roadway Construction Noise Model User's Guide* (Federal Highway Administration 2006). Emission factors related to construction delivery trucks were estimated using the latest version of the Motor Vehicle Emission Simulator, MOVES2010b (U.S. Environmental Protection Agency 2012). The MOVES2010b emission factor model provides a specific emission factor database for truck and commuter vehicle classifications. Because the MOVES2010b model does not contain data for the CNMI, the database for the U.S. Virgin Islands was used, based on a recommendation from the U.S. Environmental Protection Agency (Dave Brzezinski, U.S. Environmental Protection Agency, personal communication, May 30, 2013). To estimate air emissions generated during construction of the proposed Tinian and Pagan RTAs, the following prototypical elements were used to extrapolate emissions for the overall construction effort:

- General range clearing and grading
- Range automation installation
- Range equipment shed
- Base camp
- Airfield improvements
- Roadway construction
- Port improvements

4.4.1.2 Operation

Proposed operational training activities with the potential to impact air quality include:

- Aircraft flight operations during take-off and landing, cruising training, and transporting troops, weapons, and other training equipment
- Marine vessel operations
- Ground vehicle operations at ranges
- Support equipment operations
- Munitions operations
- Interim solid waste transfer/process operations

4.4.1.2.1 Aircraft Emissions

The number of annual training flight missions and flight hours within 3,000 feet (914 meters) above ground level defined for each alternative were based on information described in Chapter 2, *Proposed Action and Alternatives*. This altitude is defined by the U.S. Environmental Protection Agency to account for aircraft emissions within a mixing zone (see Appendix G, *Air Quality Technical Memo* for more details). The training data includes the number of landings and take-offs at Tinian International Airport and at various designated landing practice zones, and overall in-flight hours operating below 3,000 feet (914 meters) above ground level within Tinian and Pagan airspace. The emissions from aircraft flight operations were estimated using the methods and emission factors obtained from the following references:

- *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (U.S. Environmental Protection Agency 1992).
- DoN aircraft engine emission factors developed by the DoN's Aircraft Environmental Support Office (Aircraft Environmental Support Office 2000-2013).
- *Air Emissions Guide for Air Force Mobile Sources* (Air Force Civil Engineer Center 2013) and U.S. Federal Aviation Administration Emissions and Dispersion Modeling System (Version 5.01) for non-DoN aircraft emissions factors (Federal Aviation Administration 2014).

4.4.1.2.2 Marine Vessel Emissions

The training vessel operational data such as the engine power level for each vessel type, the operational hours per vessel per event, and the number of events per year were predicted based on the training tempo described in Chapter 2, *Proposed Action and Alternatives*. Vessel emissions were calculated using the methodologies, emission factors, and load factors related to diesel marine vessels obtained from *Current Methodologies in Preparing Mobile Source Port-related Emission Inventories* (U.S. Environmental Protection Agency 2009). Emission factors were multiplied by predicted annual running hours for each identified vessel to determine overall estimated emissions on an annual basis.

4.4.1.2.3 Ground Vehicles Emissions

Ground training vehicle exhaust emissions from trucks, high mobility multi-purpose wheeled vehicles, and buses used during training exercises were estimated with the same method used to predict construction vehicle emissions. The U.S. Environmental Protection Agency MOVES2010b emission factor model was used to predict emissions factors associated with each type of training vehicle (U.S. Environmental Protection Agency 2012). The model-established emission factors are based on the average weight and fuel type of each type of training vehicle. The emission factors were then multiplied by the annual vehicle running hours to determine overall emissions on an annual basis. In addition, because most of these training vehicles would maneuver on unpaved roads with the potential to generate fugitive dust, the U.S. Environmental Protection Agency's AP-42, *Compilation of Air Pollution Emission Factors*, was also used to predict particulate matter components in fugitive dust emissions from training vehicles (U.S. Environmental Protection Agency 1995).

4.4.1.2.4 Supporting Equipment and Generator Emissions

It is anticipated that during the training exercises, mobile and portable equipment; such as water and fuel trucks; forklift; and mobile and stationary diesel generators would also be required. The supporting equipment emission factors are based on both the U.S. Environmental Protection Agency's AP-42 (U.S. Environmental Protection Agency 1995) and the NONROAD model database (U.S. Environmental Protection Agency 2008). Relevant emission factors were multiplied by the annual equipment running hours to determine overall emissions on an annual basis.

4.4.1.2.5 Weapon Firing Emissions

Air emissions potentially occur during each weapon firing. Emission releases may occur during the launching of a projectile, from the propellant charge at firing position, and from the detonation explosion of the projectile in the target vicinity. The U.S. Environmental Protection Agency has published emission factors mostly in draft forms for various munitions in the AP-42 guidance. These emission factors for weapons firing and explosive detonation were used to predict overall munitions emissions.

4.4.1.2.6 Solid Waste Transfer Equipment Emissions

It is anticipated that solid waste generated as part of training exercises would be processed and transferred from Tinian to a regulatory compliant facility off-island. Mobile equipment (e.g., barges, loaders) would therefore be required to process and transport the waste between islands. The equipment emission factors are based on the same references described previously for barge emissions and non-road equipment.

4.4.2 Resource Management Measures

Resource management measures that are applicable to air quality include the following best management practices and standard operating procedures:

- Maintenance and operation of construction equipment in compliance with the Environmental Protection Agency's Tier 2 engine emission standards
- Minimization of land disturbance during construction and operational periods

- Stabilization of construction site entrances
- Covering trucks when hauling soil, stone, and debris
- Utilization of water trucks to minimize dust during construction activities
- Minimization of truck idling time
- Utilization of construction equipment with emission control devices (e.g., diesel particulate filters)

A complete listing of best management practices is provided in Appendix D, *Best Management Practices*.

4.4.3 Tinian

4.4.3.1 Tinian Alternative 1

4.4.3.1.1 Construction Impacts

Operation of construction equipment and associated vehicles may result in short-term impacts to air quality. The total construction-related air emissions were averaged evenly over a potential 9-year build period on Tinian to obtain an annual emission average (Table 4.4-1). The average annual emissions are well below the 250 tons (227 metric tons) per year threshold. Therefore, Tinian Alternative 1 construction activities would result in less than significant direct or indirect impacts to air quality.

Table 4.4-1. Annual Average Construction Emissions – Tinian Alternative 1

Construction Year	*Pollutant (tons per year)*						
	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_x	VOC	CO_2
1 – 9	0.19	9.25	0.69	0.65	8.09	1.71	1,207.57

Legend: CO = carbon monoxide; CO_2 = carbon dioxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with a particle diameter of less than or equal to 10 microns; $PM_{2.5}$ = particulate matter with a particle diameter of less than or equal to 2.5 microns; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Note: 250 ton per year threshold does not apply to CO_2.

4.4.3.1.2 Operation Impacts

Tinian Alternative 1 would not affect the permitted operational capacity of existing utility systems as discussed in Section 4.14, *Utilities*. Therefore, no adverse air quality impacts from stationary sources (i.e., new or modified fixed or immobile facilities) would occur. Annual military training activities in Tinian would increase under Tinian Alternative 1. Therefore, annual emissions for criteria pollutants would increase relative to the existing conditions. Calculated emissions are summarized in Table 4.4-2.

Table 4.4-2. Operational Training Annual Emissions – Tinian Alternatives 1, 2, and 3

Pollutant (tons per year)						
SO_2	***CO***	***PM_{10}***	***$PM_{2.5}$***	***NO_x***	***VOC***	***CO_2***
Aircraft Sorties around Tinian International Airport						
8.12	256.27	42.69	42.69	89.02	75.18	25,048.85
Aircraft Training Exercises						
2.74	3.25	11.29	11.29	28.70	0.37	3,740.83
Marine Vessels						
31.61	8.85	3.75	3.43	106.28	4.02	5,144.48
Ground Vehicles						
13.38	42.31	109.13	19.38	141.71	9.11	1,192.42
Support Equipment						
0.17	3.43	16.48	2.12	7.50	0.64	794.05
Generators						
0.35	4.71	0.34	0.29	20.57	0.60	994.00
Solid Waste Transfer						
0.10	0.31	0.06	0.06	0.95	0.07	84.56
Munitions						
0.03	56.01	38.68	13.80	1.72	0.01	82.21
Total						
56.45	375.14	222.42	93.06	396.45	90.00	37,081.40

Legend: CO = carbon monoxide; CO_2 = carbon dioxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with a particle diameter of less than or equal to 10 microns; $PM_{2.5}$ = particulate matter with a particle diameter of less than or equal to 2.5 microns; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Note: 250 ton per year threshold does not apply to CO_2.

The operational training-related emissions for Tinian Alternative 1 (Table 4.4-2) are below the comparative impact threshold of 250 tons (227 metric tons) per year for all criteria pollutants, except carbon monoxide and nitrogen oxide. The training-related carbon monoxide and nitrogen oxide emissions would occur across a large geographic area that consists of both the airspace around the airport and training facilities where aircraft would operate, the proposed RTA where training vehicles and aircraft would operate, and coastal areas where aircraft and vessels would operate.

Approximately 71% of total carbon monoxide and 56% of nitrogen oxide emissions would be generated by aircraft and seafaring vessels and would not result in impacts to air quality at ground level on land where human exposure would occur. Consequently, the total ground level carbon monoxide and nitrogen oxide emissions would be well below the 250 tons (227 metric tons) per year comparative impact threshold. Furthermore, the dominant trade winds in the region blowing from the east and northeast would quickly disperse emissions towards the ocean. Therefore, Tinian Alternative 1 operations would result in less than significant direct or indirect impacts to air quality.

4.4.3.2 Tinian Alternative 2

4.4.3.2.1 Construction Impacts

Tinian Alternative 2 would result in slightly higher construction impacts to air quality than estimated from Tinian Alternative 1. The predicted average annual construction emissions under Tinian Alternative 2 as shown in Table 4.4-3 are well below the significance threshold of 250 tons (227 metric tons) per year for criteria pollutants. Therefore, Tinian Alternative 2 construction activities would result in less than significant direct or indirect impacts to air quality.

Table 4.4-3. Annual Average Construction Emissions – Tinian Alternative 2

Construction Year	Pollutant (tons per year)						
	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_x	VOC	CO_2
1 – 9	0.19	9.49	0.70	0.66	8.20	1.75	1,223.55

Legend: CO = carbon monoxide; CO_2 = carbon dioxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with a particle diameter of less than or equal to 10 microns; $PM_{2.5}$ = particulate matter with a particle diameter of less than or equal to 2.5 microns; SO_2 = sulfur dioxide; VOC = volatile organic compound.
Note: 250 ton per year threshold does not apply to CO_2.

4.4.3.2.2 Operation Impacts

Operational training impacts to air quality resulting from Tinian Alternative 2 would be the same as those from Tinian Alternative 1 (see Table 4.4-2) because operations would be the same under both alternatives in terms of activities although the location of some of the activities would differ. See Section 4.4.3.1, *Tinian Alternative* 1, for a discussion of impacts. Therefore, Tinian Alternative 2 operations would result in less than significant direct or indirect impacts to air quality.

4.4.3.3 Tinian Alternative 3

4.4.3.3.1 Construction Impacts

Annual construction emissions resulting from Tinian Alternative 3 would be similar to, but slightly higher than, emissions resulting from Tinian Alternative 1 construction activities. The average annual construction emissions from Tinian Alternative 3, as shown in Table 4.4-4, are below the significance threshold of 250 tons (227 metric tons) per year for criteria pollutants. Therefore, construction activities associated with Tinian Alternative 3 would result in less than significant impacts to air quality.

Table 4.4-4. Annual Average Construction Emissions – Tinian Alternative 3

Construction Year	Pollutant (tons per year)						
	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_x	VOC	CO_2
1 – 9	0.19	9.30	0.69	0.65	8.12	1.72	1,210.85

Legend: CO = carbon monoxide; CO_2 = carbon dioxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with a particle diameter of less than or equal to 10 microns; $PM_{2.5}$ = particulate matter with a particle diameter of less than or equal to 2.5 microns; SO_2 = sulfur dioxide; VOC = volatile organic compound.
Note: 250 ton per year threshold does not apply to CO_2.

4.4.3.3.2 Operation Impacts

Tinian Alternative 3 would result in the same impacts to air quality as those resulting from Tinian Alternative 1 operations (see Table 4.4-2) because operations would be the same under both alternatives in terms of activities although the location of some of the activities would differ. See Section 4.4.3.1, *Tinian Alternative 1*, for a discussion of impacts. Therefore, Tinian Alternative 3 operations would also result in less than significant direct or indirect impacts to air quality.

4.4.3.4 Tinian No-Action Alternative

Under the no-action alternative for Tinian, periodic non-live-fire military training exercises would continue. Air emissions would include minor and short-term amounts of criteria pollutants related to fossil fuel combustion exhausts from ground vehicle and aircraft operations. Particulate matter in the form of dust would be emitted as vehicles and troops used unpaved road and staging areas. There would also be annual air emissions associated with the construction and subsequent operations of the four live-fire training ranges envisioned in the Guam and CNMI Military Relocation EIS (DoN 2010a). These emissions from the four ranges would be less than significant (see Table 5.2-2; DoN 2010a). Emissions under Mariana Islands Range Complex training would produce minor localized emissions and would not affect current attainment status of all criteria pollutants (see Table 3.4-8; DoN 2010b). When the combined emissions from the no-action alternative activities are considered, they would be well below the significance threshold of 250 tons (227 metric tons) per year; therefore, the no-action alternative would result in less than significant impacts to air quality on Tinian.

4.4.3.5 Summary of Impacts for Tinian Alternatives

Table 4.4-5 provides a comparison of the potential impacts to air quality resources for the three Tinian alternatives and the no-action alternative.

Table 4.4-5. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Air Quality	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Air Quality	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*

Legend: *LSI* = less than significant impact.

4.4.4 Pagan

4.4.4.1 Pagan Alternative 1

4.4.4.1.1 Construction Impacts

The annual emissions were conservatively estimated based on a 4-year construction period and are summarized in Table 4.4-6. As discussed in Chapter 2, *Proposed Action and Alternatives,* construction would occur over an 8 to 10 year period. The type and intensity of construction activities would vary across the 8 to 10 year construction period. Averaging emissions across a 4-year construction period provides a conservative estimate of annual emissions. Total emissions are below the 250 tons (227 metric tons) per year threshold. Therefore, Pagan Alternative 1 construction activities would result in less than significant direct or indirect impacts to air quality.

Table 4.4-6. Annual Construction Emissions – Pagan Alternative 1

Construction Year	Pollutant (tons per year)						
	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_x	VOC	CO_2
1 – 4	0.07	5.76	0.33	0.31	3.00	1.14	369.53

Legend: CO = carbon monoxide; CO2 = carbon dioxide; NOx = nitrogen oxides; PM_{10} = particulate matter with a particle diameter of less than or equal to 10 microns; $PM_{2.5}$ = particulate matter with a particle diameter of less than or equal to 2.5 microns; SO2 = sulfur dioxide; VOC = volatile organic compound.

Note: 250 ton per year threshold does not apply to CO_2.

4.4.4.1.2 Operation Impacts

The annual emissions for the operational elements and training exercises are summarized in Table 4.4-7 and are well below the comparative impact threshold of 250 tons (227 metric tons) per year for all criteria pollutants, except for nitrogen oxide. Approximately 75% of nitrogen oxide emissions would be generated by ground training vehicles. The training would also involve explosions detonated on lava rocks that likely contain hazardous fibrous materials and would release particulates in the air. However given the lack of studies of the impact from rock detonations, the particulate emissions generated cannot be feasibly quantified. However, because no sensitive land uses are located close to the proposed RTA and the dominant trade winds in the region would quickly disperse all emissions (including nitrogen oxide or particulates from rock detonations) towards the ocean, Pagan Alternative 1 operations would result in less than significant direct or indirect impacts to air quality.

Table 4.4-7. Operational Training Activity Annual Emissions – Pagan Alternative 1

Pollutant (tons per year)						
SO_2	***CO***	***PM_{10}***	***$PM_{2.5}$***	***NO_x***	***VOC***	***CO_2***
Aircraft Sorties around Tinian International Airport						
2.98	74.22	17.16	17.16	42.66	29.71	7,607.25
Aircraft Training Exercises						
2.29	2.31	8.00	8.00	42.64	0.28	4,810.82
Marine Vessels						
2.18	0.84	0.27	0.25	10.22	0.36	353.86
Ground Vehicles						
32.80	94.12	155.51	35.46	335.45	20.41	1,421.42
Support Equipment						
0.02	0.49	1.24	0.20	0.92	0.09	102.75
Generators						
0.30	4.04	0.29	0.25	17.61	0.52	851.20
Munitions						
0.04	6.63	24.92	23.05	0.19	0.06	315.34
Total						
40.61	182.65	207.39	84.37	449.69	51.43	15,462.64

Legend: CO = carbon monoxide; CO_2 = carbon dioxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with a particle diameter of less than or equal to 10 microns; $PM_{2.5}$ = particulate matter with a particle diameter of less than or equal to 2.5 microns; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Note: 250 ton per year threshold does not apply to CO_2.

4.4.4.1.2.1 Volcanic Impacts to Operation

Existing volcanic gases would continue to be released from volcanic eruptions as part of natural geological processes. Sulfur dioxide, a criteria pollutant, is one of the most common gases released in volcanic eruptions and is hazardous to humans. Periodic sulfur dioxide releases due to volcanic eruptions could potentially have an adverse impact to air quality. However, volcanic eruptions are natural geological processes, and the proposed action would not have an impact on the frequency of such eruptions. Therefore, Pagan Alternative 1 operations would have no impacts to air quality in regard to volcanic eruptions.

4.4.4.2 Pagan Alternative 2

4.4.4.2.1 Construction Impacts

Pagan Alternative 2 construction emissions would be similar but slightly less than emissions predicted to result from Pagan Alternative 1. The modeled annual construction emissions summarized in Table 4.4-8 are below the significance threshold of 250 tons (227 metric tons) per year for criteria pollutants. Therefore, Pagan Alternative 2 construction activities would result in less than significant impacts to air quality.

Table 4.4-8. Annual Construction Emissions – Pagan Alternative 2

Construction Year	*Pollutant (tons per year)*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
1 – 4	0.05	4.21	0.24	0.23	2.22	0.84	273.91

Legend: CO = carbon monoxide; CO_2 = carbon dioxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with a particle diameter of less than or equal to 10 microns; $PM_{2.5}$ = particulate matter with a particle diameter of less than or equal to 2.5 microns; SO_2 = sulfur dioxide; VOC = volatile organic compound.
Note: 250 ton per year threshold does not apply to CO_2.

4.4.4.2.2 Operation Impacts

Operation impacts to air quality resulting from Pagan Alternative 2 would be nearly the same as those predicted to result from Pagan Alternative 1, as the same operational activities would take place under both alternatives. See Section 4.4.4.1, *Pagan Alternative 1*, for a discussion of impacts. Therefore, Pagan Alternative 2 operations would also result in less than significant impacts to air quality.

4.4.4.2.2.1 Volcanic Impacts to Operation

Impacts to Pagan Alternative 2 operations resulting from volcanic activity would be the same as Alternative 1. See Section 4.4.4.1, *Pagan Alternative 1*, for a discussion of impacts. Therefore, Pagan Alternative 2 operations would have no impacts to air quality in regard to volcanic eruptions.

4.4.4.3 Pagan No-Action Alternative

Under the no-action alternative, air emissions associated with the proposed operations would not occur and air quality conditions would remain the same as existing conditions described in Chapter 3, *Affected Environment*. The continuation of a minor amount of visits to Pagan would not result in any impacts to air quality under the no-action alternative.

4.4.4.4 Summary of Impacts for Pagan Alternatives

Table 4.4-9 provides a comparison of the potential impacts to air quality resources for the two Pagan alternatives and the no-action alternative.

Table 4.4-9. Summary of Impacts for Pagan Alternatives

Resource Area	*Pagan (Alternative 1)*		*Pagan (Alternative 2)*		*No-Action Alternative*	
Air Quality	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Air Quality	*LSI*	*LSI; NI (regarding volcanic activity)*	*LSI*	*LSI; NI (regarding volcanic activity)*	*NI*	*NI*

Legend: *LSI* = less than significant impact; *NI* = no impact.

4.5 NOISE

Section 4.5 addresses the potential noise impacts to the environment from the proposed action. Potential noise impacts can be generated from construction activities and during training operations. This section focuses on the human aspect of noise generated by the proposed action. Other aspects of noise impacts are covered in Section 4.7, *Land and Submerged Land Use*; Section 4.8, *Recreation;* Section 4.9, *Terrestrial Biology*; Section 4.10, *Marine Biology*; Section 4.11, *Cultural Resources*; and Section 4.15, *Socioeconomics*.

4.5.1 Approach to Analysis

The following is a summary of the methodology used to analyze the potential noise impacts associated with the proposed action. Specific and more detailed information on methodology is presented in Appendix H, *Noise Study*. This noise analysis addresses changes in the noise environment resulting from the proposed action and uses modeling software to determine the breadth of impacts from audible noise (i.e., sound perceived by human hearing) generated by construction activities and training operations.

Direct impacts are those associated with elevated noise levels that can cause annoyance and/or hearing loss. Indirect noise impacts are those which occur after the noise event such as non-auditory health effects. Studies have been conducted to examine the effects of military noise exposure, focusing primarily on stress response, blood pressure, birth weight, mortality rates, and cardiovascular health. However, results of most of these cited studies are inconclusive, and it cannot be stated that a causal link exists between military noise exposure and the various type of non-auditory health effects that were studied at noise levels below 75 decibels A-weighted day-night average sound levels (Department of Defense Noise Working Group 2013).

Representative points of interest, population numbers, and acres exposed to proposed action noise levels were identified and the results compared to baseline conditions. To determine the population counts, this analysis used aerial photography to count actual houses and the U.S. Census population multiplier for Tinian (Marpo Heights) of 3.77 people per household.

Noise generated by construction and operations at the airfields, in the airspace, and at the training facilities are calculated using different modeling software because different noise metrics apply to the different activities as described in Section 3.5.1. The following summarizes the noise modeling software used for calculating proposed noise levels, and identifies the criteria applied to determine impact significance.

4.5.1.1 Construction

The Federal Highway Administration's Road Construction Noise Model was used for vehicles and equipment to determine noise levels at user specified distances from the source. The U.S. Environmental Protection Agency recommends permissible construction noise levels for residents living adjacent to construction activities. These levels are based on noise averaged over 8- and 24-hour periods. Because daily construction durations are about 8 hours, the limit for 365 days per year exposure is 75 decibels. This 75-decibel exposure recommendation applies when ambient (i.e., background) noise levels outside of working hours are less than 60 decibels (as found on Tinian and Pagan); otherwise, the 24-hour standard of 70 decibels is used.

4.5.1.2 Operations

Noise zones (defined in Section 3.5.1) are used by the U.S. military as guidelines for planning on installations and as recommendations for local communities in their planning efforts. While not specifically regulatory standards, zones are used to identify land areas of compatibility and incompatibility (see Table 3.5-1) with noise generated from military activities (Army 2007). Refer to Table 3.5-2, which identifies, by noise zone, land use compatibilities for noise levels generated by military activities, and refer to Table 3.5-3 for the probabilities of risk complaints.

4.5.1.2.1 Ground-Based Operations

The following noise modeling software was used for calculating proposed noise levels for ground-based operations:

- Small Arms Range Noise Assessment Model (Version 2.6.2003-06-06) calculated live-fire small arms of .50 caliber or less.
- Blast Noise Impact Assessment modeling program (Version 1.3.2003-07-03) modeled live-fire large caliber explosives 20 millimeter or greater.
- Non-live-fire training noise was evaluated on a case-by-case basis using equipment noise data.

For munitions, the significance criterion of 62 decibels C-weighted day-night average sound level scale was applied. Although A- and C-weighted values cannot be combined, the C-weighted criterion correlates well to the A-weighted criterion for determining compatibility with land uses (DoN 2008a). To supplement the discussion of impacts for impulsive ordnance noise (a single noise event), Peak 15 (or Peak) was used to account for the increased risk of noise complaints from people exposed to Peak noise levels exceeding 115 decibels. The low frequency peak noise from large-caliber weapons can be influenced by weather to a much greater extent than other types of noise generating activities. Unfavorable weather is a condition when the wind is blowing from the noise source towards populated areas. Conversely, neutral weather conditions occur when there is little wind and/or the wind is blowing away from populated areas towards the noise source.

4.5.1.2.2 Airfield and Airspace Based Operations

The following noise modeling software was used for calculating proposed noise levels for aircraft operations:

- NOISEMAP calculated noise levels in the airfield environment at Tinian International Airport, North Field, and the Pagan airfield (Moulton 1990).
- MRNMAP modeled, aircraft-generated noise levels in Special Use Airspace (Lucas 1995).
- Rotorcraft Noise Model was used for rotary-wing Landing Zones, Drop Zones, and general hovering activities (Page et al. 2008).

For aircraft-generated noise at the airfields, landing zones, and airspace, a criterion of 65 decibels A-weighted day-night average sound level scale was used to determine significance (DoN 2008b). Impacts would be considered significant if sensitive receptors; people living in residential areas and occupying sensitive land uses such as schools and hospitals, were exposed to noise levels in Zones II and III (see Table 3.5-1). The analysis applied herein uses the 65-decibel threshold; however, the Federal Aviation Administration considers a 1.5-decibel increase in noise sensitive areas (e.g., schools, hospitals, and places of worship) over 65 decibels as a significance criterion.

4.5.1.2.3 Traffic

The following noise modeling software was used for calculating proposed noise levels for traffic operations:

- Traffic on Tinian roads was modeled using the Federal Highway Administration's Traffic Noise Model Version 2.5 (Federal Highway Administration 2004).
- On Pagan, noise generated by vehicles would be negligible and because of the lack of population and relatively few vehicles being proposed for use on Pagan traffic noise was not modeled.

As presented in Section 3.5.1, several noise metrics were used in the modeling and include:

- *A-weighted Scale.* Applied to noise sources such as aircraft, small-caliber weapons, and vehicles.
- *C-weighted Scale*. Measured the low-frequency components of noise and applied to impulsive noise and vibrations generated by explosive charges and large-caliber weapons.
- *Peak 15*. Measured impulsive sounds generated by munitions, explosions, and sonic booms. It represents a single event where the Peak noise level is likely to be exceeded 15% of the time. Peak was also used to gauge the potential risk for receiving complaints and hereafter referred to as Peak.

4.5.1.2.4 Supplemental Noise Metrics

Supplemental metrics identify potential noise effects from aircraft overflights. These impacts include potential hearing loss, speech interference, classroom interruptions, and sleep disturbance. This approach is taken because noise levels generated by aircraft operations are most likely to affect receptors. According to U.S. Environmental Protection Agency (1974), changes in the hearing level of less than 5 decibels would not be considered noticeable or significant (see Appendix H, *Noise Study* for further explanation). For classroom interruption analysis, a threshold for the indoor background, equivalent noise level of 40 decibels was applied. The equivalent noise level, averaged over the 9 hours of normal school hours (i.e., 8:00 a.m. to 5:00 p.m.) was used for determining classroom disruption. Refer to Appendix H, *Noise Study*, for detailed information on these supplemental noise metrics.

4.5.1.2.5 Occupational Noise

For occupational noise, the significance level derives from a National Institute for Occupational Safety and Health (Institute) criteria document published in the early 1970s. It recommended an exposure limit of 85 decibels as an 8-hour time-weighted average. This exposure limit was reevaluated in 1998, when the Institute made recommendations that went beyond conserving hearing, by focusing on the prevention of occupational hearing loss. Using a then new risk assessment technique, the Institute published another criteria document which reaffirmed the 85 decibel recommended exposure limit (National Institute for Occupational Safety and Health 1998).

4.5.1.2.6 Underwater Noise

For underwater noise, there is no set significance level for human receptors. See Section 4.10, *Marine Biology* for significance criteria for marine biological resources.

4.5.2 Resource Management Measures

These resource management measures apply to Tinian because there is a permanent population on Tinian. Pagan does not have a permanent population; therefore, resource management measures to reduce impacts of noise on human populations are not necessary except those for worker safety.

4.5.2.1 Construction

4.5.2.1.1 Avoidance and Minimization Measures

- Minimizing night time construction activities to the extent practical.
- A construction perimeter could be set up to prevent recreational divers from being in the vicinity during pile driving activities at Unai Chulu.
- Sequencing work to minimize the number of loud construction equipment when working near residences.

4.5.2.1.2 Best Management Practices and Standard Operating Procedures

- Assuring all noise muffling equipment is installed and working properly.
- Shutting off idling equipment when not in use.
- Adhering to all Occupational Safety and Health Act noise reduction and hearing protection requirements and regulations.

4.5.2.2 Operation

4.5.2.2.1 Avoidance and Minimization Measures

- Limiting night time expenditures of large-caliber weapons use to only 4% of the total planned expenditures.
- Shifting some large-caliber operations from the southernmost firing points to points farther away from Tinian receptors.
- On Tinian, limiting normal departure and arrival procedures to areas over the Military Lease Area to the north of the runway. On occasion, infrequent exceptions may occur and flights may be directed to south of the runway.
- Assuring that operations to the south would occur only in case of a missed approach or during the rare westerly winds when take-offs and landings are oriented to the west.

4.5.2.2.2 Best Management Practices and Standard Operating Procedures

- Adhering to all Occupational Safety and Health Act noise reduction and hearing protection requirements and regulations.

4.5.3 Tinian

Noise-generating activities associated with the proposed action include construction of support facilities and operation of the RTA. Specifically, operations include training within the Military Lease Area; aircraft activities at Tinian International Airport, North Field, landing zones, and in Special Use Airspace and local airspace; waterborne operations at the port, designated beaches in the Military Lease Area, and in adjacent waters; and heavy- and light-vehicle traffic between the port and airport and the Military Lease Area.

Construction, aircraft noise, waterborne noise, traffic, and occupational noise impacts are similar among the three alternatives. Noise generated by live-fire weapons varies by alternative because of the different locations of some training facilities (e.g., Battle Area Complexes). The following is a synopsis of the impact analysis; refer to Appendix H, *Noise Study*, for the specific data input used and the results generated by the noise modeling.

4.5.3.1 Tinian Alternative 1

4.5.3.1.1 Construction Impacts

4.5.3.1.1.1 On Land

Noise modeling from construction activities used the A-weighted scale, and determined the noise levels by identifying the type of equipment and how long it would run. Earth-moving equipment (e.g., graders, excavators, dozers) and impact devices (e.g., pile drivers and jackhammers) are examples of heavy (large) equipment that would be used for construction. Smaller construction equipment includes generators, concrete saws, and compressors. Equipment and other construction activities typically generate noise levels ranging from 70 to 90 decibels at a distance of 50 feet (15 meters), see Appendix H, *Noise Study* (see Table 2.4-1) for specific equipment noise levels (U.S. Department of Transportation 2006). Noise modeling of construction activities averaged noise levels over 1 hour, assumed consistent equipment numbers throughout the workday, and that the equipment operated in the same location.

RTA construction and improvement activities within the Military Lease Area are too distant to generate elevated noise levels outside of its boundaries. Therefore, construction noise levels would not be detectable in any residential areas on Tinian.

At Tinian International Airport, noise generated from military airport facilities and infrastructure construction and improvement activities may be perceptible to residents of San Jose. Assuming 20 pieces of construction equipment would be active in one general location and at the same time, noise levels of 82 decibels at 100 to 500 feet (30 to 152 meters) from the airport construction site would be generated. The nearest point of interest is Tinian Middle/High School, located about 6,400 feet (1,950 meters) from the proposed construction area. Noise levels at the school would be 49 decibels, far below the significance criterion of 65 decibels.

At the Port of Tinian, proposed improvement activities would occur closer to San Jose, thereby increasing the potential to expose the population to construction-related noise; however, port improvement activities could generate noise levels no greater than 65.6 decibels at the nearest residents in the port area, still within acceptable levels of noise. Construction noise impacts would be compatible with residential areas, and would not affect schools, places of worship, or hospitals (i.e., sensitive receptors). Therefore, construction noise levels on land would be less than significant.

4.5.3.1.1.2 Underwater

Noise would be caused by shore-based construction equipment dredging the nearshore substrate at Unai Chulu to construct an in-water landing ramp for Amphibious Assault Vehicles. The dredging would require the use of a crane dredge and an excavator. Sheet piles would be driven to create a causeway for access and steel piles would be driven to build a temporary trestle for the dredging equipment. No blasting would be required. The duration for the proposed construction could take approximately 8 months.

Comparative operations that measured dredging noise with a limestone bottom were used to estimate dredging noise levels. The highest typical in-water noise levels for excavation dredging of limestone material measured a root mean squared noise at 179 decibels referenced to 1 micro Pascal at 3 feet (1 meter) (Reine et al. 2014). Underwater noise is based upon sound pressure levels with a base reference pressure of 1 micro Pascal. This differs from airborne noise that references 20 micro Pascal, thus in-water noise is expressed as “decibels referenced to 1 micro Pascal.” Estimated noise levels for either a 24 inch (0.6 meter) steel pipe or 24 inch (0.6 meter) sheet pile using recent measurements from other projects for impact pile diving indicate Sound Exposure Levels of approximately 190 decibels referenced to 1 micro Pascal at 33 feet (10 meters) and approximately 177 decibels referenced 1 micro Pascal root mean squared (Illinworth and Rodkin 2007). Vibratory pile driving of steel sheet piles yielded noise level results 25-30 decibels quieter than impact pile driving.

Underwater noise would not affect human receptors and a perimeter would be established to prevent recreational divers from entering areas of high in-water noise levels. Therefore, noise impacts to human receptors due to in-water construction would be less than significant.

Refer to Section 4.10, *Marine Biology* for information on noise effects to marine biological resources.

4.5.3.1.2 Operation Impacts

Training operations generate two different noise types: higher frequency from small-caliber munitions and lower frequency from large-caliber ordnance, explosives, and artillery blasts. For small-caliber weapons use, as well as aircraft and vehicle operations, the A-weighted scale was applied. The C-weighted scale was used to model impulsive noise generated by explosions and large-caliber weapons. Peak was applied to single-event percussive events generated by small- and large-caliber weapons. As noted in Section 3.5 and in Appendix H, *Noise Study*, a 10-decibel penalty was applied to operations occurring during nighttime hours, between 10:00 p.m. and 7:00 a.m.

4.5.3.1.2.1 Ground-Based Operations

Small-caliber Weapons

The small-caliber weapons proposed for use include .50 caliber and smaller caliber. Training facilities supporting small-caliber weapons would generate 5,049,643 rounds fired annually (see Appendix H, *Noise Study;* Table 6.2-1). Figure 4.5-1 presents Tinian Alternatives 1, 2, and 3 A-weighted day-night average sound level contours and Figure 4.5-2 illustrates Peak sound levels generated by small arms (Army Public Health Command 2014).

Table 4.5-1 provides the area and population affected by small-caliber weapons noise in A-weighted day-night average sound levels and Table 4.5-2 provides Peak noise levels. All three alternatives generate similar average noise levels, and are presented together for easy comparison of acres and population affected. However, single-event noise levels at representative points of interest can still vary among the alternatives. Representative points of interest exposed to small-caliber weapons noise levels because of Tinian Alternative 1 operations are presented in Table 4.5-3. Schools were identified to evaluate potential effects to children and non-school points of interest were identified to evaluate noise effects to people and locations.

For Tinian Alternative 1, small-caliber (A-weighted) noise generated within the Military Lease Area would potentially to expose 5,553 acres (2,247 hectares) in Zones II and III, but no residential population would be affected. Also within the Military Lease Area, two points of interest would be exposed to Noise Zone II or III levels: Mount Lasso Overlook and the Bateha Isolated Wetlands. However, the public would not be exposed to these noise levels because public access would be prohibited when the RTA is operational. Noise levels outside the Military Lease Area would be less than 50 decibels A-weighted, compatible with land uses.

For Peak noise exposure from Tinian Alternative 1, six points of interest within the Military Lease Area would be exposed to Noise Zone III, but exposure would be considered compatible with exposed land uses because these points are military facilities, other non-human resources, or are recreational sites where access during RTA training operations would be restricted. Therefore, the public would not be exposed to Noise Zone III levels. Outside the Military Lease Area, noise generated by small-caliber weapons from Tinian Alternative 1 operations would affect neither people nor lands on Tinian or Saipan.

Outside of the Military Lease Area, land uses exposed to A-weighted day-night average sound levels would be considered compatible. Small-caliber Peak noise levels would also be considered compatible. Therefore, Tinian Alternative 1 operations would result in less than significant direct and indirect noise impacts from small-caliber weapons use.

Table 4.5-1. Area and Population on Tinian Affected by Small-caliber Weapons Noise for All Tinian Alternatives(A-weighted)

Zone	*Noise Levels (in decibels)*	*Acres/Hectares*		
		Alternative 1	*Alternative 2*	*Alternative 3*
Within the Military Lease Area				
II	65 – 69	2,532/1,025	2,696/1,091	2,914/1,179
	70 – 74	1,459/590	1,769/716	1,645/666
III	75 – 79	693/280	862/349	810/328
	80 – 84	444/180	570/231	533/216
	85+	425/172	530/214	548/222
Total		**5,553/2,247**	**6,427/2,601**	**6,444/2,610**
Area and Population Outside the Military Lease Area				
II	65 – 69	0/0 and 0 population all alternatives		
	70 – 74			
III	75 – 79	0/0 and 0 population all alternatives		
	80 – 84			
	85+			
Total		**0/0**	**0/0**	**0/0**
Off Shore				
Zones Not Applicable	65 – 69	15/6	15/6	15/6
	70 – 74	12/5	12/5	12/5
	75 – 79	5/2	5/2	5/2
	80 – 84	2/1	2/1	2/1
	85+	2/1	2/1	2/1
	Total	**36/15**	**36/15**	**36/15**

Table 4.5-2. Area and Population on Tinian Affected by Small-caliber Weapons Noise for All Tinian Alternatives (Peak)

Noise Levels (in decibels)	*Acres/Hectares*		
	Alternative 1	*Alternative 2*	*Alternative 3*
Within the Military Lease Area			
Zone II			
87-104	7,897/3,196	6,010/2,432	6,422/2,599
Zone III			
>104	6,898/2,792	9,032/3,655	8,623/3,490
Total Zones II and III	**14,795/5,988**	**15,042/6,087**	**15,045/6,089**
Area and Population Outside the Military Lease Area			
Zone II			
87-104	411/166 0 population	600/243 0 population	600/243 0 population
Zone III			
>104	0/0	0/0	0/0
Total Zones II and III	**411/166**	**600/243**	**600 /243**
Off Shore			
87-104	26,025/10,532	28,362/11,478	27,316/11,054
>104	607/246	492/199	672/272
Total	**26,632/10,788**	**28,854/11,677**	**27,988/11,326**

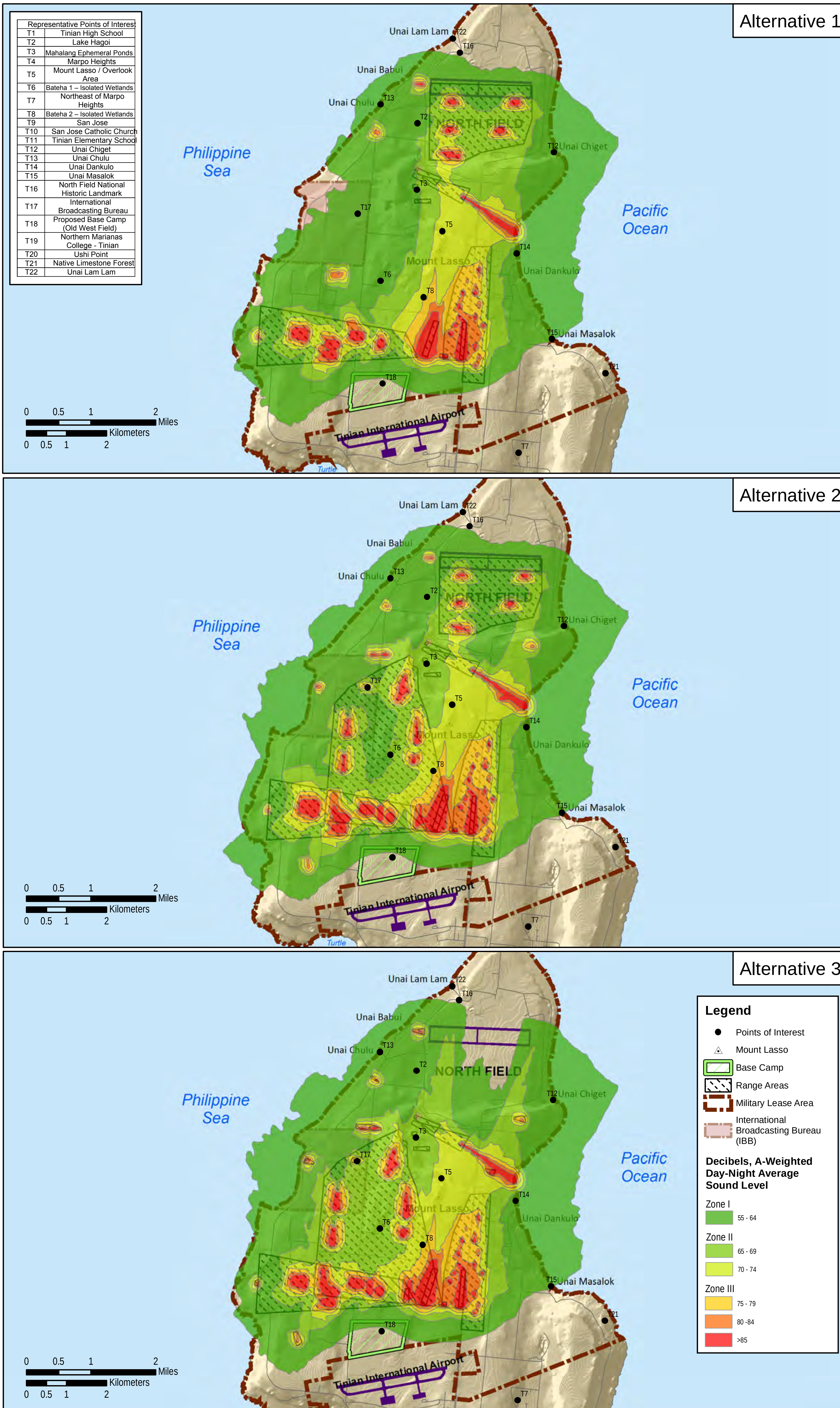

Figure 4.5-1. All Tinian Alternatives Small-Caliber Weapons Noise Levels (A-weighted)

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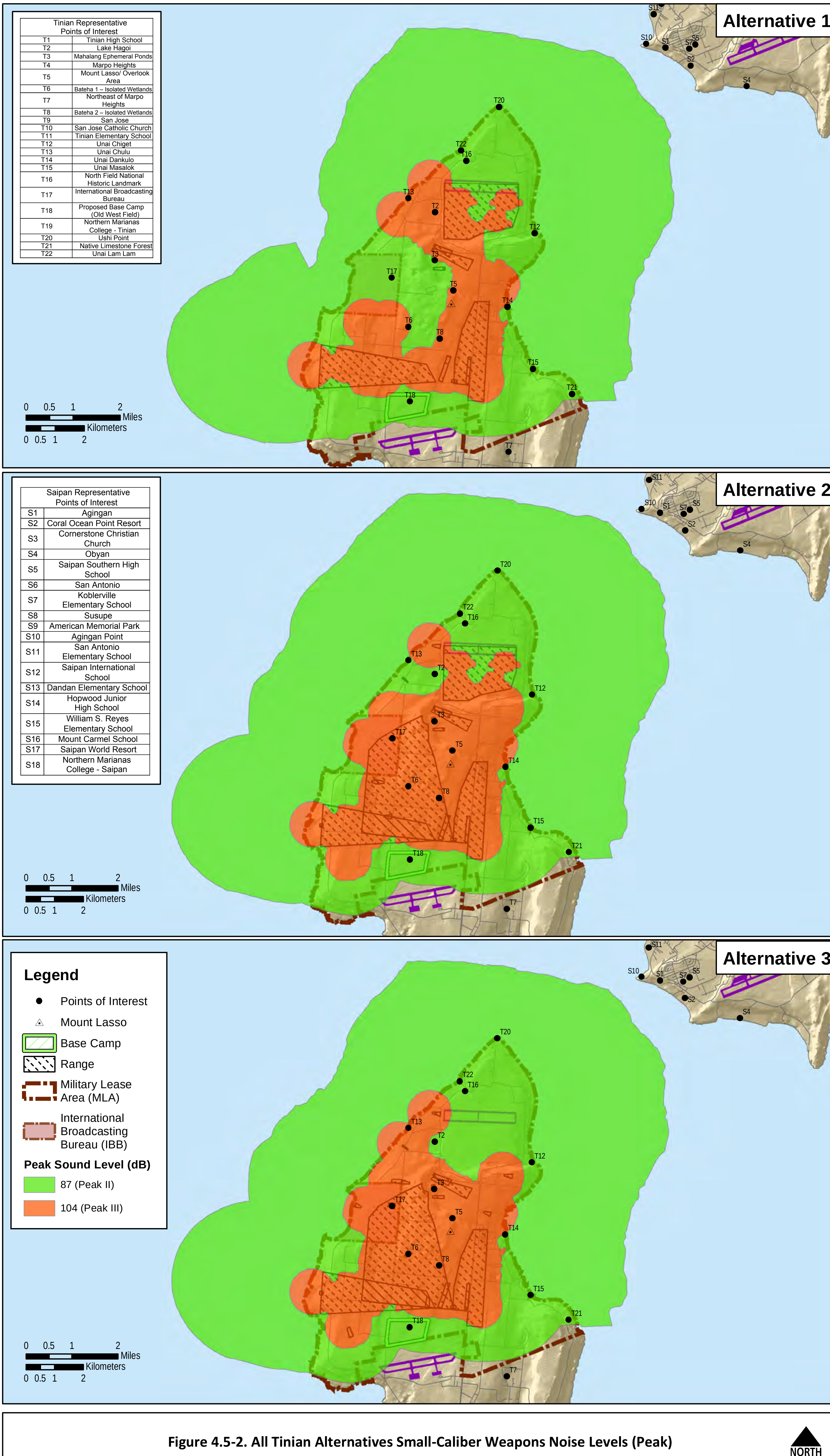

Figure 4.5-2. All Tinian Alternatives Small-Caliber Weapons Noise Levels (Peak)

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Table 4.5-3. Tinian Alternative 1 Representative Points of Interest on Tinian Affected by Small-caliber Weapons Noise (A-weighted and Peak)

Point of Interest (POI)			*A-Weighted Day-Night Average Sound Levels (ADNL)*			*Peak*		
Identification Number	*Description*	*Type*	*Decibel*	*Zone*	*POI Conflict*	*Decibel*	*Zone*	*POI Conflict*
T1	Tinian High School	School	< 50	I	No	< 80	I	No
T2	Lake Hagoi	Other	63	I	NA	108	III	NA
T3	Mahalang Ephemeral Ponds	Other	63	I	NA	102	II	NA
T4	Marpo Heights	Residential	< 50	I	No	< 80	I	No
T5	Mount Lasso Overlook Area	Other	71	II	NA	106	III	NA
T6	Bateha 1 - Isolated Wetlands	Other	63	I	NA	105	III	NA
T7	Northeast of Marpo Heights	Residential	< 50	I	No	83	I	No
T8	Bateha 2 - Isolated Wetlands	Other	75	III	NA	108	III	NA
T9	San Jose	Residential	< 50	I	No	< 80	I	No
T10	San Jose Catholic Church	Church	< 50	I	No	< 80	I	No
T11	Tinian Elementary School	School	< 50	I	No	< 80	I	No
T12	Unai Chiget	Other	60	I	NA	96	II	NA
T13	Unai Chulu	Other	61	I	NA	106	III	NA
T14	Unai Dankulo	Other	64	I	NA	104	III	NA
T15	Unai Masalok	Other	55	I	NA	96	II	NA
T16	North Field National Historic Landmark	Other	55	I	NA	98	II	NA
T17	International Broadcasting Bureau	Administrative	57	I	NA	95	II	No
T18	Proposed Base Camp (Old West Field)	Transient Lodging	54	I	NA	92	II	No
T19	Northern Marianas College	School	< 50	I	No	< 80	I	No
T20	Ushi Point	Other	< 50	I	NA	97	II	NA
T21	Native Limestone Forest	Other	< 50	I	NA	91	II	NA
T22	Unai Lam Lam	Other	54	I	NA	95	II	NA

Notes: Shading denotes POIs inside the Military Lease Area
[1]Other includes sites with cultural, biological, historical, or recreational concerns that are not related to human factors such as health or annoyance and will be addressed in the applicable resource section of this EIS/OEIS.
[2]Noise level threshold is 50 decibels A-weighted day-night average sound level (or decibel ADNL).
[3]U.S. military small-caliber decibel ADNL Noise Zones defined as: Zone III (75-79 decibel ADNL; 80-84 decibel ADNL; > 85 ADNL), Zone II (65-69 decibel ADNL; 70-74 decibel ADNL), and Zone I (< 55 decibel ADNL; 55-64 decibel ADNL).
Legend: NA = not applicable, see annotation number 1.
Source: Army Public Health Command 2014.

Large-caliber Weapons

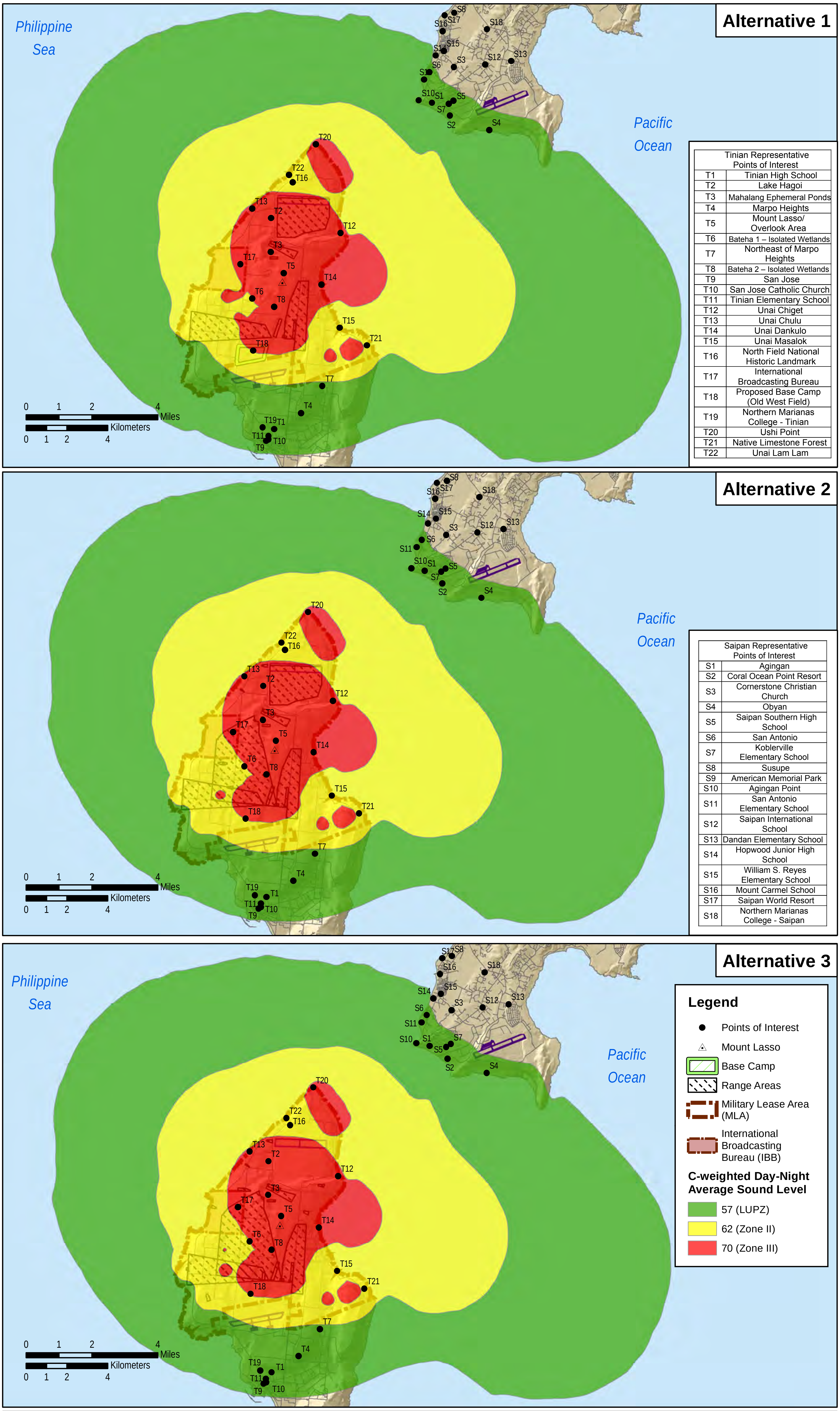
Large-caliber weapons proposed under Tinian Alternative 1 include: live hand grenades, mortars, howitzers, tanks, and amphibious assault vehicles. Under Tinian Alternative 1, 101,135 large-caliber rounds of ground-delivered munitions and an additional 50,000 large-caliber rounds of air-delivered munitions would be fired in an average year. Large-caliber weapons use during the nighttime hours of 10:00 p.m. to 7:00 a.m. constitutes only 4% of total munitions expended. Large-caliber artillery firing points would be located primarily at the north end of the Military Lease Area and near the proposed base camp (i.e., away from populated areas outside the Military Lease Area). As presented in Table 4.5-4 and illustrated in Figure 4.5-3, while three alternatives are proposed, C-weighted noise results would be identical for population affected, but vary slightly in the number of acres impacted. On Tinian, the acreage differences lie completely within the Military Lease Area or off shore. No areas on Saipan would be exposed to C-weighted day-night average sound levels in Noise Zones II or III.

Table 4.5-4. Area and Population on Tinian and Saipan Affected by Large-caliber Weapons Noise for All Tinian Alternatives (C-weighted)

Noise Levels (in decibels)	*Acres/Hectares*				*Population*[1]	
	Tinian Military Lease Area	*Tinian Non-Military Lease Area*	*Off Shore*	*Saipan*	*Tinian*	*Saipan*
Tinian Alternative 1						
Noise Zone II						
62-70	5,644/2,284	1,300/526	27,681/11,202	0/0	0/0	0/0
Noise Zone III						
>70	8,861/3,586	0/0	2,557/1,035	0/0	0/0	0/0
Total	**14,505/5,870**	**1,300/526**	**30,238/12,237**	**0/0**	**0/0**	**0/0**
Tinian Alternative 2						
Noise Zone II						
62-70	6,045/2,446	1,267/513	26,369/10,671	0/0	0/0	0/0
Noise Zone III						
>70	8,599/3,480	0/0	2,322/940	0/0	0/0	0/0
Total	**14,644/5,870**	**1,267/513**	**28,691/11,611**	**0/0**	**0/0**	**0/0**
Tinian Alternative 3						
Noise Zone II						
62-70	5,986/2,422	1,300/526	26,559/10,748	0/0	0/0	0/0
Noise Zone III						
>70	8,680/3,513	0/0	2,338/946	0/0	0/0	0/0
Total	**14,666/5,935**	**1,300/526**	**28,897/11,694**	**0/0**	**0/0**	**0/0**

Note: [1]Population on Tinian is outside Military Lease Area on Non-Military Lease Area lands.
Source: Army Public Health Command 2014.

In terms of risk of complaints, large-caliber Peak noise levels, when neutral weather conditions persist (as illustrated on Figure 4.5-4 and shown in Table 4.5-5), would expose 521 acres (211 hectares) outside of Military Lease Area boundaries to Peak noise conditions of 115 decibels. This would have the potential for increased risk of complaints (i.e., people may be annoyed and complain about noise generated within the RTA). No areas on Saipan would be exposed under neutral weather conditions. However, under unfavorable weather conditions (as illustrated in Figure 4.5-5 and listed in Table 4.5-6), population and areas exposed to increased risk of complaints increases to 1,223 people (80 on Tinian and 1,143 on Saipan) exposed to Peak noise levels of 115 decibels under Tinian Alternative 1. Although the affected population would be the same for all alternatives, the acres affected under Tinian Alternatives 2 and 3 vary slightly.



Tinian Representative Points of Interest	
T1	Tinian High School
T2	Lake Hagoi
T3	Mahalang Ephemeral Ponds
T4	Marpo Heights
T5	Mount Lasso/ Overlook Area
T6	Bateha 1 – Isolated Wetlands
T7	Northeast of Marpo Heights
T8	Bateha 2 – Isolated Wetlands
T9	San Jose
T10	San Jose Catholic Church
T11	Tinian Elementary School
T12	Unai Chiget
T13	Unai Chulu
T14	Unai Dankulo
T15	Unai Masalok
T16	North Field National Historic Landmark
T17	International Broadcasting Bureau
T18	Proposed Base Camp (Old West Field)
T19	Northern Marianas College - Tinian
T20	Ushi Point
T21	Native Limestone Forest
T22	Unai Lam Lam

Saipan Representative Points of Interest	
S1	Agingan
S2	Coral Ocean Point Resort
S3	Cornerstone Christian Church
S4	Obyan
S5	Saipan Southern High School
S6	San Antonio
S7	Koblerville Elementary School
S8	Susupe
S9	American Memorial Park
S10	Agingan Point
S11	San Antonio Elementary School
S12	Saipan International School
S13	Dandan Elementary School
S14	Hopwood Junior High School
S15	William S. Reyes Elementary School
S16	Mount Carmel School
S17	Saipan World Resort
S18	Northern Marianas College - Saipan

Figure 4.5-3. All Tinian Alternatives Large-Caliber Weapons Noise Levels (C-weighted)

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Figure 4.5-4. All Tinian Alternatives Large-Caliber Peak Noise Levels under Neutral Weather Conditions (Peak)

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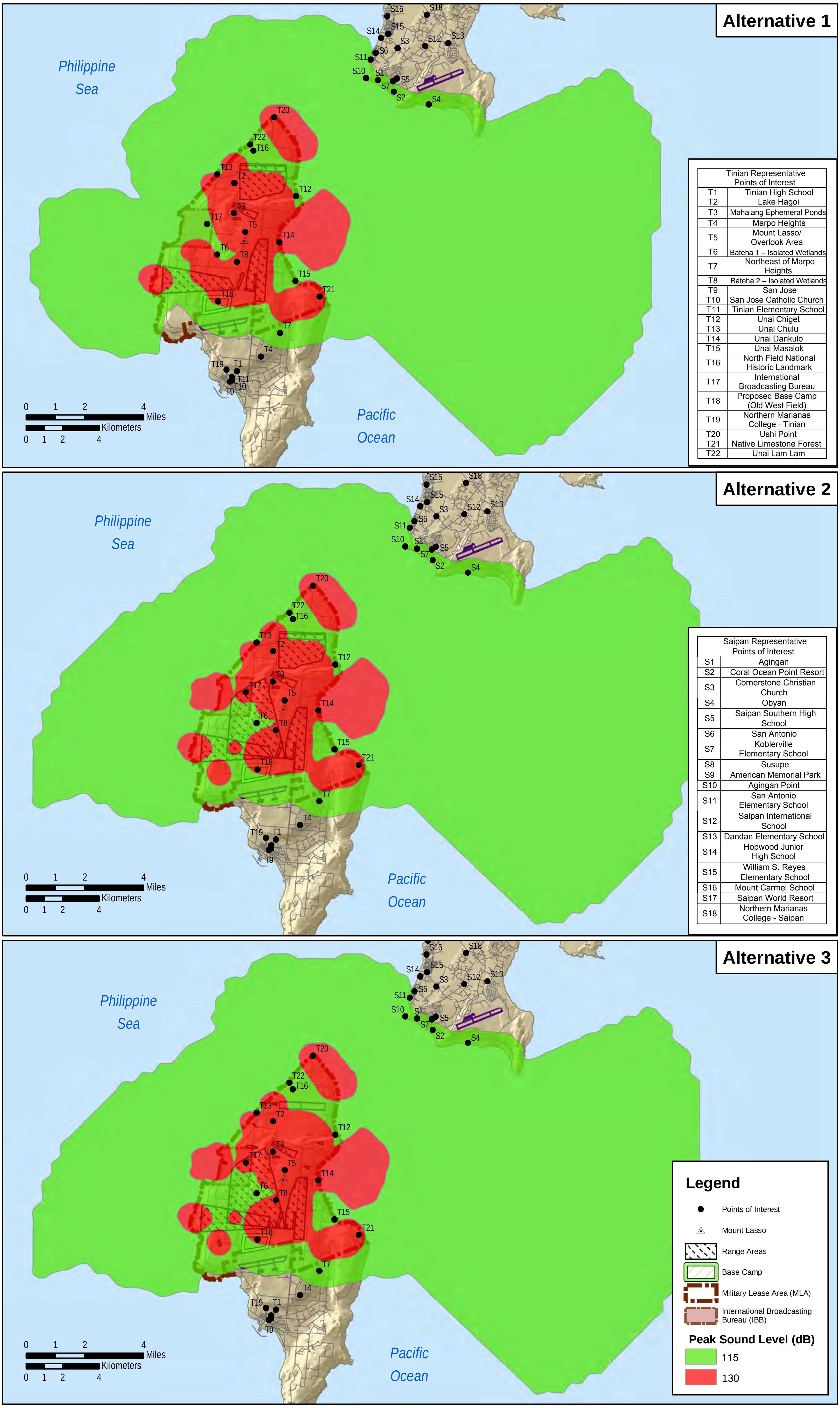

Figure 4.5-5. All Tinian Alternatives Large-Caliber Peak Noise under Unfavorable Weather Conditions (Peak)

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Table 4.5-5. Area and Population on Tinian and Saipan Affected by Large-caliber Weapons Noise - Risk Complaint Neutral Weather for All Tinian Alternatives (Peak)

Peak Noise Levels (in decibels)	*Acres/Hectares*						*Population*	
	Alternative 1		*Alternative 2*		*Alternative 3*		*All Action Alternatives*	
	Tinian	*Saipan*	*Tinian*	*Saipan*	*Tinian*	*Saipan*	*Tinian*	*Saipan*
Off shore								
115	11,582/4,687		15,115/2,070		15,115/2,070		NA	NA
130	408/165		552/223		547/221		NA	NA
Total	**11,990/4,852**		**15,667/2,293**		**15,662/2,291**		**NA**	**NA**
On Shore								
Within the Military Lease Area								
115	8,592/3,477	0	9,902/4,007	0	10,157/4,110	0	0	0
130	3,669/1,485	0	3,938/1,594	0	3,683/1,490	0	0	0
Total	**12,261/4,962**	**0**	**13,840/5,601**	**0**	**13,840/5,600**	**0**	**0**	**0**
Outside the Military Lease Area								
115	521/211	0	521/211	0	519/210	0	0	0
130	0	0	0	0	0	0	0	0
Subtotal	**521/211**	**0**	**521/211**	**0**	**519/210**	**0**	**0**	**0**
Total	**12,782/5,173**		**14,361/5,812**		**14,359/5,810**		**0**	

Table 4.5-6. Area and Population on Tinian and Saipan Affected by Large-caliber Weapons Noise - Risk Complaint Unfavorable Weather for All Tinian Alternatives (Peak)

Peak Noise Levels (in decibels)	*Acres/Hectares*						*Population*	
	Alternative 1		Alternative 2		Alternative 3		All Alternatives	
	Tinian	Saipan	Tinian	Saipan	Tinian	Saipan	Tinian	Saipan
Off shore								
115	105,272/42,602		111,014/44,926		111,014/44,926		NA	NA
130	4,518/1,828		5,233/2,118		5,223/2,114		NA	NA
Total	**109,790/44,430**		**116,247/47,044**		**116,237/47,040**		**NA**	**NA**
On Shore								
Within the Military Lease Area								
115	4,884/1,976	NA	5,032/2,036	0	5,074/2,053	0	0	0
130	9,879/3,998	NA	10,201/4,128	0	10,159/4,111	0	0	0
Total	**14,763/5,974**	**NA**	**15,233/6,164**	**0**	**15,233/6,164**	**0**	**0**	**0**
Outside the Military Lease Area								
115	2,297/930	1,552/628	2,399/970	1,552/628	2,398/970	1,552/628	80	1,143
130	130/53	0	130/53	0	130/53	0	0	0
Subtotal	**2,427/983**	**1,552/628**	**2,529/1,023**	**1,552/628**	**2,528/1,023**	**1,552/628**	**80**	**1,143**
Total	**18,742/7,585**		**19,314/7,816**		**19,313/7,815**		**1,223**	

Table 4.5-7 presents the Tinian points of interest exposed to large-caliber C-weighted day-night average sound levels and Table 4.5-8 presents the same information for Saipan. No incompatibilities with residential land uses or other points of interest outside the Military Lease Area on Tinian or Saipan would be exposed to C-weighted day-night average sound levels exceeding 65 decibels. Several points of interest within the Military Lease Area would be exposed to Noise Zone III levels; however, these levels would be considered compatible with exposed land uses because these points are military tactical training facilities, other non-human resources, or recreational areas where public access would be

restricted during those times that large-caliber weapon noise would be generated. Under Alternative 1, the International Broadcast Bureau facility would be exposed to noise levels of 72 decibels C-weighted day-night average sound level. These levels would not pose risks to workers because they are below Occupational Safety and Health standards. They are outdoor levels and most employees work indoors. In addition, the facility is considered industrial and would be compatible with these noise levels.

Table 4.5-7. Representative Points of Interest on Tinian Affected by Large-caliber Weapons Noise under All Tinian Alternatives (C-weighted)

Point of Interest (POI)			*C-weighted Day-Night Average Sound Levels (CDNL)*		
Identification Number	*Description*	*Type[1]*	*Decibel*	*Zone[2]*	*POI Conflict*
T1	Tinian High School	School	58	LUPZ	No
T2	Lake Hagoi	Other	77	III	NA
T3	Mahalang Ephemeral Ponds	Other	89	III	NA
T4	Marpo Heights	Residential	59	LUPZ	No
T5	Mount Lasso Overlook Area	Other	85	III	NA
T6	Bateha 1 - Isolated Wetlands	Other	70	III	NA
T7	Northeast of Marpo Heights	Residential	61	LUPZ	No
T8	Bateha 2 - Isolated Wetlands	Other	71	III	NA
T9	San Jose	Residential	58	LUPZ	No
T10	San Jose Catholic Church	Church	58	LUPZ	No
T11	Tinian Elementary School	School	58	LUPZ	No
T12	Unai Chiget	Other	72	III	NA
T13	Unai Chulu	Other	71	III	NA
T14	Unai Dankulo	Other	78	III	NA
T15	Unai Masalok	Other	66	II	NA
T16	North Field National Historic Landmark	Other	68	II	NA
T17	International Broadcasting Bureau	Administrative	72	III	No[3]
T18	Proposed Base Camp (Old West Field)	Transient Lodging	70	III	No[4]
T19	Northern Marianas College - Tinian	School	58	LUPZ	No
T20	Ushi Point	Other	73	III	NA
T21	Native Limestone Forest	Other	67	II	NA
T22	Unai Lam Lam	Other	67	II	NA

Notes: Shading denotes POIs inside the Military Lease Area

Noise levels are similar for all three alternatives only T8 and T18 varied by 1 decibel.

[1]Other includes sites with cultural, biological, historical, or recreational concerns that are not related to human factors such as health or annoyance and will be addressed in the applicable resource section of this EIS.

[2]Demolition and large caliber Noise Zones defined as: Land Use Planning Zone (LUPZ) (57-62 decibel CDNL); Zone I (<62 decibel CDNL); Zone II (62-70 decibel CDNL); and Zone III (>70 decibel CDNL). See Section 3.5.1 for more details on Land Use noise zones.

[3]No = This is not classified as a noise-sensitive land use because it is of an industrial nature.

[4]No = This is not classified as a noise-sensitive land use because it is considered a tactical training location.

Legend: NA = not applicable, see annotation number 1.

Source: Army Public Health Command 2014.

Table 4.5-8. Representative Points of Interest on Saipan Affected by Large-caliber Weapons Noise under All Tinian Alternatives (C-weighted)

Point of Interest (POI)			*C-weighted Day-Night Average Sound Levels (CDNL)*		
Identification Number	*Description*	*Type*[1]	*Decibel*	*Zone*[2]	*POI Conflict*
S1	Agingan	Residential	59	LUPZ	No
S2	Coral Ocean Point Resort	Resort	59	LUPZ	No
S3	Cornerstone Christian Church	Church	56	I	No
S4	Obyan	Residential	59	LUPZ	No
S5	Saipan Southern High School	School	58	LUPZ	No
S6	San Antonio	Residential	58	LUPZ	No
S7	Koblerville Elementary School	School	59	LUPZ	No
S8	Susupe	Residential	55	I	No
S9	American Memorial Park	Other	51	I	NA
S10	Agingan Point	Other	60	LUPZ	NA
S11	San Antonio Elementary School	School	58	LUPZ	No
S12	Saipan International School	School	55	I	No
S13	Dandan Elementary School	School	54	I	No
S14	Hopwood Junior High School	School	57	LUPZ	No
S15	William S. Reyes Elementary School	School	56	I	No
S16	Mount Carmel School	School	56	I	No
S17	Saipan World Resort	Transient Lodging	56	I	No
S18	Northern Marianas College - Saipan	School	54	I	No

Notes: The POI noise levels are the same for all three alternatives.

[1]Other includes sites with cultural, biological, historical, or recreational concerns that are not related to human factors such as health or annoyance and will be addressed in the applicable resource section of the EIS.

[2]Demolition and large caliber Noise Zones defined as: Land Use Planning Zone (LUPZ) (57-62 decibel CDNL); Zone I (<62 decibel CDNL); Zone II (62-70 decibel CDNL); Zone III (>70 decibel CDNL). See Section 3.5.1 for more details on Land Use noise zones.

Legend: NA = not applicable, see annotation number 1.

Source: Army Public Health Command 2014.

Peak noise levels under neutral and unfavorable weather conditions are presented in Table 4.5-9 for Tinian and in Table 4.5-10 for Saipan. Peak noise levels and their associated complaint risk are provided to assist the reader to understand noise levels better and provide the answer to "how loud is it?" However, no established significance criteria are associated with large-caliber weapons Peak noise levels. Munitions containing the greatest amount of explosives generate the loudest Peak noise levels and generate the greatest risk of noise complaints. On Tinian, the largest munitions proposed for use are the 155 millimeter high explosive artillery rounds.

Under neutral weather conditions and within the Military Lease Area (Table 4.5-9), 12 points of interest would be exposed to Peak levels of 115 decibels or greater. These areas would only be open to the public when the training facilities would not be in use; therefore, human receptors would not be present when noise-producing activities are occurring. On Saipan, no points of interest would be exposed to elevated Peak noise levels when weather conditions are neutral.

Table 4.5-9. Representative Points of Interest on Tinian Affected by Large-caliber Weapons Noise for All Tinian Alternatives (Peak)

Point of Interest (POI)			*Neutral Weather*			*Unfavorable Weather*		
Identification Number	*Description*	*Type*[2]	*Decibel*[3]	*Zone*	*POI Conflict*	*Decibel*	*Zone*	*POI Conflict*
T1	Tinian High School	School	< 110	Low	Low	110	Low	Low
T2	Lake Hagoi	Other	124	Moderate	NA	135	High	NA
T3	Mahalang Ephemeral Ponds	Other	138	High	NA	147	High	NA
T4	Marpo Heights	Residential	100	Low	Low	111	Low	Low
T5	Mount Lasso Overlook Area	Other	134	High	NA	145	High	NA
T6	Bateha 1 - Isolated Wetlands	Other	117	Moderate	NA	130	Moderate	NA
T7	Northeast of Marpo Heights	Residential	112	Low	Low	123	Moderate	Moderate
T8	Bateha 2 - Isolated Wetlands	Other	119	Moderate	NA	131	High	NA
T9	San Jose	Residential	< 110	Low	Low	110	Low	Low
T10	San Jose Catholic Church	Church	< 110	Low	Low	< 110	Low	Low
T11	Tinian Elementary School	School	< 110	Low	Low	< 110	Low	Low
T12	Unai Chiget	Other	119	Moderate	NA	129	Moderate	NA
T13	Unai Chulu	Other	116	Moderate	NA	131	Moderate	NA
T14	Unai Dankulo	Other	127	Moderate	NA	138	High	NA
T15	Unai Masalok	Other	116	Moderate	NA	127	Moderate	NA
T16	North Field National Historic Landmark	Other	112	Low	NA	122	Moderate	NA
T17	International Broadcasting Bureau[1]	Administrative	118	Moderate	Moderate	128	Moderate	Moderate
T18	Proposed Base Camp (Old West Field)	Transient Lodging	121	Moderate	NA[4]	133	High	NA[4]
T19	Northern Marianas College - Tinian	School	< 110	Low	Low	110	Low	Low
T20	Ushi Point	Other	129	Moderate	NA	140	High	NA
T21	Native Limestone Forest	Other	123	Moderate	NA	135	High	NA
T22	Unai Lam Lam	Other	110	Low	NA	121	Moderate	NA

Notes: Shading denotes POIs inside the Military Lease Area
The POI noise levels are nearly identical for all three alternatives, only POI T6 varied (126 decibels for both Alternatives 2 and 3).
[1]Under Alternatives 2 and 3 the International Broadcasting Bureau mission is relocated.
[2]Other includes sites with cultural, biological, historical, or recreational concerns that are not related to human factors such as health or annoyance and will be addressed in the applicable resource section of this EIS/OEIS.
[3]Noise level threshold is 110 decibels Peak (or decibel Peak).
[4]Complaint risk areas defined as: low risk of complaints <115 decibel Peak; moderate risk of complaints 115-130 decibel Peak; high risk of complaints > 130 decibel Peak.
[5]POI is considered a Tactical Training location and complaint risk correlation does not apply.
Legend: NA = not applicable, see annotation number 2.
Source: Army Public Health Command 2014.

Table 4.5-10. Representative Points of Interest on Saipan Affected by Large-caliber Weapons Noise for All Tinian Alternatives (Peak)

Point of Interest (POI)			*Neutral Weather*			*Unfavorable Weather*		
Identification Number	*Description*	*Type*	*Decibel*	*Zone*	*POI Conflict*	*Decibel*	*Zone*	*POI Conflict*
S1	Agingan	Residential	< 110	Low	Low	117	Moderate	Moderate
S2	Coral Ocean Point Resort	Resort	< 110	Low	Low	117	Moderate	Moderate
S3	Cornerstone Christian Church	Church	< 110	Low	Low	< 110	Low	Low
S4	Obyan	Residential	< 110	Low	Low	120	Moderate	Moderate
S5	Saipan Southern High School	School	< 110	Low	Low	113	Low	Low
S6	San Antonio	Residential	< 110	Low	Low	114	Low	Low
S7	Koblerville Elementary School	School	< 110	Low	Low	115	Moderate	Moderate
S8	Susupe	Residential	< 110	Low	Low	< 110	Low	Low
S9	American Memorial Park	Other	< 110	Low	Low	< 110	Low	NA
S10	Agingan Point	Other	< 110	Low	NA	117	Moderate	NA
S11	San Antonio Elementary School	School	< 110	Low	Low	115	Moderate	Moderate
S12	Saipan International School	School	< 110	Low	Low	< 110	Low	Low
S13	Dandan Elementary School	School	< 110	Low	Low	< 110	Low	Low
S14	Hopwood Junior High School	School	< 110	Low	Low	112	Low	Low
S15	William S. Reyes Elementary School	School	< 110	Low	Low	< 110	Low	Low
S16	Mount Carmel School	School	< 110	Low	Low	112	Low	Low
S17	Saipan World Resort	Transient Lodging	< 110	Low	Low	111	Low	Low
S18	Northern Marianas College – Saipan	School	< 110	Low	Low	< 110	Low	Low

Notes: The POI noise levels are the same for all three alternatives.
[1]Other includes sites with cultural, biological, historical, or recreational concerns that are not related to human factors such as health or annoyance and will be addressed in the applicable resource section of this EIS/OEIS.
[2]Noise level threshold is 110 decibels Peak (or decibel Peak).
[3]Complaint risk areas defined as low risk of complaints <115 decibel Peak; moderate risk of complaints 115-130 decibel Peak; high risk of complaints > 130 decibel Peak.
Legend: NA = not applicable, see annotation number 1.
Source: Army Public Health Command 2014.

Unfavorable weather conditions occur when the wind blows in the opposite direction of normal trade winds. It was estimated that this condition would occur a maximum of 10-15% of the total training time, equaling about 2-3 weeks per year. Under any of the three alternatives, numerous points of interest would be impacted by elevated Peak noise levels within the Military Lease Area. However, these locations are military training facilities, other non-human resources, or sites where public access would be restricted during munitions operations producing these Peak noise levels. Outside of the Military Lease Area, one Tinian point of interest (T7) would have a moderate potential for risk of complaints when weather conditions are unfavorable (see Table 4.5-9). On Saipan (see Table 4.5-10), five points of interest (S1, S2, S4, S7, and S11) would be exposed to elevated Peak noise levels and thus have the potential for increased risk of noise complaints.

Tinian Alternative 1 large-caliber weapons operations would have less than significant direct and indirect impacts on the noise environment and would be compatible with sensitive land uses and points of interest.

4.5.3.1.2.2 Airfield and Airspace Based Operations

Table 4.5-11 presents the proposed number of annual military operations at Tinian International Airport and North Field under all Tinian alternatives. At the airfields and Landing Zones, an operation consists of either a take-off or a landing, each of which counts as one operation. Within the airspace, a flight through one unit of Special Use Airspace is considered an operation. These projected operations would be in addition to those flown under baseline at Tinian International Airport. As described in Section 3.5, *Noise*, the baseline is represented by total aircraft operations flown in 2012. Based on the 2014 to 2040 year-over-year growth rate estimated by the Federal Aviation Administration Terminal Area Forecast (Federal Aviation Administration 2013), air traffic operations for Tinian International Airport would not be expected to change (see also Appendix O, *Transportation Study*). Aircraft operations occurring during the nighttime hours, between 10:00 p.m. and 7:00 a.m., are identified because they receive a 10-decibel penalty. This penalty is applied to A-weighted day-night average sound level. Of the 11,664 annual operations, 75% occur during the day and 25% during the night.

Table 4.5-11. Annual Airfield Operations[1] at Tinian International Airport and North Field for All Tinian Alternatives

Aircraft Type[2]	*Tinian International Airport*			*North Field*			*Total*		
	Day	*Night*	*Total*	*Day*	*Night*	*Total*	*Day*	*Night*	*Total*
Transport Tilt-rotor	720	280	1,000	320	80	400	1,040	360	1,400
Transport Rotary Wing	680	280	960	280	80	360	960	360	1,320
Attack Helicopter	520	240	760	120	40	160	640	280	920
Transport Fixed Wing	800	400	1,200	800	400	1,200	1,600	800	2,400
Unmanned	200	100	300	200	100	300	400	200	600
Fighter	1,600	400	2,000	NA			1,600	400	2,000
Heavy commercial transport	24	0	24	NA			24	0	24
Fighter – Field Carrier Landing Practice	2,500	500	3,000	NA			2,500	500	3,000
Total	**7,044**	**2,200**	**9,244**	**1,720**	**700**	**2,420**	**8,764**	**2,900**	**11,664**

Notes: [1]Operations include a takeoff or a landing.
[2]Examples of aircraft types: Transport Tilt-rotor = MV-22, Transport Rotary Wing, CH-53, Attack Helicopter = AH-1, AH-64, Transport Fixed Wing = C-130, KC-135, C-17, Unmanned = RQ-7, Fighter = FA-18, AV-8, and F-35.
Legend: NA = not applicable.

Noise contour bands for baseline and all Tinian alternatives are illustrated in Figure 4.5-6. These noise contours include both the projected operations listed above and the baseline operations that would continue at Tinian International Airport. Also included are noise levels generated from operations at North Field, at the Landing Zones, and by aircraft flying overhead in the proposed Tinian Military Operations Area and Restricted Areas, R-7203 A/B/C/X/Y/Z.

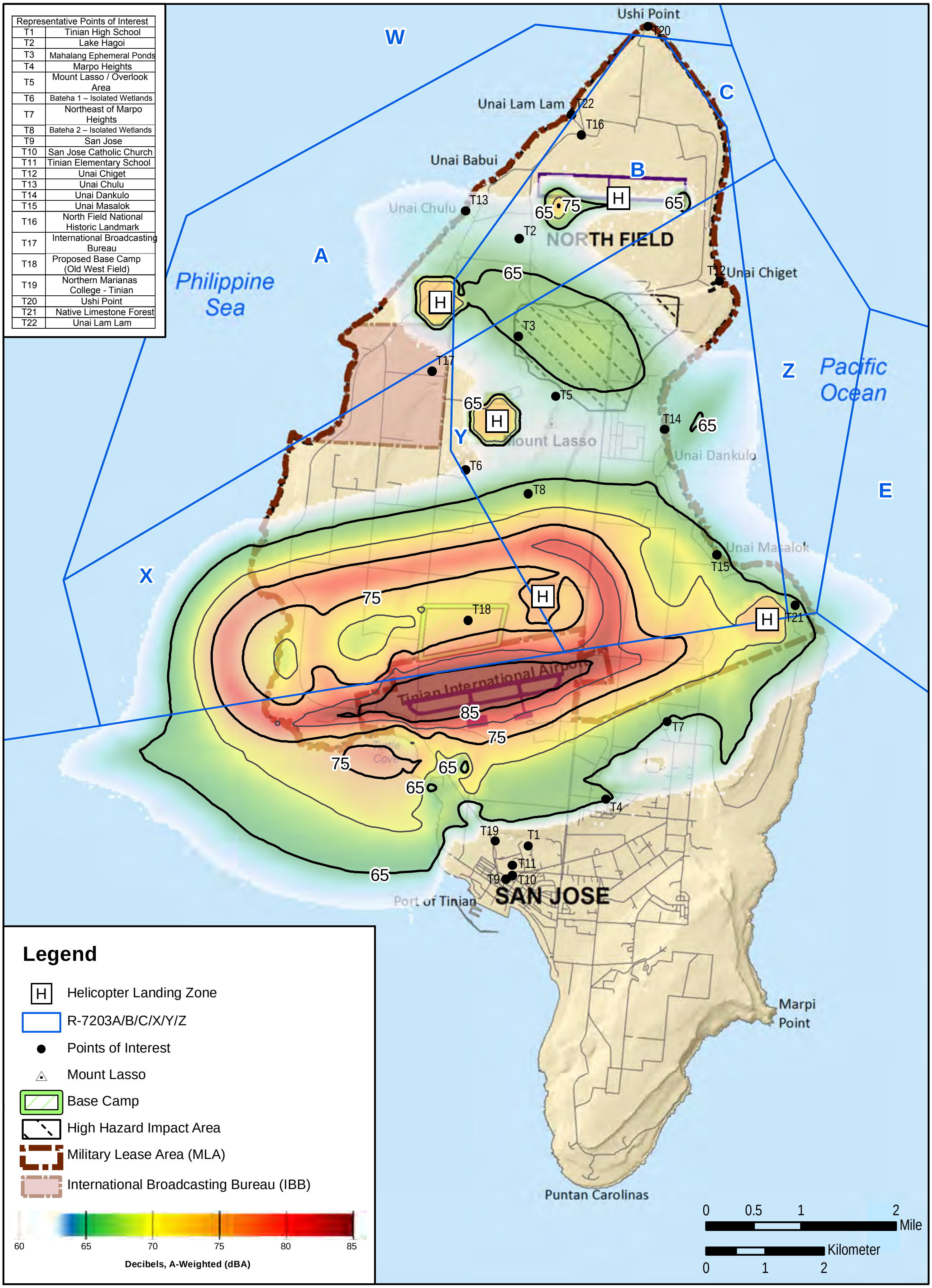


Figure 4.5-6. Airfield and Airspace Noise Levels for All Tinian Alternatives (A-weighted)

Table 4.5-12 presents the acres and population affected by proposed noise levels for areas within the Military Lease Area, outside the Military Lease Area, and offshore exposed to A-weighted day-night average sound levels equal to or greater than 65 decibels. Most of the acreage exposed to 65 decibels or greater outside the Military Lease Area is on Tinian International Airport property (see Figure 4.5-6). However, a small portion borders the edge of Marpo Heights (see point of interest T4 on Figure 4.5-6). Similar to the ground-based weapons noise calculations, to determine the population by contour band, this analysis used aerial photography and counted actual houses.

Table 4.5-12. Noise Area and Population Generated by Aircraft Operations for All Tinian Alternatives Compared to Baseline (2012) Levels (A-weighted)

Zone	*Noise Levels (in decibels)*	*Baseline*		*Alternatives 1, 2, and 3*	
		Acres/Hectares	*Population*	*Acres/Hectares*	*Population*
Within the Military Lease Area					
II	*65 – 69*	59/24	NA	2,733/1,106	NA
	70 – 74	0/0	NA	2,775/1,123	NA
III	75 – 79	0/0	NA	1,636/662	NA
	80 – 84	0/0	NA	334/135	NA
	>85	0/0	NA	3/1	NA
Total		**59/24**	**NA**	**7,481/3,029**	**NA**
Area and Population Outside the Military Lease Area					
II	65 - 69	361/146	0	1,292/523	40
	70 - 74	194/79	0	375/152	0
III	75 - 79	133/54	0	334/165	0
	80 - 84	31/13	0	389/157	0
	>85	0/0	0	547/221	0
Total		**719/291**	**0**	**2,937/1,189**	**40**
Off Shore					
NA	65 - 69	0	NA	1,621/656	NA
	70 - 74	0	NA	1,099/445	NA
	75 - 79	0	NA	506/205	NA
	80 - 84	0	NA	1/0	NA
	>85	0	NA	0/0	NA
Total		**0**	**NA**	**3,227/1,306**	**NA**

Legend: NA = not applicable.

When compared to baseline conditions, A-weighted noise levels of 65 decibels or greater would increase and potentially affect 2,937 acres (1,189 hectares) outside the Military Lease Area. Review of aerial photography revealed that approximately 10 households and 40 people in Marpo Heights (see point of interest T4 on Figure 4.5-6) would be affected by aircraft noise levels 65 decibels and greater. This represents 1.3% of the total population of Tinian. Noise exposure to these residences would also exceed the Federal Aviation Administration criterion of 1.5-decibel increase in areas over 65 decibels. The Federal Aviation Administration requires reporting 3 decibel increases between 60 and 65 decibels, and 5 decibel increases from 45 to 60 decibels for residential areas. Residents in the area northeast of Marpo Heights and in San Jose would have noise increases above these criteria but would remain below 65 decibels.

Under Tinian Alternative 1, most flight operations would be directed to flight tracks along a path in line with the runway or north of the runway that correspond to operations occurring while normal trade winds persist. However, operations causing the impacts to the 10 residences in Marpo Heights would occur when wind blows counter to the normal trade winds. This opposite wind condition causes aircraft to fly to the south upon approach to the Tinian International Airport and to conduct missed aircraft approaches to the south. Opposite wind conditions were modeled to occur as often as 15% of the time but actual operations would be expected to be less than 15%. A missed approach occurs during a low-visibility, instrument procedure when the pilot does not have the runway lined up correctly, or is traveling at the incorrect speed, or does not have the proper approach altitude. If any of these occur, the pilot flies to a known point at a radio direction transmitter and sets up specific control points back to the runway. One of the points would be south of the airport to safely turn the aircraft in the correct direction. Missed approaches would be very infrequent considering the reliability of the trade winds, the good visibility that normally occurs on Tinian, and training involves experienced pilots.

Table 4.5-13 shows A-weighted noise levels for representative points of interest on Tinian potentially affected by aircraft operations. Of the 22 points of interest affected, six would experience increases of noise levels above 65 decibels when compared to baseline conditions. These six include one residential receptor (T4), four non-residential receptors (T3, T7, T8, and T21), and the proposed base camp (T18). All receptors would see an increase of over 15 decibels except Ushi Point (T20). While there would be increases in noise levels for residential areas (T4, T7, and T9), they would still be at or below 65 decibels and be considered compatible land uses. However, because the increases over baseline conditions exceed Federal Aviation Administration reportable changes in exposure limits, noise increases would be considered significant.

Tinian Alternative 1 aircraft operations would introduce significant direct noise impacts to ten residences housing about 40 people in the Marpo Heights area because the increase would result in noise levels greater than 65 decibels and have an increase of almost 20 decibels above baseline conditions. While this represents a significant change from baseline conditions, operations causing these impacts would rarely occur. No indirect noise impacts to human receptors would result from airfield or airspace operations.

Table 4.5-13. All Tinian Alternatives Points of Interest Noise Level Exposure Generated by Aircraft Operations (A-weighted)

Points of Interest			***Decibels***		
Identification Number	***Description***	***Type***	***Baseline***	***Proposed***	***Change from Baseline***
T1	Tinian High School	School	37.6	55.6	18.0
T2	Lake Hagoi	Other	44.1	63.4	19.3
T3	Mahalang Ephemeral Ponds	Other	39.5	65.4	25.9
T4	Marpo Heights	Residential	45.4	65.2	19.8
T5	Mount Lasso Overlook Area	Other	40.7	63.9	23.2
T6	Bateha 1 - Isolated Wetlands	Other	38.8	61.9	23.1
T7	Northeast of Marpo Heights	Residential	48.5	64.8	16.3
T8	Bateha 2 - Isolated Wetlands	Other	45.6	66.6	21.0
T9	San Jose	Residential	37.3	54.1	16.8
T10	San Jose Catholic Church	Church	37.1	54.3	17.2
T11	Tinian Elementary School	School	36.9	54.8	17.9
T12	Unai Chiget	Other	35.4	57.8	22.4
T13	Unai Chulu	Other	44.0	63.4	19.4
T14	Unai Dankulo	Other	47.0	64.0	17.0
T15	Unai Masalok	Other	48.8	66.0	17.2
T16	North Field National Historic Landmark	Other	41.2	57.9	16.7
T17	International Broadcasting Bureau	Administrative	41.8	60.8	19.0
T18	Proposed Base Camp (Old West Field)	Transient Lodging	54.6	72.4	17.8
T19	Northern Marianas College – Tinian	School	37.2	58.0	20.8
T20	Ushi Point	Other	36.3	49.6	13.3
T21	Native Limestone Forest	Other	50.0	65.5	15.5
T22	Unai Lam Lam	Other	39.0	56.7	17.7

Notes: Bold indicates human receptor.
[1]Access to sites would only occur when adjacent ranges are not in use and noise levels would be lower during human occupation.
[2]Point of interest is human but would be considered a Tactical Training location and not incompatible.

4.5.3.1.2.3 Supplemental Noise Metrics

Under the three Tinian alternatives, no population would be exposed to the 24-hour equivalent noise level of 80 decibels or greater noise contour. There would be no potential for hearing loss.

Speech interference, classroom interruptions, and sleep disturbance noise analyses are provided to assist the reader in understanding noise impacts from experiences that are more common rather than a rare annoyance. Although aircraft noise would create significant impacts, the noise levels would be generally compatible and the supplemental analyses reveal only a few events per training day where noise events could be intrusive for speech interference, classroom interruptions, and sleep disturbance. Specific details regarding the supplemental analyses are provided in Appendix H, *Noise Study*.

4.5.3.1.2.4 Traffic

Vehicular traffic associated with the proposed action would include permanently based vehicles and trips between the port and base camp by units arriving for training. Table 4.5-14 shows the representative number of vehicles a generic Marine expeditionary unit and battalion landing team requires and Table 4.5-15 shows the proposed unit permanently based vehicles.

Table 4.5-14. Representative Unit Level Vehicle Requirements

Vehicle Type	*Generic Marine Expeditionary Unit*	*Generic Battalion Landing Team*
HMMWV (Humvee)	63	78 (8 with TOW Missile mounts)
Light Armored Vehicles	7	7
MTVR 7-ton Trucks	30	12
Amphibious Assault Vehicles (on Trailers)	14	15
Logistic Vehicle Systems	4	0
M77 155mm Howitzers (on Tow Trailers)	6	6
D7 Bulldozer	0	3
MTVR Dump Truck	0	1
Total	**124**	**122**

Notes: Generic Marine Expeditionary Unit with 1,214 personnel. Generic Battalion Landing Team with 1,257 personnel.
Legend: HMMWV = High Mobility Multi-purpose Wheeled Vehicles; mm = millimeter; MTVR = Medium Tactical Vehicle Replacements; TOW = Tube-launched, Optically-tracked, Wire-guided.
Source: DoN 2014, Appendix O, *Transportation Study*.

Table 4.5-15. All Tinian Alternatives Proposed Base Vehicles

Vehicle Type	*Number of Vehicles*
Buses (for troop transport)	8
Sedans (for use by permanent staff)	2
4-Wheel Drive Trucks (Light) - Service pick-ups for use by permanent staff (facilities and range maintenance)	15
Medium Tactical Vehicle Replacement 7-ton Trucks (range maintenance)	5
Commercial Flat Bed Trucks	5
D7 Bulldozer	2
Front End Loader	2
Medium Tactical Vehicle Replacement 7-ton Dump Truck	2
Rough Terrain Forklift	1
(Rough Terrain) Material Handling Equipment (for port and airfield use)	1
Extended Boom Forklift	1
Total	**44**

Source: DoN 2014, Appendix O, *Transportation Study*.

Most vehicle traffic outside the Military Lease Area would be prior to and at the end of a 2-week training cycle, with occasional trips by Amphibious Assault Vehicles conducting training within the port. Vehicles would be required to pass biosecurity inspection at the proposed military biosecurity and wash-down facility at the port. As a result, vehicle traffic would be light and dispersed throughout the training period and each day. The only instance that vehicles would be moved in a concentrated period of time would be at the end of the training cycle when all vehicles and personnel are transported from base camp to the port for loading onto the High Speed Vessel or other marine transport.

Including round trips by buses and autos, the hourly maximum would be approximately 237 vehicles. This would result in hourly equivalent noise levels of 64, 59, 56, and 54 decibels at 50, 100, 150, and 200 feet, respectively, from the roadway. Along the planned roadway, there are only a few homes within 100 feet (30 meters) from the roadway. Noise levels would be below Federal Highway Administration level guidelines and U.S. Environmental Protection Agency guidelines and would potentially occur at these levels once every 2 weeks for a limited time. The most likely scenario would be for a more dispersed movement from base camp lasting most of the day and noise levels would be appreciably lower.

Traffic-generated noise resulting from Tinian Alternative 1 operations would have less than significant direct and indirect noise impacts to land uses and people.

4.5.3.1.2.5 Waterborne Operations

Waterborne activities would include Amphibious Assault Vehicles, Landing Craft Air Cushion, and Landing Craft Utility. In addition, large vessel operations of ships, a High Speed Vessel, and a barge would occur for transporting personnel and equipment to Tinian.

Landing Craft Air Cushion Operations

Of all the vessels planned for use, the Landing Craft Air Cushion operations would be the loudest. These vessels ride on a cushion of air generated by powerful engines, driving fans that elevate the vessel above the water. Landing Craft Air Cushions generate maximum noise levels of 98 decibels at 200 feet (61 meters) during ground run-up conditions, and sound exposure levels up to 104 A-weighted decibels at 40 knots (74 kilometers per hour) on water (DoN 2009). For safety purposes, visitors would not have access to beach when training exercises are occurring. However, visitors may be allowed to have access to adjacent beaches. Under any of the Tinian alternatives, Landing Craft Air Cushion vehicles that would operate at one of the amphibious landing beaches and near shore of the Military Lease Area would generate noise audible at the nearest adjacent beach. For example, Landing Craft Air Cushion vehicles operating at Unai Babui would generate noise levels of about 74 decibels during ground run-up conditions and 80 decibels at 40 knots (74 kilometers per hour) at Unai Chulu. However, the public would not have access to the amphibious landing beach training areas when these vessels are operating and, therefore, they would not be exposed to elevated noise levels created by these activities. Noise for Landing Craft Air Cushion vessels could be audible to visitors, but noise impacts to the public would be less than significant.

Amphibious Assault Vehicles have sound exposure levels of about 87-88 decibels moving on water or land, and around 72 decibels at a distance of 100 feet (30 meters) while at idle. Amphibious Assault Vehicles could come ashore four at a time. Therefore, noise levels in these situations would be higher, approximately 96 decibels at 100 feet (30 meters). Landing Craft Utility and Light Armored Vehicles would be used but are smaller and have less horsepower. This would result in noise levels lower than either the Landing Craft Air Cushion or the Amphibious Assault Vehicles. For safety purposes, visitors would not have access to beach or nearby areas when training exercises are occurring, and therefore no noise impacts to the public would occur.

Tinian Port Operations

Operations would primarily occur prior to and at the end of a 2-week training cycle period, as one of the potential transportation options for marine personnel and equipment embarkation/debarkation points. Harbor operations would include one Joint High Speed Vessel, other ships, a barge, and Landing Craft Utility that could be in port simultaneously. Port arrivals and departures would occur at low-engine speeds of 5 knots or less. Noise from visiting vessels would be consistent with normal port vessels and persist when loading and unloading for a day or two. Amphibious Assault Vehicles would also use the port and generate noise levels of 72 decibels at 100 feet (30 meters). The nearest residence would be over 200 feet (60 meters) from the planned route for the vehicle to transit from the port to the training area and the noise levels would be less than 66 decibels.

Underwater

Underwater operational noise generated by sea-going vessels' engines would not create noise levels affecting people or sensitive land uses.

Tinian Alternative 1 waterborne operations would generate less than significant direct and indirect noise impacts to land uses and people.

4.5.3.2 Tinian Alternative 2

4.5.3.2.1 Construction Impacts

Construction noise levels from implementation of Tinian Alternative 2 would be similar to those described for Tinian Alternative 1 because differences between the construction activities for the Tinian Alternatives would occur away from sensitive receptors. Activities sufficiently close to receptors that can have a potential noise impact are identical for each alternative. The North and South Battle Area Complexes and five additional Convoy Engagement Areas would be established and the mission of the International Broadcasting Bureau would be moved when compared to Tinian Alternative 1. Construction noise would not fall outside military boundaries; therefore, impacts would be compatible with residential areas, and not affect schools, places of worship, or hospitals (i.e., sensitive receptors).

Tinian Alternative 2 construction activities would result in less than significant direct or indirect noise impacts on land and underwater.

4.5.3.2.2 Operation Impacts

4.5.3.2.2.1 Ground Based Operations

Small-caliber Weapons

Noise generated from Tinian Alternative 2 small-caliber weapons operations would be similar to Tinian Alternative 1. Acreage and population affected by small-caliber weapons were presented in Table 4.5-1 and illustrated in Figure 4.5-1 for A-weighted day-night average sound levels. The analysis indicated that no acreage or population outside of the Military Lease Area would be affected by A-weighted noise levels 65 decibels or greater (or Noise Zones II and III). Table 4.5-2 and Figure 4.5-2 presented Peak noise levels and indicated that while no population would be exposed to elevated Peak noise levels, about 200 more acres (81 hectares) would be exposed to 87-104-decibel Peak noise levels when compared to Tinian Alternative 1. Potential A-weighted and Peak noise effects at points of interest under Tinian Alternative 2 are listed in Table 4.5-16 and shown in Figure 4.5-1 and Figure 4.5-2. Noise levels would not be perceptibly different from those modeled under Tinian Alternative 1.

Small-caliber weapons operations associated with Tinian Alternative 2 would result in less than significant direct and indirect noise impacts. Neither A-weighted nor Peak noise levels would be incompatible with the points of interest.

Table 4.5-16. Tinian Alternative 2 Representative Points of Interest Affected by Small-caliber Weapons Noise on Tinian (A-weighted and Peak)

Point of Interest			*A-weighted Day-Night Average Sound Levels (ADNL)*			*Peak*		
Identification Number	*Description*	*Type*	*Decibel*	*Zone*	*Points of Interest Conflict*	*Decibel*	*Zone*	*Points of Interest Conflict*
T1	Tinian High School	School	< 50	I	No	< 80	I	No
T2	Lake Hagoi	Other	63	I	NA	100	II	NA
T3	Mahalang Ephemeral Ponds	Other	67	II	NA	104	III	NA
T4	Marpo Heights	Residential	< 50	I	No	< 80	I	No
T5	Mount Lasso Overlook Area	Other	71	II	No	106	III	No
T6	Bateha 1 - Isolated Wetlands	Other	65	II	NA	107	III	NA
T7	Northeast of Marpo Heights	Residential	< 50	I	No	83	I	No
T8	Bateha 2 - Isolated Wetlands	Other	75	III	NA	108	III	NA
T9	San Jose	Residential	< 50	I	No	< 80	I	No
T10	San Jose Catholic Church	Church	< 50	I	No	< 80	I	No
T11	Tinian Elementary School	School	< 50	I	No	< 80	I	No
T12	Unai Chiget	Other	59	I	No	96	II	No
T13	Unai Chulu	Other	61	I	No	106	III	No
T14	Unai Dankulo	Other	64	I	No	104	III	No
T15	Unai Masalok	Other	55	I	No	96	II	No
T16	North Field National Historic Landmark	Other	55	I	No	98	II	No
T17	International Broadcasting Bureau	Administrative	***	***	No	***	***	No
T18	Proposed Base Camp (Old West Field)	Transient Lodging	54	I	No	95	II	No
T19	Northern Marianas College	School	< 50	I	No	< 80	I	No
T20	Ushi Point	Other	< 50	I	NA	97	II	NA
T21	Native Limestone Forest	Other	< 50	I	NA	91	II	NA
T22	Unai Lam Lam	Other	54	I	NA	95	II	NA

Notes: NA – not applicable, see annotation number 1 and shading denotes points of interest inside the Military Lease Area.
***Under Alternatives 2 and 3 the International Broadcasting Bureau mission is relocated.
[1]Other includes sites with cultural, biological, recreational, or other concerns that are unrelated to human factors and are addressed in the applicable resource sections of the CJMT EIS/OEIS.
[2]Noise level threshold is 50 decibel ADNL and 80 decibel Peak.
[3]Small-caliber Peak Noise Zones defined as: Zone I (< 55 decibel ADNL; 55-64 decibel ADNL); Zone II (65-69 decibel ADNL; 70-74 decibel ADNL); and Zone III (75-79 decibel ADNL; 80-84 decibel ADNL; > 85 decibel ADNL).
Source: Army Public Health Command 2014.

Large-caliber Weapons

Noise impacts on acres and population would be similar to Tinian Alternative 1 (see Table 4.5-4); however, outside the Military Lease Area boundaries, Tinian Alternative 2 would affect 33 fewer acres (13 hectares) exposed to Noise Zone II and III levels (62-70 decibels C-weighted) when compared to Tinian Alternative 1. However, as with Tinian Alternative 1, people would not be impacted by either Noise Zone II or III C-weighted noise levels on Tinian. On Saipan, neither acreage nor people would be impacted by C-weighted day-night average sound levels under Tinian Alternative 2 (see Table 4.5-4). Peak noise levels under Tinian Alternative 2 (see Table 4.5-5), when weather conditions are neutral, would affect the same number of acres on Tinian as found under Tinian Alternative 1 (521 acres/211 hectares). On Saipan, no acres or people would be affected by Peak noise levels when weather conditions are neutral. When weather conditions are unfavorable, however, Peak noise impacts (see Table 4.5-6) on Tinian would affect 102 more acres (41 hectares) when compared to Tinian Alternative 1. On Saipan, the same 1,552 acres (628 hectares) would be exposed to Peak noise levels of 115 decibels. Under Tinian Alternative 2, 80 people on Tinian and 1,143 on Saipan would be exposed to elevated Peak noise levels. Table 4.5-7 and Table 4.5-8 presented C-weighted day-night average sound levels to points of interest on Tinian and Saipan, respectively. Table 4.5-9 and Table 4.5-10 presented the Peak noise levels under neutral and unfavorable weather conditions at points of interest on Tinian and Saipan. Figures 4.5-3, 4.5-4, and 4.5-5 illustrate these potential noise levels. As found with Tinian Alternative 1, one Tinian point of interest (T7) would have a moderate potential for risk of complaints when weather conditions are unfavorable (see Table 4.5-9). On Saipan (see Table 4.5-10), five points of interest (S1, S2, S4, S7, and S11) would be exposed to elevated Peak noise levels and thus have the potential for increased risk of noise complaints.

Large-caliber weapons use associated with Tinian Alternative 2 operations would result in less than significant direct or indirect noise impacts and noise levels would be considered compatible with land uses and sensitive receptors.

4.5.3.2.2.2 Airfield and Airspace Based Operations

Tinian Alternative 2 aircraft and airspace operations are the same as Tinian Alternative 1. Proposed annual military operations at Tinian International Airport and North Field were presented in Table 4.5-11 and noise contour bands illustrated in Figure 4.5-6. When compared to baseline conditions, A-weighted noise levels of 65 decibels and greater would potentially affect 2,937 acres (1,189 hectares) outside the Military Lease Area under Tinian Alternative 2. Review of aerial photography revealed that approximately 10 residences and 40 people in Marpo Heights (see point of interest T4 on Figure 4.5-6) would be affected by aircraft noise levels of 65 decibels and greater.

Identical to Tinian Alternative 1, Tinian Alternative 2 aircraft operations would introduce significant direct noise impacts to approximately 40 people residing in 10 residences in the Marpo Heights area. While this represents a significant change from baseline conditions, operations causing these impacts would occur infrequently. No indirect noise impacts to human receptors would result from airfield or airspace operations.

4.5.3.2.2.3 Waterborne Operations

Noise generated by waterborne activities would be the same as Tinian Alternative 1 operations. Therefore, Tinian Alternative 2 waterborne operations would generate less than significant direct and indirect impacts to land uses and receptors (e.g., people, residential areas, hospitals, and schools).

4.5.3.2.2.4 Traffic

Traffic noise generated by operations would be similar to Tinian Alternative 1 because vehicle operations that have the potential to cause noise that can be heard by San Jose residents would be nearly identical to Alternative 1. Under this alternative there would be slightly less trips by International Broadcasting Bureau employees, but that would have negligible effects of traffic noise. There would be less than significant direct and indirect noise impacts to land uses and receptors with Tinian Alternative 2.

4.5.3.3 Tinian Alternative 3

4.5.3.3.1 Construction Impacts

Construction noise levels under Tinian Alternative 3 would be similar to those described for Tinian Alternatives 1 and 2 because differences between the construction activities for the Tinian Alternatives would occur away from sensitive receptors. Activities sufficiently close to receptors that can have a potential noise impact are identical for each alternative. When compared to Tinian Alternative 1, the southern Battle Area Complex and five additional Convoy Course Engagement Areas would be established and the mission of the International Broadcasting Bureau would move. There would be less than significant direct or indirect construction noise impacts on land or underwater resulting from RTA, airport, or port construction and improvements under Tinian Alternative 3.

4.5.3.3.2 Operation Impacts

4.5.3.3.2.1 Ground Based Operations

Small-caliber Weapons

Noise generated under Tinian Alternative 3 would be similar to Tinian Alternative 1. Acreage and population affected by small-caliber weapons were presented in Table 4.5-1 and illustrated in Figure 4.5-1 for A-weighted day-night average sound levels. The analysis indicated that no acreage or population outside of the Military Lease Area would be affected by A-weighted noise levels 65 decibels or greater (or Noise Zones II and III). Table 4.5-2 and Figure 4.5-2 presented potential Peak noise levels and indicated that while no population would be exposed to elevated Peak noise levels, about 200 more acres (81 hectares) would be exposed to 87-104 Peak noise levels when compared to Tinian Alternative 1. Potential A-weighted and Peak noise effects at points of interest for Tinian Alternative 3 are listed in Table 4.5-17 and shown in Figure 4.5-1 and Figure 4.5-2. Noise would not be perceptibly different when compared to Tinian Alternative 1.

Tinian Alternative 3 would have less than significant direct and indirect operations noise impacts resulting from small-caliber weapons use, and these noise levels would be considered compatible with sensitive receptors. Small-caliber A-weighted noise levels would not be incompatible to any points of interest.

Table 4.5-17. Tinian Alternative 3 Representative Points of Interest Affected by Small-caliber Weapons Noise on Tinian (A-weighted and Peak)

Point of Interest			*A-weighted Day-Night Average Sound Levels*			*Peak*		
Identification Number	*Description*	*Type*	*Decibel*	*Zone*	*Points of Interest Conflict*	*Decibel*	*Zone*	*Points of Interest Conflict*
T1	Tinian High School	School	< 50	I	No	< 80	I	No
T2	Lake Hagoi	Other	62	I	NA	100	II	NA
T3	Mahalang Ephemeral Ponds	Other	66	II	NA	105	III	NA
T4	Marpo Heights	Residential	< 50	I	No	< 80	I	No
T5	Mount Lasso Overlook Area	Other	71	II	NA	106	III	NA
T6	Bateha 1 - Isolated Wetlands	Other	67	II	NA	106	III	NA
T7	Northeast of Marpo Heights	Residential	< 50	I	No	83	I	No
T8	Bateha 2 - Isolated Wetlands	Other	75	III	NA	108	III	NA
T9	San Jose	Residential	< 50	I	No	< 80	I	No
T10	San Jose Catholic Church	Church	< 50	I	No	< 80	I	No
T11	Tinian Elementary School	School	< 50	I	No	< 80	I	No
T12	Unai Chiget	Other	58	I	NA	96	II	NA
T13	Unai Chulu	Other	61	I	NA	103	II	NA
T14	Unai Dankulo	Other	64	I	NA	104	III	NA
T15	Unai Masalok	Other	55	I	NA	96	II	NA
T16	North Field National Historic Landmark	Other	55	I	NA	98	II	NA
T17	International Broadcasting Bureau	Administrative	***	***	***	***	***	***
T18	Proposed Base Camp (Old West Field)	Base Camp	54	I	No	95	II	No
T19	Northern Marianas College	School	< 50	I	No	< 80	I	No
T20	Ushi Point	Other	< 50	I	NA	97	II	NA
T21	Native Limestone Forest	Other	< 50	I	NA	91	II	NA
T22	Unai Lam Lam	Other	57	I	NA	95	II	NA

Notes: NA – not applicable, see annotation number 1 and shading denotes points of interest inside the Military Lease Area.
***Under Alternatives 2 and 3 the International Broadcasting Bureau mission is relocated.
[1]Other includes sites with cultural, biological, recreational, or other concerns that are unrelated to human factors and are addressed in the applicable resource sections of the CJMT EIS/OEIS.
[2]Noise level threshold is 50 decibels A-weighted day-night average sound level (or decibel ADNL).
[3]Small-caliber ADNL Noise Zones defined as: Zone I (< 55 decibel ADNL; 55-64 decibel ADNL); Zone II (65-69 decibel ADNL; 70-74 decibel ADNL); and Zone III (75-79 decibel ADNL; 80-84 decibel ADNL; > 85 decibel ADNL).
Source: Army Public Health Command 2014.

Large-caliber Weapons

Noise impacts from large-caliber weapons to acres and population would be similar to Tinian Alternative 1 (see Table 4.5-4). For Tinian Alternative 3, outside the Military Lease Area boundaries, there would be the same amount of area (1,300 acres/526 hectares) exposed to Noise Zone II and III levels (62-70 decibels C-weighted) on Tinian as found under Tinian Alternative 1. Additionally, as with Tinian Alternative 1, no people would be impacted by either Noise Zone II or III C-weighted noise levels on Tinian. On Saipan, neither acreage nor people would be impacted by C-weighted day-night average sound levels under Tinian Alternative 3 (see Table 4.5-4). Peak noise levels (see Table 4.5-5), when weather conditions are neutral, would affect a slightly lesser amount of area—519 acres (210 hectares)—on Tinian when compared to Tinian Alternative 1 (521 acres/211 hectares). On Saipan, no acres or people would be affected by Peak noise levels when weather conditions are neutral. When weather conditions are unfavorable; however, Peak noise levels of 115 decibels (see Table 4.5-6) would affect 101 more acres (a little less than 41 hectares) on Tinian when compared to Tinian Alternative 1. The same 80 people would be exposed to Peak noise levels under Tinian Alternative 3 operations as found with the other alternatives. On Saipan, 1,552 acres (628 hectares) and 1,143 people would be exposed to Peak noise levels of 115 decibels as found under the other two alternatives. Similar to Tinian Alternative 1, one Tinian point of interest (T7) would have a moderate potential for risk of complaints when weather conditions are unfavorable (see Table 4.5-9) for Tinian Alternative 3. On Saipan (see Table 4.5-10), five points of interest (S1, S2, S4, S7, and S11) would be exposed to elevated Peak noise levels and thus have the potential for increased risk of noise complaints.

Large-caliber weapons operations associated with Tinian Alternative 3 would result in less than significant direct and indirect noise impacts, and noise levels would be considered compatible with land uses and sensitive receptors.

4.5.3.3.2.2 Airfield and Airspace Based Operations

Tinian Alternative 3 aircraft operations would be identical to Tinian Alternative 1. Proposed annual military operations at Tinian International Airport and North Field are presented in Table 4.5-11 and noise contour bands illustrated in Figure 4.5-6. Under Tinian Alternative 3, A-weighted noise levels of 65 decibels and greater would potentially affect 2,937 acres (1,189 hectares) outside the Military Lease Area. As found under the other two alternatives, approximately 10 residences and 40 people in Marpo Heights (see point of interest T4 on Figure 4.5-6) would be infrequently affected by aircraft noise levels exceeding 65 decibels A-weighted. Because airfield and airspace operations are identical to Tinian Alternative 1, Tinian Alternative 3 aircraft operations would introduce significant direct noise impacts to 10 residences and 40 people in the Marpo Heights area (the same as found under Tinian Alternatives 1 and 2). While this represents a significant change from baseline conditions, operations causing these impacts would occur infrequently. No indirect noise impacts to human receptors would result from airfield or airspace operations.

4.5.3.3.2.3 Waterborne Operations

Noise generated by waterborne activities would be the same as Tinian Alternative 1. Therefore, Tinian Alternative 3 waterborne operations would generate less than significant direct and indirect impacts to land uses and receptors (e.g., people, residential areas, hospitals, and schools).

4.5.3.3.2.4 Traffic

Tinian Alternative 3 operations generating traffic noise would be the same as Tinian Alternative 2. There would be less than significant direct and indirect noise impacts to land uses and receptors.

4.5.3.4 Tinian No-Action Alternative

The periodic non-live-fire military training exercises that occur in the Military Lease Area on Tinian generate noise in association with troop maneuvering, ground vehicles, helicopter and fixed-wing aircraft operations. These military exercises are of short duration (1 to 2 weeks) and have only occurred four times in the past 3 years. If implemented, the four live -fire training ranges included in the Guam and CNMI Military Relocation EIS (DoN 2010a) would produce noise. Military activities on the four ranges would generate less than significant noise levels near existing sensitive receptors (i.e., below 65 decibels A-weighted day-night average sound level) (see Table 6.2-7; DoN 2010a). Similarly, noise generated by aircraft operations within the Mariana Islands Range Complex are not anticipated to elevate noise levels above the established threshold 65 decibels A-weighted day-night average sound level near existing sensitive receptors (see Table 3.5-4; DoN 2010b). Therefore, the Tinian no-action alternative would result in less than significant noise impacts.

4.5.3.5 Summary of Impacts for Tinian Alternatives

Table 4.5-18 provides a comparison of the potential impacts to noise resources for the three Tinian alternatives and the no-action alternative.

Table 4.5-18. Summary of Impacts for Tinian Alternatives

Resource Area	*Tinian (Alternative 1)*		*Tinian (Alternative 2)*		*Tinian (Alternative 3)*		*No-Action Alternative*	
Noise	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
On Land	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*LSI*
In-water	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*Not applicable*	*LSI*
Ground-Based Operation	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*LSI*	*LSI*
Airfield and Airspace Based Operations	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*LSI*
Waterborne Operation	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*Not applicable*
Traffic	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*LSI*	*LSI*
Occupational Noise	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*	*NI*	*NI*

Legend: *NI* = no impact; *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.5.4 Pagan

4.5.4.1 Pagan Alternative 1

4.5.4.1.1 Construction Impacts

Construction activities and airfield improvements would not affect any residential properties or noise-sensitive receptors such as schools, and hospitals because none currently exist on Pagan. Construction activities would generate noise due to heavy construction machinery, such as graders, excavators, and some explosive blasting of lava rock. Visitors would be allowed on Pagan but noise levels generated by construction activities at the airfield would be approximately 55-60 decibels at Red Beach and about 68 decibels at Green Beach. No underwater construction is proposed. Pagan Alternative 1 would have less than significant direct or indirect noise impacts generated by construction.

4.5.4.1.2 Operation Impacts

4.5.4.1.2.1 Ground Based Operations

Small-caliber Weapons

The small-caliber weapons proposed for both Pagan alternatives include 9 millimeter and .45 caliber pistols, M16/M4 rifles, and M240 and M249 machine guns. Small caliber weapons expenditures under Pagan Alternative 1 would generate 665,455 rounds fired annually. Figure 4.5-7 and Figure 4.5-8 present the small-caliber A-weighted day-night average sound level contours and the Peak noise levels, respectively. Table 4.5-19 provides the acres affected by small arms noise in Noise Zones II and III. Both alternatives are presented together because they generate very similar noise levels and for easy comparison of area affected.

Pagan Alternative 1, small-caliber munitions expenditures would have the potential to expose, onshore, 1,813 acres (732 hectares) to 65 decibels and greater A-weighted day-night average sound levels. Peak noise levels would affect 8,536 acres (3,456 hectares).

Small-caliber weapons operations would result in no direct or indirect impacts for Pagan Alternative 1. No noise-sensitive land uses (e.g., residences, schools) or people would be affected by A-weighted and Peak noise levels.

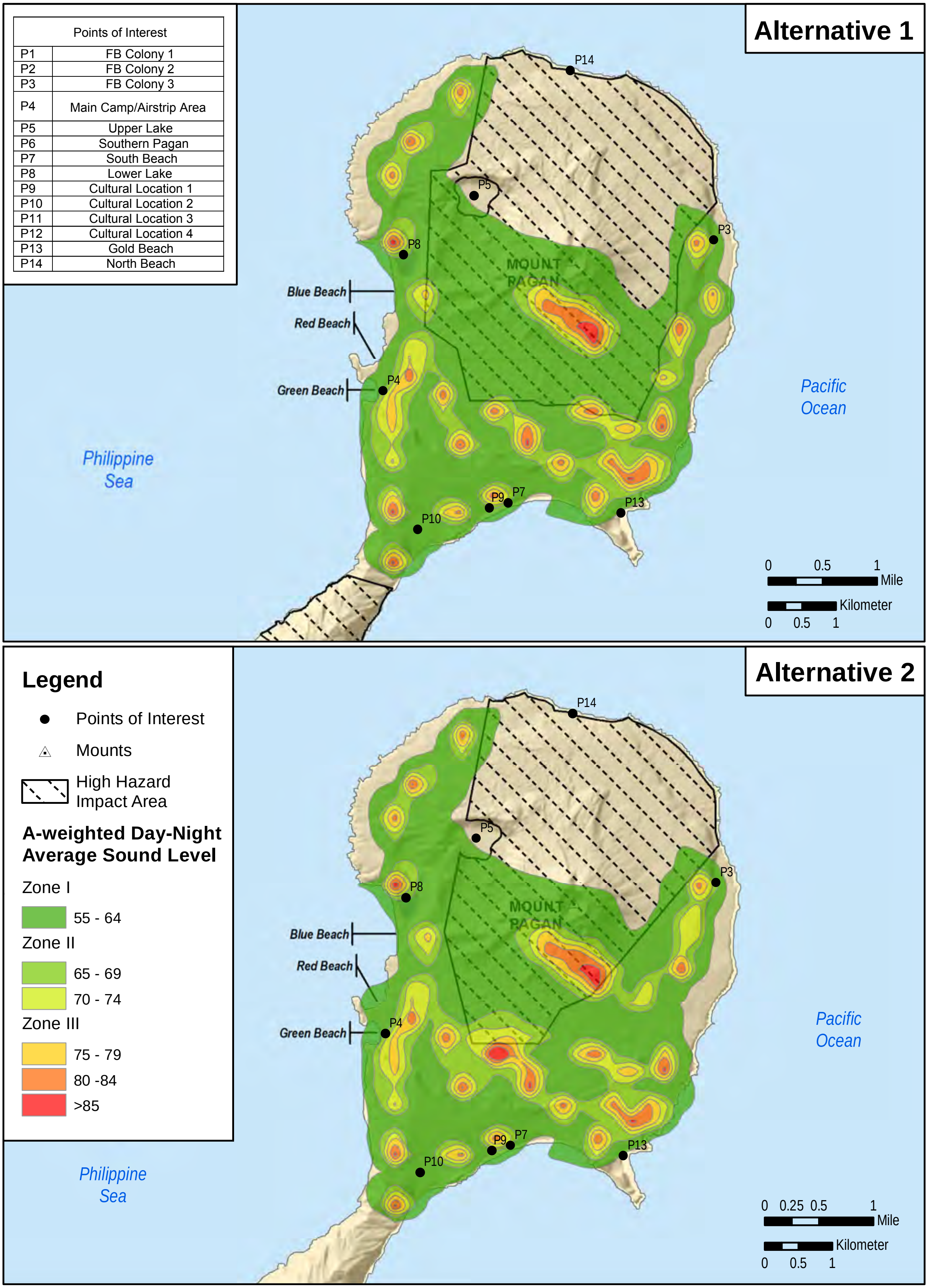
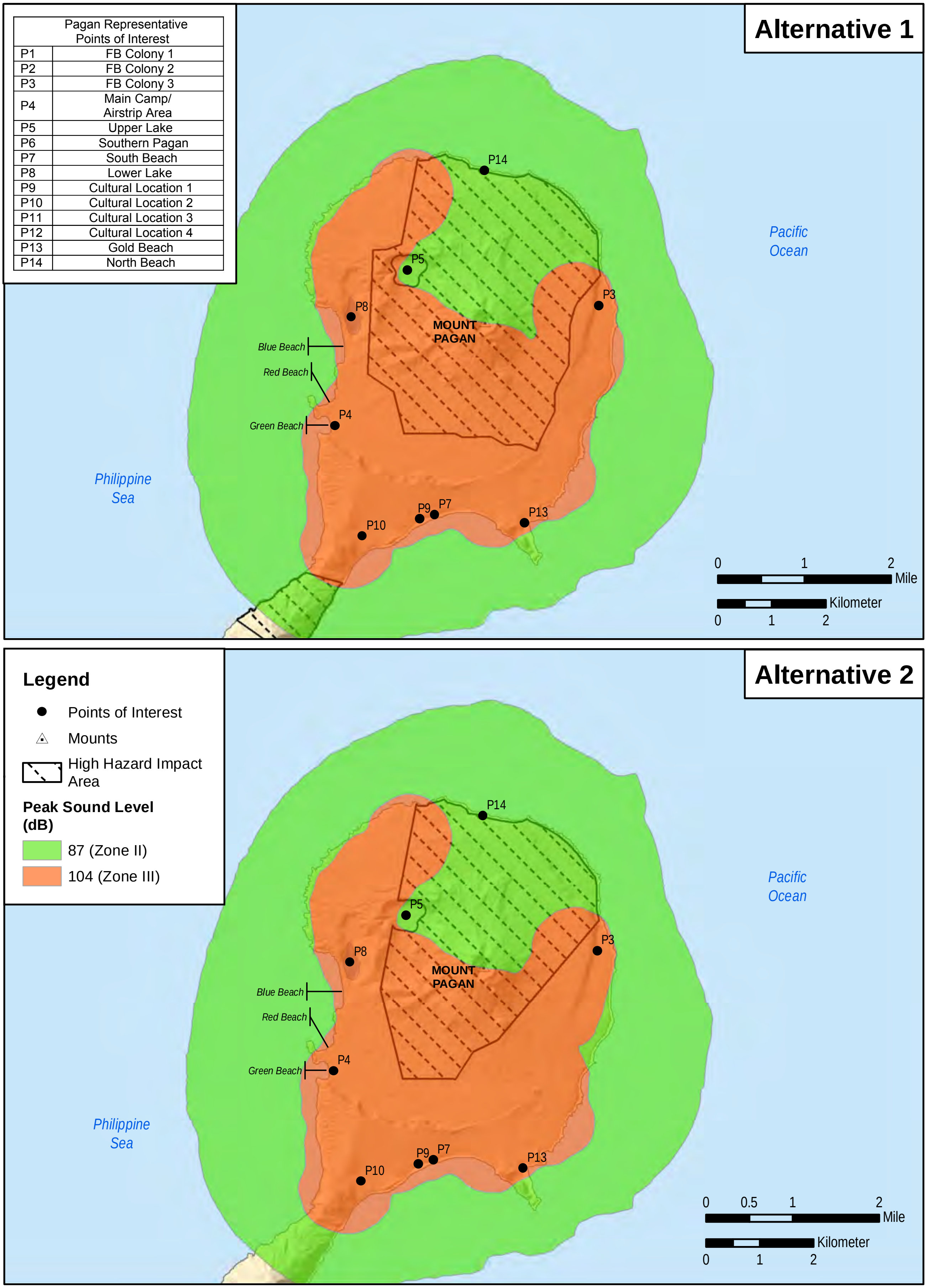


Figure 4.5-7. All Pagan Alternatives Small-Caliber Weapons Noise Levels (A-weighted)



Pagan Representative Points of Interest	
P1	FB Colony 1
P2	FB Colony 2
P3	FB Colony 3
P4	Main Camp/ Airstrip Area
P5	Upper Lake
P6	Southern Pagan
P7	South Beach
P8	Lower Lake
P9	Cultural Location 1
P10	Cultural Location 2
P11	Cultural Location 3
P12	Cultural Location 4
P13	Gold Beach
P14	North Beach

Figure 4.5-8. All Pagan Alternatives Small-Caliber Weapons Noise Levels (Peak)

NORTH

Table 4.5-19. All Pagan Alternatives Affected by Small-caliber Weapons Noise (A-weighted and Peak)

Noise Levels (in decibels)					
On Shore					
Zone II					
A-weighted Day-Night Sound Levels	**Acres/Hectares**		**Peak Noise Levels**	***Acres/Hectares***	
	Alternative 1	**Alternative 2**		**Alternative 1**	**Alternative 2**
65 – 69	819/331	961/398	87-104	2,112/855	2,152/871
70 – 74	530/214	605/245			
Total Zone II	**1,349/545**	**1,566/634**	**Peak Total Zone II**	**2,112/855**	**2,152/871**
Zone III					
75 – 79	302/122	318/128	> 104	6,424/2,601	6,384/2,585
80 – 84	142/57	152/62			
>85	220/8	31/13			
Total Zone III	**464/187**	**500/203**	**Total Zone III**	**6,424/2,601**	**6,384/2,585**
Total On shore	**1,813/732**	**2,066/837**	**Total On shore**	**8,536/3,456**	**8,536/3,456**
Off shore					
Zone II					
65 – 69	4/2	4/2	87-104	10,745/4,350	10,802/4,373
70 – 74	0	0			
Total Zone II	**4/2**	**4/2**	**Peak Total Zone II**	**10,745/4,350**	**10,802/4,373**
Zone III					
75 – 79	0	0	> 104	893	837/339
80 – 84	0	0			
>85	0	0			
Total Zone III	**0**	**0**	**Total Zone III**	**893/362**	**837/339**
Total Off shore	**4/2**	**4/2**	**Total Off shore**	**11,638/4,712**	**11,639/4,712**

Large-caliber Weapons

Large-caliber weapons include live hand grenades, mortars, artillery, and aviation ordnance. Under Pagan Alternative 1, 13,748 large-caliber rounds of ground-delivered ordnance and an additional 13,670 large-caliber rounds of air- and naval-delivered ordnance would be fired in an average year. Table 4.5-20 presents noise generated from Pagan Alternative 1 for C-weighted and Peak (neutral and unfavorable weather conditions); again, both Pagan alternatives are presented. Illustrated in Figure 4.5-9 are the C-weighted day-night average sound level noise contour bands. Figure 4.5-10 illustrates Peak noise levels under neutral weather conditions and Figure 4.5-11 shows Peak noise contours under unfavorable weather conditions. Under Pagan Alternative 1, large-caliber expenditures would expose 8,883 acres (3,595 hectares) of land to noise levels exceeding 62 decibels C-weighted. Visitors may be on Pagan outside of surface danger zones during training activities; however, there would not be any permanent noise-sensitive land uses (e.g., residences, schools) to be affected by C-weighted and Peak noise levels.

Table 4.5-20. All Pagan Alternatives Area Affected by Large-caliber Weapons Noise (C-weighted and Peak)

Noise Zone	Acres/Hectares		
	C-Weighted Day-Night Average Sound Level	Peak Neutral	Peak Unfavorable
Alternative 1			
On Shore			
Zone II/Moderate Complaint Risk	1,120/453	744/301	2,655/1,075
Zone III/High Complaint Risk	7,763/3,142	8,749/3,542	9,138/3,700
Total	**8,883/3,595**	**9,493/3,843**	**11,793/4,774**
Off Shore			
Zone II/Moderate Complaint Risk	17,846/7,222	17,3577,027	108,855/44,071
Zone III/High Complaint Risk	1,880/761	100,315/40,613	112,072/45,373
Total	**19,726/7,983**	**117,672/47,640**	**220,927/89,444**
Alternative 2			
On Shore			
Zone II/Moderate Complaint Risk	943/382	1,069/433	3,521/1,426
Zone III/High Complaint Risk	7,401/2,995	7,393/2,993	8,272/3,349
Total	**8,344/3,377**	**8,462/3,426**	**11,793/4,774**
Off Shore			
Zone II/Moderate Complaint Risk	16,618/6,725	19,127/7,744	119,492/48,377
Zone III/High Complaint Risk	1,822/737	88,996/36,031	101,436/41,067
Total	**18,440/7,462**	**108,123/43,774**	**220,928/89,445**

Notes: Zone II = 62-70 decibels, Zone III >70 decibels for C-Weighted day-night average sound level.
Moderate Complaint Risk = 115-130 decibels, High Complaint Risk is >130 decibels for Peak Noise Level.

Source: Army Public Health Command 2014.

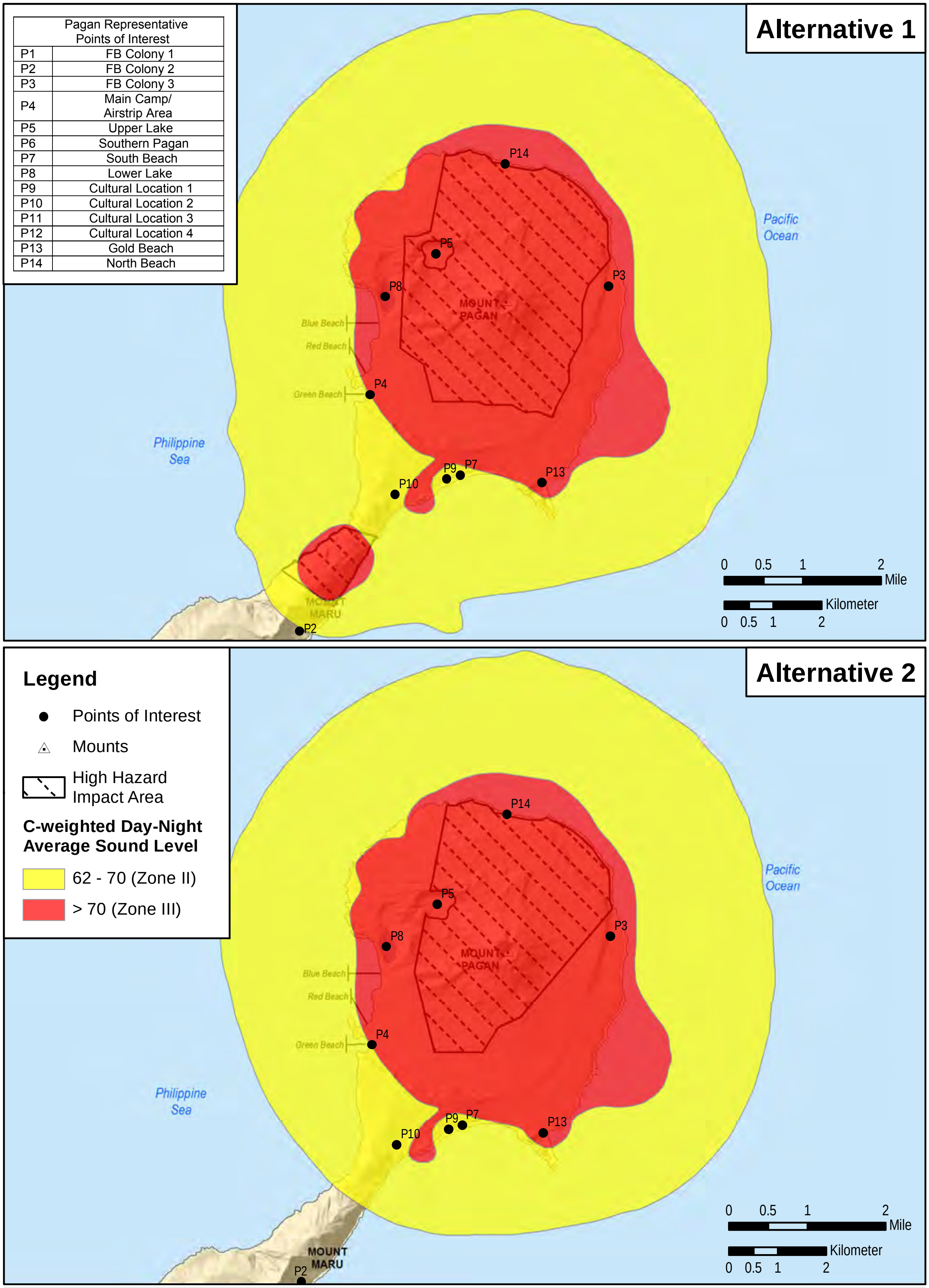
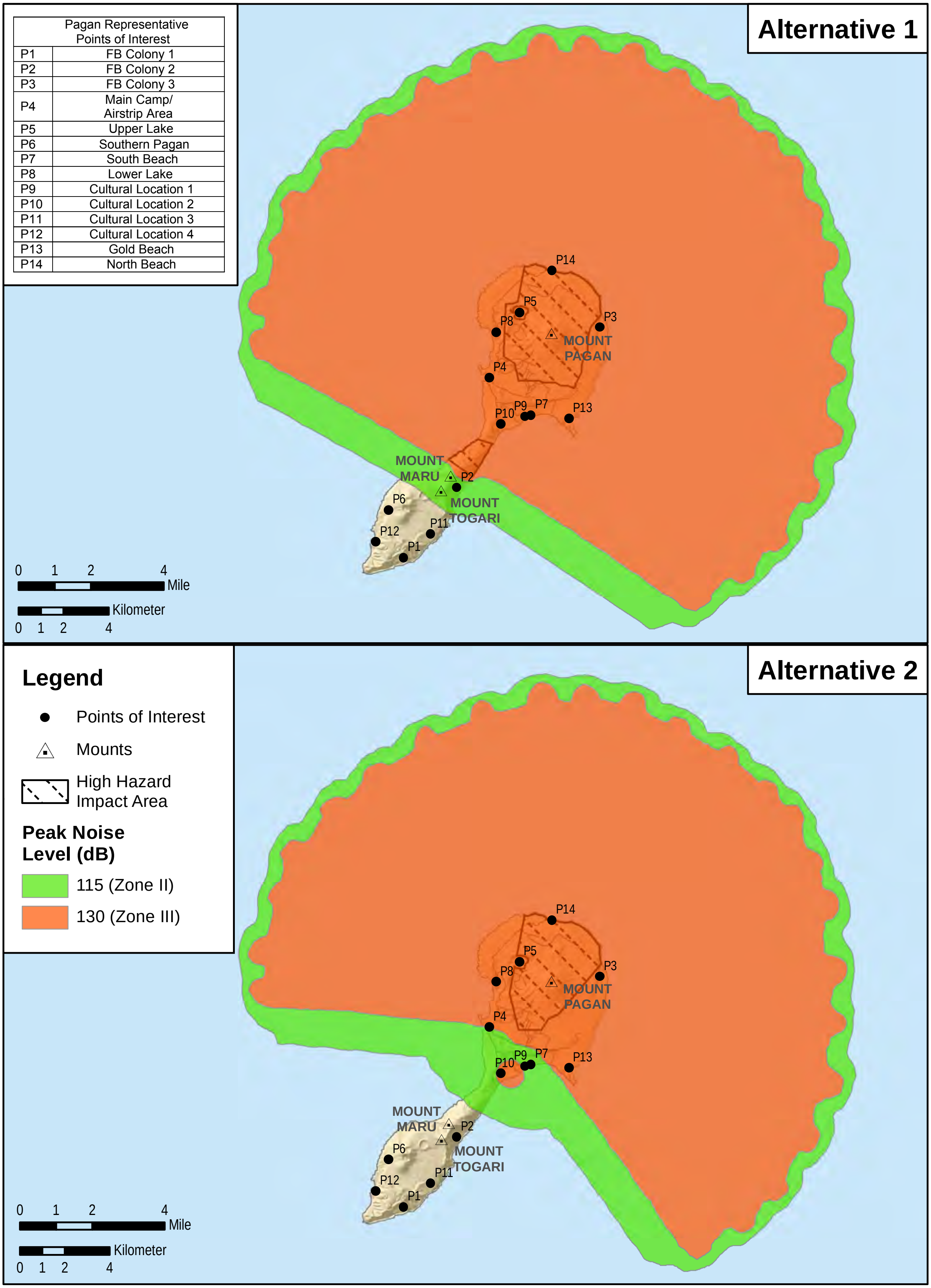


Figure 4.5-9. All Pagan Alternatives Large-Caliber Weapons Noise Levels (C-weighted)

NORTH



Pagan Representative Points of Interest	
P1	FB Colony 1
P2	FB Colony 2
P3	FB Colony 3
P4	Main Camp/ Airstrip Area
P5	Upper Lake
P6	Southern Pagan
P7	South Beach
P8	Lower Lake
P9	Cultural Location 1
P10	Cultural Location 2
P11	Cultural Location 3
P12	Cultural Location 4
P13	Gold Beach
P14	North Beach

Figure 4.5-10. All Pagan Alternatives Large-Caliber Noise Levels Under Neutral Weather Conditions (Peak)

NORTH

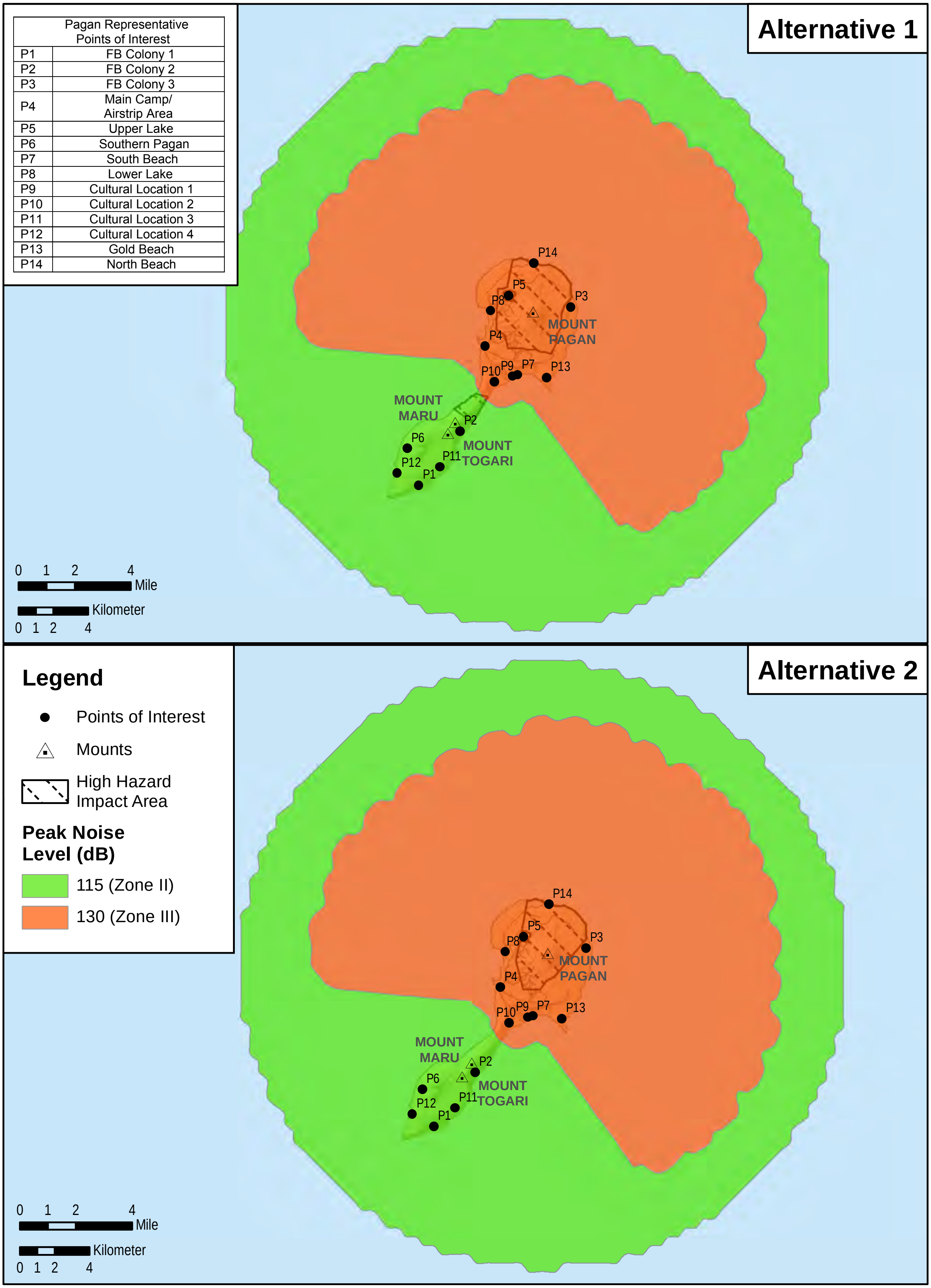


Figure 4.5-11. All Pagan Alternatives Large-Caliber Noise Levels under Unfavorable Weather Conditions (Peak)

Table 4.5-21 presents the C-weighted day-night average sound levels and Table 4.5-22 lists Peak noise levels, respectively, at representative points of interest on Pagan. All points of interest would be exposed to Noise Zones II and III. However, these C-weighted noise levels would be compatible because there are no residences, schools, or hospitals on the island. While there may be visitors on Pagan, the number of visitors is unknown, they would be present for short periods of time, and they are not present outside of southern Pagan during training events. Therefore, estimates for affected population were not included.

Large-caliber weapons operations associated with Pagan Alternative 1 would result in no direct or indirect noise impacts that would cause incompatibilities to sensitive land uses (i.e., residences or schools) or points of interest.

Table 4.5-21. All Pagan Alternatives Points of Interest from Large-caliber Weapon Activity (C-weighted)

Identification Number	*Point of Interest (POI)*	*Type of POI[1]*	*Alternative 1*			*Alternative 2*		
			Decibels	*Noise Zone[2]*	*Noise-Sensitive POI Conflict*	*Decibels*	*Noise Zone[1]*	*Noise-Sensitive POI Conflict*
P1	Fruit Bat Colony 1	Other	55	I	NA	55	I	NA
P2	Fruit Bat Colony 2	Other	62	II	NA	58	I	NA
P3	Fruit Bat Colony 3	Other	74	III	NA	74	III	NA
P4	Main Camp/ Airstrip Area	Transient Lodging	70	III	No[3]	70	III	No[3]
P5	Upper Lake	Other	76	III	NA	77	III	NA
P6	Southern Pagan	Other	56	I	NA	55	I	NA
P7	South Beach	Other	69	II	NA	69	II	NA
P8	Lower Lake	Other	74	III	NA	74	III	NA
P9	Cultural Location 1	Other	69	II	NA	69	II	NA
P10	Cultural Location 2	Other	69	II	NA	69	II	NA
P11	Cultural Location 3	Other	56	I	NA	56	I	NA
P12	Cultural Location 4	Other	55	I	NA	54	I	NA
P13	Gold Beach	Other	74	III	NA	74	III	NA
P14	North Beach	Other	78	III	NA	79	III	NA

Notes: NA – not applicable, see annotation number 1.
[1]Other includes sites with biological, cultural, recreational, or other concerns that are not related to human factors and are addressed in the applicable resource sections of the CJMT EIS/OEIS.
[2]Demolition and large-caliber Noise Zones defined as: LUPZ (57-62 decibel CDNL); Zone I (<57 decibel CDNL); Zone II (62-70 decibel CDNL); and Zone III (>70 decibel CDNL)
[3]POI is human but is a tactical training location and, therefore, considered compatible with these noise levels.
Source: Army Public Health Command 2014.

Table 4.5-22. All Pagan Alternatives Representative Points of Interest Affected by Large-caliber Weapons Noise (Peak)

Point of Interest (POI)			*Alternative 1*		*Alternative 2*	
			Unfavorable Weather Conditions	*Neutral Weather Conditions*	*Unfavorable Weather Conditions*	*Neutral Weather Conditions*
Identification Number	*Description*	*Type*[1]	*Decibel*[2]	*Decibel*[2]	*Decibel*[2]	*Decibel*[2]
P1	Fruit Bat Colony 1	Other	120	< 110	120	< 110
P2	Fruit Bat Colony 2	Other	136	125	124	112
P3	Fruit Bat Colony 3	Other	> 150	147	> 150	147
P4	Main Camp/Airstrip Area	Transient Lodging	139[2]	131[2]	139[2]	128[2]
P5	Upper Lake	Other	> 150	> 150	> 150	> 150
P6	Southern Pagan	Other	121	< 110	121	< 110
P7	South Beach	Other	137	134	137	126
P8	Lower Lake	Other	> 150	146	> 150	146
P9	Cultural Location 1	Other	139	134	139	127
P10	Cultural Location 2	Other	145	134	145	134
P11	Cultural Location 3	Other	121	< 110	121	< 110
P12	Cultural Location 4	Other	119	< 110	119	< 110
P13	Gold Beach	Other	> 150	145	> 150	145
P14	North Beach	Other	> 150	> 150	> 150	> 150

Notes: [1]Other includes sites with cultural, biological, recreational, or other concerns that are unrelated to human factors and are addressed in the applicable resource sections of the CJMT EIS/OEIS.
[2]Noise level threshold is 110 decibel Peak.
[3]Complaint risk areas defined as: low risk of complaints <115 decibel Peak; moderate risk of complaints 115-130 decibels Peak; and high risk of complaints > 130 decibel Peak.
[4]POI is considered a tactical training location and complaint risk correlation does not apply.
Source: Army Public Health Command 2014.

4.5.4.1.2.2 Airfield and Airspace Based Operations

Acres exposed to noise levels exceeding 65 decibels (A-weighted) at and around the airfield are presented in Table 4.5-23 for Pagan Alternatives 1 and 2. Figure 4.5-12 illustrates the noise contour bands. While there are visitors on Pagan, they are not permanent residents, and therefore estimates for affected population were not included.

Table 4.5-23. All Pagan Alternatives Noise Exposure Area at and Around the Airfield (A-weighted)

Contour Band (in decibels)	*Acres/Hectares*	
	On Shore	*Off Shore*
65 – 70	4,608/1,866	1,331/539
70 – 75	153/62	0
75 – 80	0	0
80 – 85	0	0
85+	0	0
Total	**4,761/1,928**	**1,331/539**

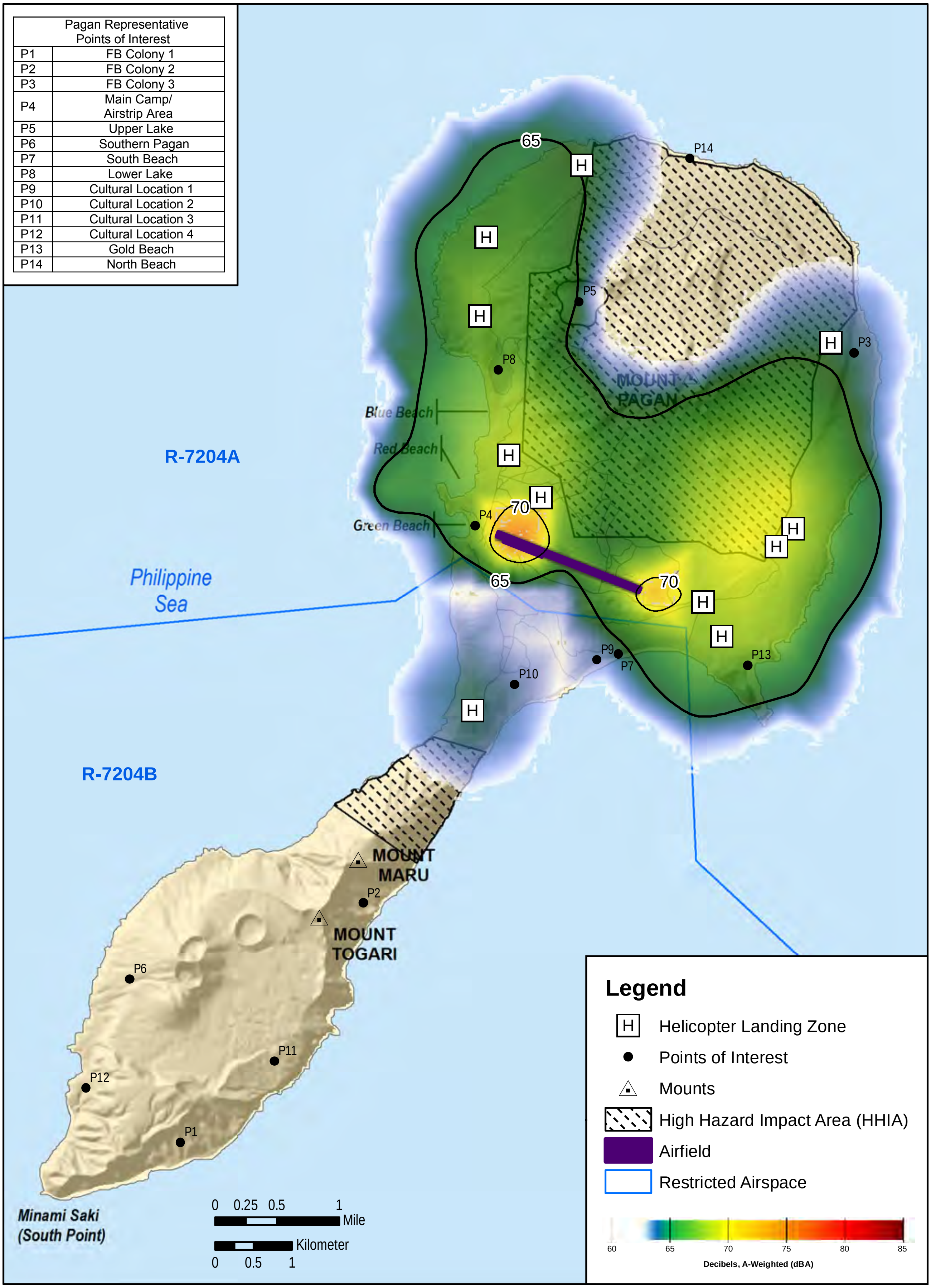


Figure 4.5-12. All Pagan Alternatives Airfield and Airspace Noise Levels (A-weighted)

Under Pagan Alternative 1, 4,761 acres (1,928 hectares) would be exposed to noise levels between 65 and 75 decibels, A-weighted day-night average sound levels generated by airfield activities. Subsonic (i.e., aircraft flying slower than the speed of sound) noise levels resulting from overland aircraft training is depicted in Figure 4.5-12. No sensitive receptors (e.g., schools or hospitals) would be affected and no people live permanently on the island. Supersonic activities (i.e., aircraft flying faster than the speed of sound) would be allowed immediately above and in Special Use Airspace around Pagan. Supersonic activities would be infrequent, occurring about 30 times per year, for approximately 1 minute each time, and above 10,000 feet (3,048 meters) MSL.

Pagan Alternative 1 aircraft operations would result in no direct or indirect noise impacts. No sensitive receptors (e.g., schools or hospitals) or people would be exposed to subsonic or supersonic noise levels.

4.5.4.1.2.3 Waterborne Operations

Waterborne activities would include Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, and Landing Craft Utility for transporting personnel and equipment to Pagan. Of all the vessels planned for use, the Landing Craft Air Cushion operations would be the loudest. During ground run-up conditions Landing Craft Air Cushions generate maximum noise levels of 98 decibels at 200 feet (61 meters), and on water sound exposure levels could be up to 104 A-weighted decibels at 40 knots (74 kilometers per hour) (DoN 2009).

Landing Craft Air Cushion vessels would operate at amphibious landing beaches and near shore of Pagan and generate noise levels of about 74 decibels during ground run-up conditions and 80 decibels at 40 knots (74 kilometers per hour). Amphibious Assault Vehicles would be the next loudest vessels, with sound exposure levels of about 87-88 decibels moving on water or land, and around 72 decibels at a distance of 100 feet (30 meters) while at idle. Landing Craft Utility and Light Armored Vehicles would be used but are smaller and have less horsepower. This would result in noise levels lower than either the Landing Craft Air Cushion or the Amphibious Assault Vehicles.

Underwater operational noise generated by sea-going vessels’ engines would not create noise levels affecting people or sensitive land uses.

Waterborne operations would generate no direct and indirect noise impacts for Pagan Alternative 1 because there are no residences, schools, or hospitals to affect. While there are visitors on Pagan, they do not permanently reside there at the time of this study, and therefore estimates for affected population were not included.

4.5.4.1.2.4 Traffic

Vehicular traffic associated with Pagan Alternative 1 would include movement across the island on equipment brought by the training units, such as wheeled and tracked vehicles.

Pagan Alternative 1 traffic operations would result in no direct or indirect noise impacts because there are neither sensitive receptors (e.g., schools or hospitals) nor people that permanently reside on Pagan at the time of this study who could be affected.

4.5.4.2 Pagan Alternative 2

4.5.4.2.1 Construction Impacts

Noise impacts associated with Pagan Alternative 2 construction activities and airfield improvements would be similar to Pagan Alternative 1. The only differences, which would not change any construction activities identified in Pagan Alternative 1, are that the High Hazard Impact Area on the isthmus would not be established and the northern High Hazard Impact Area would be smaller. Construction activities (including all training and support facilities) and airfield improvements would not affect any permanent residential properties or noise-sensitive receptors such as schools, places of worship, and hospitals, and no underwater construction is proposed as of the time of this study.

Pagan Alternative 2 would result in no direct or indirect noise impacts generated by construction activities.

4.5.4.2.2 Operation Impacts

4.5.4.2.2.1 Ground Based Operations

Small-caliber Weapons

Pagan Alternative 2 small-caliber weapons expenditures would be the same as Pagan Alternative 1. Table 4.5-19 provides the acres affected by small-caliber weapons noise in Noise Zones II and III. Figure 4.5-7 and Figure 4.5-8 present the small-caliber A-weighted day-night average sound level contours and Peak noise levels, respectively. Pagan Alternative 2, A-weighted noise levels would affect 2,066 acres (837 hectares) on shore, an increase of the 253 acres (102 hectares) when compared to Pagan Alternative 1. Peak noise levels would be the same as Pagan Alternative 1 and affect 8,536 acres (3,456 hectares). No permanent noise-sensitive land uses (e.g., residences, schools) or people permanently reside on Pagan at the time of this study that would be affected.

Pagan Alternative 2 small-caliber weapons operations would result in no direct or indirect significant noise impacts. No permanent noise-sensitive land uses (e.g., residences, schools) or people permanently reside on Pagan at the time of this study that would be affected by A-weighted and Peak noise levels.

Large-caliber Weapons

Pagan Alternative 2 large-caliber weapons expenditures would be the same as Pagan Alternative 1. Table 4.5-20 presents noise generated from Pagan Alternative 2 for C-weighted and Peak (neutral and unfavorable weather conditions). Figure 4.5-9 shows the C-weighted day-night average sound level contours, Figure 4.5-10 depicts the Peak noise levels under neutral weather conditions, and Figure 4.5-11 shows the Peak noise contours under unfavorable weather conditions. Under Pagan Alternative 2, large-caliber expenditures would expose 8,344 acres (3,377 hectares) of land to noise levels exceeding 62 decibels C-weighted. When compared to Pagan Alternative 1, this is a decrease of 539 acres (218 hectares). No noise-sensitive land uses (e.g., residences, schools) or people would be impacted by these C-weighted and Peak noise levels. In respect to points of interest (see Table 4.5-21), all would be exposed to Noise Zones II and III. However, these C-weighted noise levels would be considered compatible because there are no permanent residences, schools, or hospitals to affect, and no people permanently reside on Pagan at the time of this study that are present to impose increased risks of complaints from elevated Peak noise levels.

Large-caliber weapons operations would result in no direct or indirect noise impacts for Pagan Alternative 2. No permanent noise-sensitive land uses (e.g., residences, schools) or people permanently reside on Pagan at the time of this study that would be affected by C-weighted and Peak noise levels.

4.5.4.2.2.2 Airfield and Airspace Based Operations

Pagan Alternative 2 aircraft operations would be the same as Pagan Alternative 1. For Pagan Alternative 2, the acres exposed to noise levels exceeding 65 decibels A-weighted, at and around the airfield, are presented in Table 4.5-23; Figure 4.5-12 illustrates the noise contour bands. Pagan Alternative 2 A-weighted day-night average sound levels generated by airfield activities would expose 4,761 acres (1,928 hectares) to noise levels between 65 and 75 decibels, the same as Pagan Alternative 1.

Pagan Alternative 2 aircraft operations would result in no direct or indirect noise impacts. No permanent sensitive receptors (e.g., schools or hospitals) or people permanently reside on Pagan at the time of this study that would be exposed to subsonic or supersonic noise levels.

4.5.4.2.2.3 Waterborne Operations

Underwater operational noise generated by sea-going vessels' engines would not create noise levels affecting people or noise-sensitive land uses.

Pagan Alternative 2 waterborne operations would not generate any direct or indirect noise impacts because there are no permanent residences, schools, or hospitals to affect, and no people permanently reside on Pagan at the time of this study that are present.

4.5.4.2.2.4 Traffic

Vehicular traffic associated with Pagan Alternative 2 would be the same as Pagan Alternative 1. Vehicular traffic would include travel and training across the island by training personnel and their associated equipment.

Pagan Alternative 2 traffic operations would have no direct or indirect noise impacts. There are neither permanent sensitive receptors (e.g., schools or hospitals) nor people permanently reside on Pagan at the time of this study that that would be affected.

4.5.4.3 Pagan No-Action Alternative

The Pagan no-action alternative assumes non-live-fire training on Pagan. Only infrequent visitation of eco-tourism customers or scientific survey personnel would be expected to continue. Military personnel have periodically visited Pagan for search and rescue training and this activity would be expected to continue. The no-action alternative would consist of short term and infrequent activities and would have no noise impacts.

4.5.4.4 Summary of Impacts for Pagan Alternatives

Table 4.5-24 provides a comparison of the potential impacts to noise resources for the two Pagan alternatives and the no-action alternative.

Table 4.5-24. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Noise	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
On Land	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*	*Not applicable*
In Water	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*
Ground-Based Operation	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*
Airfield and Airspace Based Operations	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*
Waterborne Operation	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*
Traffic	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*
Occupational Noise	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*

Legend: *LSI* = less than significant impact; *NI* = no impact.

4.6 AIRSPACE

Section 4.6 describes the impacts that could potentially occur to the existing airspace environment from the proposed action. Potential impacts would stem from the establishment of new Special Use Airspace, including restricted areas, a military operations area, and a warning area. Establishment of these requires rulemaking (restricted areas) and non-rulemaking (military operations and warning areas) actions by the Federal Aviation Administration, per Joint Order 7400.2K. *Procedures for Handling Airspace Matters* (Federal Aviation Administration 2014a). Additional details, including the geographic coordinates, altitudes, and times of use for each proposed area, can be found in Appendix I, *Airspace Technical Memo*.

The analysis of potential impacts to airspace addresses: (1) en route operations, (2) access to public airports, (3) air traffic control services, and (4) measures to mitigate or lessen any impacts. Other potential impacts associated with airspace use are covered in Section 4.5, *Noise;* Section 4.9, *Terrestrial Biology*; and Section 4.15, *Socioeconomics and Environmental Justice*. Impacts to air transportation and airports are addressed in Section 4.13, *Transportation*. In accordance with Federal Aviation Administration, Joint Order 7400.2K, Section 6, paragraph 21-6-1, *Aeronautical Study,* an aeronautical study is required for all restricted areas, military operations areas and warning area proposals (Federal Aviation Administration 2014a). For this EIS/OEIS, the Federal Aviation Administration is preparing two separate aeronautical studies, one for Tinian and one for Pagan. Each aeronautical study will identify impacts of the proposed Special Use Airspace on the safe and efficient use of airspace and air traffic control procedures. Phase I of the study will include an in-depth analysis of aircraft operations and existing flight routes based on radar track data and flight plan information recorded by the Performance Data Analysis and Recording System. Other sources deemed necessary to ensure a comprehensive study will also be used. Phase II of the study will be completed by a team that specializes in airspace use, including representatives of the Federal Aviation Administration, U.S. military, and the CNMI. The aircraft operational data gathered during Phase I will be used to design any new approaches required to minimize effects to airport traffic and define the final airspace configurations and the procedures necessary to meet military mission needs while ensuring the safe and efficient use of the airspace by all users.

4.6.1 Approach to Analysis

The methodology for identifying and evaluating impacts to airspace involves defining the existing controlled and uncontrolled airspace used to manage air traffic operations in the CNMI and the amount of air traffic needing access to the airspace. The airspace used to support airport arrivals and departures as well as existing aviation routes used to transit the CNMI set the stage for defining impacts. Available aircraft operations are used as a gauge for competing aviation interests and in identifying airspace requirements specific to the region. Figure 4.6-1 illustrates the region of influence for airspace impacts.

The analysis of potential impacts to airspace considers both direct and indirect impacts. Impacts are based on the existing environment and representative examples of how training missions would use the proposed airspace (see Appendix H, *Noise Study*).

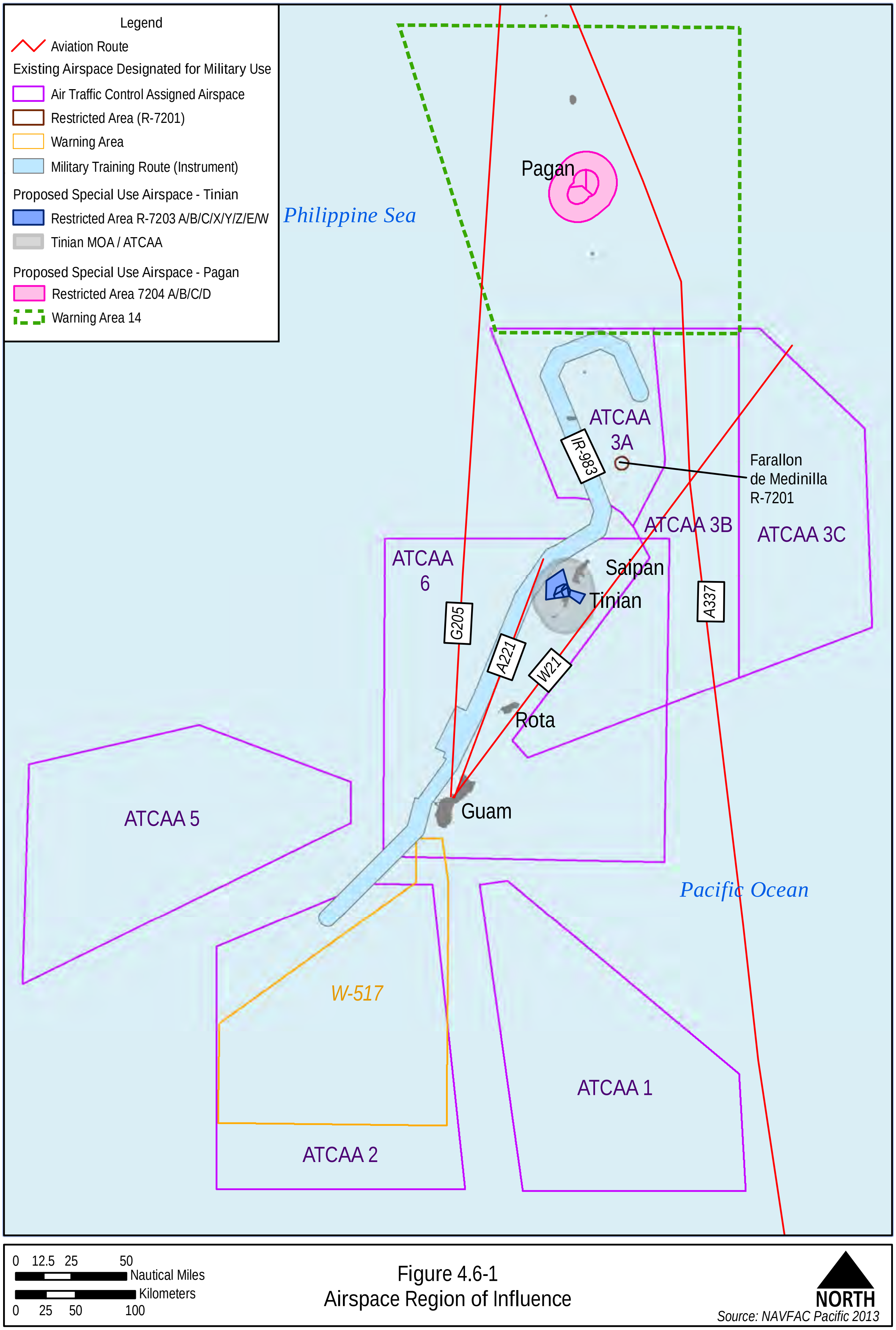


Figure 4.6-1
Airspace Region of Influence

For this EIS/OEIS impacts are identified for the local region of influence and based on the best information available. Therefore, significance was determined qualitatively based on the degree of change as well as regulatory standards where applicable. Direct impacts would be expected to result if use of the proposed airspace would interfere with the safe and efficient use of the airspace or interference with the safe, orderly, and expeditious flow of air traffic. Indirect impacts are based on potential economic impacts (i.e., fuel consumption, additional time needed to transit the airspace) that could occur as a result of changes to published aviation routes, instrument approach procedures, standard instrument departure procedures, or a requirement for visual flight rule air traffic to change from a regular flight course or altitude.

A Notice to Airmen is a notice or advisory distributed by local aviation authorities. It contains information concerning the establishment, conditions, or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel and systems concerned with flight operations. Joint Region Marianas is responsible for ensuring Notices to Airmen are issued prior to airspace activation. Notices to Airmen are available on the Internet at https://www.notams.jcs.mil.

The analysis in this EIS/OEIS is based on the following factors.

- Each airspace unit would be activated as needed for live-fire training.
- The proposed Restricted Areas 7203A/B/C would be charted for use daily from 7:00 a.m. to 10:00 p.m. except for periods with Saipan International Airport flight (large passenger jet or jetliner) activity. The airspace would be activated at other times through Notices to Airmen.
- The proposed Restricted Areas 7203X/Y/Z would be charted for use daily from 7:00 a.m. to 10:00 p.m. with activation at other times through a Notice to Airmen.
- The proposed Restricted Areas 7203E/W, and Tinian Military Operations Area would be charted for use and activated as needed through Notices to Airmen. Tinian Air Traffic Control Assigned Airspace would be requested as needed to extend the Tinian Military Operations Area.
- Restricted Area 7204A/B/C/D, and Warning Areas 14 High and 14 Low would be charted for use and activated as needed through Notices to Airmen.
- Each Restricted Area would be activated as needed from the surface to altitudes between 4,000 feet (1,219 meters) and 18,000 feet (5,182 meters) MSL based on the ranges and weapons to be used and the intent to train with participating aircraft (see Appendix I, *Airspace Technical Memo* for additional detail).
- As depicted in Figure 2.4-18, proposed restricted area 7203 has been segmented into eight individual airspace units, Restricted Area 7203A/B/C/X/Y/Z/E and W. Each restricted area's configuration is based on RTA locations and the distance (both vertical and horizontal) needed to ensure safe separation of military activities from non-participating aircraft. The division of Restricted Area 7203 into eight segments would support optimal management of the ranges and airspace and accommodate airport air traffic and smaller inter-island commuter aircraft travelling between Tinian and Saipan. The segmented airspace was specifically designed to provide for airspace activation of those areas and those altitudes necessary to complete training while minimizing any potential effects on air traffic. The segmentation would ensure that provisions can be made for access to Tinian and Saipan International Airports with minimum delay as required by Federal Aviation Administration Joint Order 7400.2K, paragraph 23-1-4.

Additionally, the segmented airspace supports the current requirement for the fleet of single engine airplanes operating between Tinian and Saipan to remain within glide distance to shore.

- The floor of the proposed Tinian Military Operations Areas was raised from 1,500 feet (457 meters) above ground level to 3,000 feet (914 meters) to accommodate air traffic and eliminate penetration of Saipan International Airport's Class D airspace.
- Individual airspace units on Tinian (Restricted Areas 7203A/B/C/X/Y/Z/E/W) and the Tinian Military Operations Area/Air Traffic Control Assigned Airspace (see Chapter 2, *Proposed Action and Alternatives*, Figure 2.4-14a) would be used either individually or in conjunction with each other depending on the training being conducted. Similarly, Pagan (Restricted Areas 7204A/B/C and Warning Areas 14 High and 14 Low) would be used either individually or in conjunction with each other.
- Training periods on Tinian and Pagan could overlap with each other or be independent of each other.
- The operations estimates are based on the optimum number of mission events required by air and ground forces to maintain combat readiness proficiency levels. Due to variations in missions and pilot tactics, the operational information presented in Appendix H, *Noise Study,* to define altitude distributions and times of day are representative examples of how missions would be flown.

In accordance with Federal Aviation Administration Joint Order 7400.2k, paragraph 23-1-4, the restricted area must exclude the airspace 1,500 feet (457 meters) above ground level and below within a 3 nautical mile (5.6 kilometer) radius of airports available for public use. For this EIS/OEIS it is assumed that Change 2 to Federal Aviation Administration Joint Order 7400.2K, publicized and opened for public comment in November 2014, will be approved as requested by the DoN, in part, to support this proposed action. The order states that a reduction to the 3-nautical mile (5.6-kilometer) exclusionary airspace surrounding Tinian International Airport, may be approved by the Federal Aviation Administration on a case-by-case basis after a risk based analysis is accomplished in accordance with the safety risk management process, and development of a risk resolution implementation plan (Federal Aviation Administration 2015).

4.6.2 Resource Management Measures

The Federal Aviation Administration has regulatory authority over the National Airspace System and all airspace is governed by Federal Aviation Administration policies and procedures; therefore, best management practices and standard operating procedures do not apply to airspace. The U.S. military is, however, committed to limiting impacts to other users of the airspace and is working closely with the Federal Aviation Administration with regards to the establishment of this proposed airspace. The potential mitigation measures identified in this section are currently being coordinated with the Federal Aviation Administration and could be modified during the coordination process. A mitigation plan will be prepared in coordination with Federal Aviation Administration as part of the EIS process. The Department of Defense will continue working with the Federal Aviation Administration to minimize potential impacts and define required mitigation measures.

4.6.3 Tinian

The potential impacts analyzed herein are based on establishment and use of the proposed Restricted Areas 7203A/B/C/X/Y/Z/E and W and the Tinian Military Operations Area as they relate to civilian aircraft operations needing access to the airspace associated with use of the Tinian and Saipan International Airports. Impacts to commercial air traffic on published aviation routes are discussed based on potential interaction with the Tinian Military Operations Area/Air Traffic Control Assigned Airspace. Impacts to navigable airspace as a result of proposed construction projects are addressed as airspace obstructions. Discussion of airspace obstructions includes only the effect of proposed construction projects that would place restrictions on the use of the airspace and that require Federal Aviation Administration review and approval. Details regarding construction and airport improvements are included in Section 4.13, *Transportation*.

The Marine Corps Guam Range Management Division would have the overall responsibility for safety functions during all training events within the RTA on Tinian. These functions would include airspace management, access, aircraft movement, and Special Use Airspace de-confliction surveillance. They are described in detail in Appendix C, *Unconstrained Training Concept for Tinian and Pagan*.

Continued coordination during the Federal Aviation Administration's aeronautical process will include development of the procedures needed to accommodate arrivals, departures and missed approaches to the Saipan and Tinian International Airports. The procedures would set forth appropriate measures to assure the safe passage of all commercial and private aircraft and provide for commercial large passenger jets and jetliners approaching Saipan to be given priority access to the airspace needed to land.

4.6.3.1 Tinian Alternative 1

Tinian Alternative 1 has the potential of impacting the airspace associated with aircraft operations at Tinian and Saipan International Airports, the airspace associated with the transition between Tinian and Saipan, and published commercial routes in the region of influence. The impacts based on the proposed increase in aircraft operations at the Tinian International Airport and establishment of a new military operations area, air traffic control assigned airspace, and restricted area follow.

4.6.3.1.1 Tinian

4.6.3.1.1.1 Increased Operations at Tinian International Airport

The increase in aircraft operations at Tinian International Airport would have direct effects on civilian air traffic. As indicated in Table 4.6-1, there were 48,640 non-military operations at Tinian International Airport in 2013. Approximately 18,656 (i.e., annual average day operations multiplied by 140 days) of the non-military operations could be impacted by the proposed action. These operations would continue to require access to the Tinian International Airport as well as the airspace needed to transit between Tinian and Saipan. This could be expected for some part of each day for up to 20 weeks per year based on the training being conducted.

Table 4.6-1. Change in Tinian International Airport Annual Airport Operations[1,2]

Aircraft Type	Existing Airport Operations	Proposed Airport Operations	Change in Airport Operations
Military	476	9,244	+8,768
GA Single Engine[3]	48,640	48,640	0
Total	**49,116**	**57,884**	**+8,768**

Notes: [1]Operations include departures, arrivals and closed patterns. Closed patterns count as two airport operations, one approach and one departure.
[2]Based on the 2014 to 2040 year-over-year growth rate estimated by the Federal Aviation Administration Terminal Area Forecast (Federal Aviation Administration 2013), air traffic operations for Tinian International Airport would not be expected to change (see also Appendix O, *Transportation Study*).
[3]Air traffic between Saipan International Airport, Tinian International Airport, and Rota International Airport.

As shown in Table 4.6-1, annual operations at Tinian International Airport would be expected to increase by 8,768 operations or an average of approximately 62 operations per day (31 approaches and 31 departures) during some portion of the 20 weeks of training (non-consecutive), although the tempo would fluctuate during the training period. Approximately 45% of the operations (3,898 annual/28 daily) would be related to field carrier landing practice and other practice approaches by fighter aircraft (3,000 annual/21 daily), helicopters (598 annual/4 daily), and MV-22's (300 annual/2 daily). Each airframe would practice multiple approaches during a single flight. The number of approaches is dependent on pilot proficiency requirements. Table 4.5-11, (see Section 4.5, *Noise*), provides detailed information on proposed military operations.

The increase in military air traffic would not restrict access to Tinian International Airport, but civilian flights could experience delays in departures and arrivals during the time when military aircraft are practicing approaches to the runway. Aircraft arrivals and departures would continue to occur on a first come, first serve basis with pilots notifying each other of their intentions via the common traffic advisory frequency or as directed by Air Traffic Control. Pilots flying to and from Saipan would be expected to continue to land and depart using visual flight rules. Guam Combined Center/Radar Approach Control would continue to be responsible for departures and arrivals on published approaches above 3,500 feet (1,067 meters) MSL.

Without mitigation, there is a potential for significant impacts to aircraft needing access to the Tinian International Airport at times when military are practicing field carrier landings. The following potential mitigation measures would minimize direct and indirect impacts to Tinian International Airport arrivals and departures.

Potential mitigation measures include:

- Establish a Letter of Procedure or Joint Use Agreement to accommodate civilian arrivals and departures into the airport.
- Establish communication procedures between Tinian Range Control and Saipan International Airport Air Traffic Control to ensure priority access to Tinian International Airport for life-flight and other emergency-related activities.
- Add positive control measures (e.g., air traffic control tower at Tinian, short-range radar on Tinian or Saipan that would allow air traffic controllers to see aircraft operating below 2,000 feet [609 meters]), and communications capability at Saipan or Tinian to ensure non-participating aircraft are advised of military operations.

Implementation of the above measures and others identified through coordination with the Federal Aviation Administration would reduce impacts to less than significant. The Letter of Procedure and communications procedures would include the procedures necessary to ensure the safe and efficient use of airspace by all users. The addition of a Tactical Air Navigational System and positive control measures would benefit all users of the airspace as air traffic control services would be available to aircraft operating below 2,000 feet (609 meters) MSL.

4.6.3.1.1.2 Tinian Military Operations Area

Activation of the Tinian Military Operations Area independent of the restricted airspace would not be expected to impact commuter flight routes or the departures or approaches to Tinian International Airport.

Tinian Military Operations Area is defined by a 12-nautical mile (22-kilometer) boundary surrounding Tinian with vertical limits from 3,000 feet (914 meters) MSL up to, but not including, 18,000 feet (5,486 meters) MSL with Air Traffic Control Assigned Airspace requested as necessary to support activity at and above 18,000 feet (5,486 meters) MSL.

Pilots transiting between Saipan and Tinian would be expected to fly below 3,000 feet (914 meters) MSL, the floor of the Tinian Military Operations Area. Pilots desiring to fly above 3,000 feet (914 meters) MSL (military and non-military) would need to follow see-and-avoid procedures as they do today to ensure safe separation of aircraft. Pilots desiring not to transit through the active military operations area would need to remain below 3,000 feet (914 meters) MSL.

Aircraft arriving on published approaches into Tinian International Airport would be at or above 2,600 feet (792 meters) MSL within 11 nautical miles (20 kilometers) of the runway and would be descending when they reach the Tinian Military Operations Area boundary (Skyvector 2013). Missed approaches to the runway would climb to 2,800 feet (853 meters) and hold or return for another approach. Aircraft departures would need to remain below 3,000 feet (914 meters) until clear of the military operations area. Air traffic would be expected to remain below 3,000 feet (914 meters) MSL.

The proposed Tinian Military Operations Area would have less than significant impacts to aircraft operations needing access to the airspace to transit between Saipan and Tinian.

4.6.3.1.1.3 Restricted Area 7203

As can be seen in Figure 4.6-2, when active, Restricted Area 7203 would directly impact the existing Tinian commuter aircraft flight path. As non-participating aircraft, civilian aircraft would not be permitted to use the existing flight path while the restricted areas are active without permission of the controlling agency. Although chartered and private flights between islands would continue to be flown under visual flight rules using the most direct route possible, they would need to fly outside of the restricted area or obtain permission from the controlling agency to transit the area. The two major airspace units that would have the most impact to this type of transit are Restricted Area 7203W (west of Tinian) and Restricted Area 7203E (east of Tinian). If only one of these is activated together with the airspace units overlying Tinian (Restricted Area 7203A/B/C/X/Y/Z), civilian aircraft can continue flights on the other side of the island. Rerouting around the west end of the island would increase distance and add time to the flights, while rerouting around the east of the island would not (see more detailed discussion below).

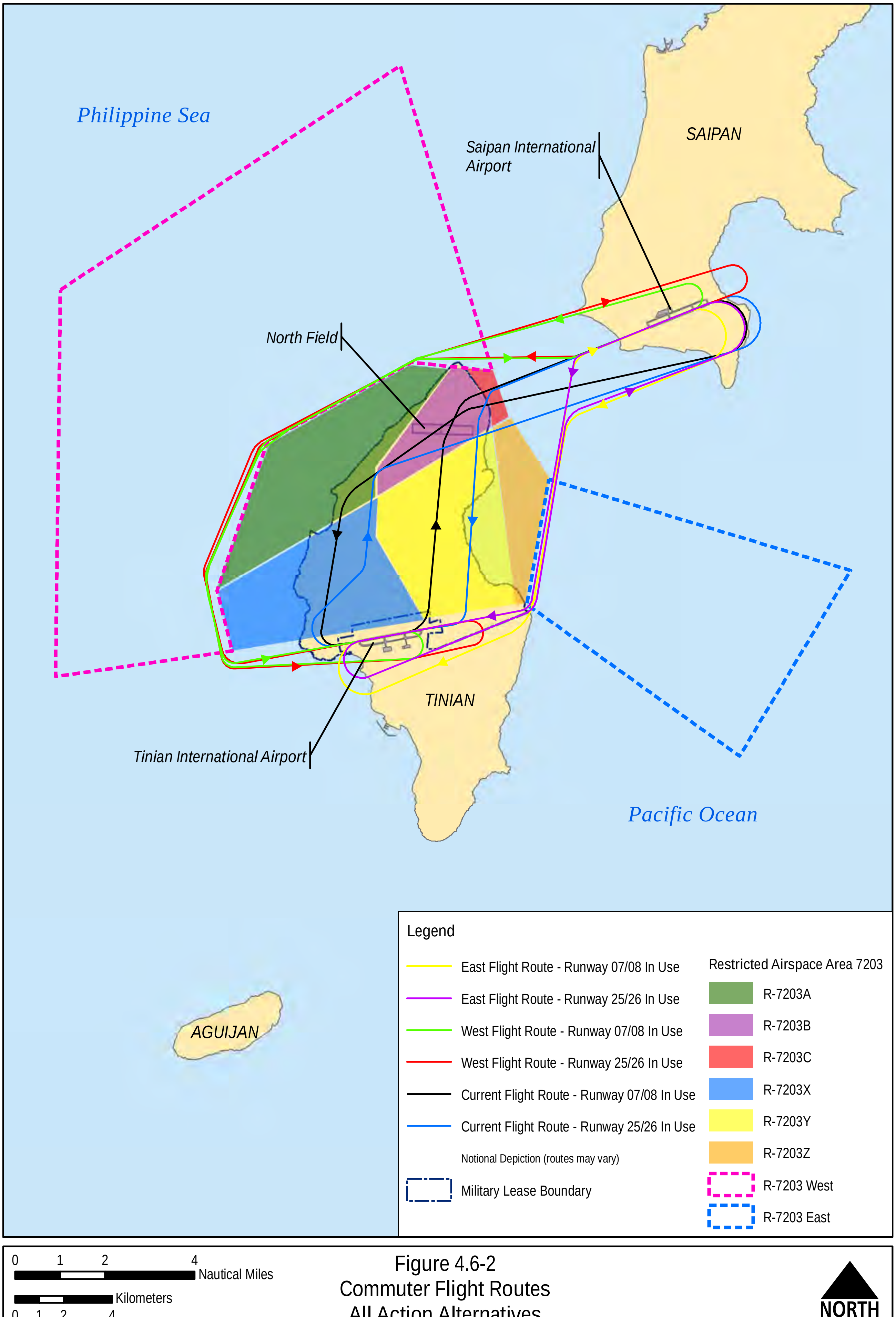


Figure 4.6-2
Commuter Flight Routes
All Action Alternatives

When all airspace units (i.e., Restricted Areas 7203A/B/C/X/Y/Z/E/W) are activated, civilian aircraft could not transit on either side. However, activation of all airspace units at the same time would typically occur only one or two times per week during the 20 weeks of training, and the duration would be two hours or less. With advance notice and coordination, chartered and private flights would be able to plan for these events. Furthermore, the Department of Defense would coordinate with commercial air taxi and charter services to minimize disruptions to their service to the extent possible.

Based on the notional flight paths presented in Figure 4.6-2, it is possible for civilian aircraft to be routed around the airspace when Restricted Areas 7203E and 7203W are not activated together while staying within the minimum safety glide slope. For example, using a 10:1 glide ratio (i.e., for every 10 feet [3 meters] travelled horizontally, 1 foot [0.3 meter] of altitude is lost), the glide distance of a single engine aircraft such as the Piper Cherokee traveling 3,000 feet (914 meters) above ground level at 100 miles per hour (185 kilometers) would be approximately 5 nautical miles (9 kilometers). Under the proposed configuration, aircraft could fly around the active restricted airspace and remain within 2 nautical miles (3.7 kilometers) of shore except for periods when Restricted Areas 7203E and W are activated together. Traveling around Restricted Areas-7203E or 7203W would require aircraft to be more than 10 nautical miles (18 kilometers) from shore. Based on the above safety glide slope example, when the entire restricted area (i.e., Restricted Areas 7203A/B/C/X/Y/Z/E/W) is activated, single engine aircraft used to transit to and from Saipan and Tinian International Airports would not be able to meet the minimum safety glide slope requirements and flight delays would be expected. This could occur for brief periods during the 1-2 hours per day for up to 135 days per year that Restricted Area 7203E is activated for use.

When Restricted Areas 7203E and 7203W are not in use, civilian aircraft could still transit between Saipan and Tinian even if Restricted Areas 7203A/B/C/X/Y/Z are in use. Aircraft could either fly around the east side or the west side. As can be seen in Table 4.6-2, there would be no change in the distance when aircraft can be routed to the east around the restricted areas. Aircraft would experience the greatest change in distance (10 to 12 nautical miles [18 to 22 kilometers, respectively]) when they need to be routed to the west of the restricted areas. This could be required for some portion of the 1-2 hours per day up to 135 days per year when Restricted Area 7203E is active.

Table 4.6.2 Distances between Saipan and Tinian

Runway in Use	***Distance (Nautical Miles)****				
	Existing Flight Path	***East Around Restricted Area***	***Change***	***West Around Restricted Area***	***Change***
Saipan 25	11	11	0	23	+12
Saipan 07	17	17	0	20	+3
Tinian 26	17	17	0	22	+5
Tinian 08	11	11	0	21	+10

Note: *Distances based on notional flight patterns presented in Figure 4.6-2.

When Restricted Area 7203A/B/C/X/Y/Z and E are activated independently of Restricted Area 7203W and aircraft are routed to the west of the airspace, additional time and fuel would be needed. However, less than significant impacts would be expected as this would only occur up to two hours per day for up to 135 days per year. No impacts would be expected with activation of Restricted Area 7203A/B/C/X/Y/Z/W independent of Restricted Area 7203E as aircraft could fly to the east of Tinian without adding time or distance between locations.

Aircraft needing to be routed to the west around the active airspace would experience indirect effects such as additional travel distances, time en route, and fuel consumption. As mentioned earlier, with advance notice and coordination, chartered and private flights would be able to plan for these events. Furthermore, the Department of Defense would coordinate with commercial air taxi and charter services to minimize to the extent possible disruptions to their service.

Activating all Restricted Area-7203 segments together would rarely occur. However, when it does occur, single engine commuter aircraft would not be able to transit the area as they would not meet the minimum safety glide slope requirements. Without mitigation, commuter aircraft needing access to the airspace during the time (up to two hours per day for up to 135 days per year) would be directly and significantly impacted.

Potential mitigation measures include:

- Establish communication procedures to provide immediate feedback between air traffic controllers and range control to accommodate smaller inter-island commuter aircraft travelling between Saipan and Tinian when needed.
- Add positive control measures (e.g., air traffic control tower at Tinian, short-range radar on Tinian or Saipan that would allow air traffic controllers to see aircraft operating below 2,000 feet [609 meters]), and communications capability at Saipan or Tinian to ensure non-participating aircraft are properly separated from restricted area activities.

Once the U.S. military's coordination with the Federal Aviation Administration is complete, less than significant impacts would be expected. The procedures necessary to ensure the safe and efficient use of airspace by all users would be in place. The addition of positive control measures would benefit all users of the airspace as air traffic control services would be available to aircraft operating below 2,000 feet (609 meters) MSL.

4.6.3.1.1.4 Airspace Obstructions

The proposed construction of a Munitions Storage Area is within 3,600 feet (183 meters) of the approach end of Tinian International Airport's Runway 08. The Munitions Storage Area safety arcs are located to the north of the Runway Protection Zone. Federal Aviation Administration regulations and Unified Facilities Criteria prohibiting flights below 500 feet (152 meters) above ground level over ammunition magazines and staging areas while ammunition is being staged or handled would be in place. When Runway 08 is in use, aircraft arriving on published approaches would be expected to be aligned with the runway and outside of the safety arcs. Commuter aircraft approaching the Tinian International Airport would need to fly around the munitions storage area or be at altitudes greater than 500 feet (152 meters) above ground level and implement a circling approach to land. This would occur up to 20 weeks per year that the area is in use. During the times when the military is not training, live munitions would not be stored in the staging area and no restrictions would be required. Runway 26 departures would experience the same restrictions.

Construction of new towers and use of cranes, etc. during construction of base camp facilities requires notification to the Federal Aviation Administration. The Federal Aviation Administration would complete an obstruction evaluation/airport airspace analysis to determine the marking and lighting requirements necessary to ensure flight safety in accordance with Federal Aviation Administration's Advisory Circular 70/7460-1K, *Obstruction Marking and Lighting* (see also Section 4.13.2, *Transportation*).

The International Broadcasting Bureau (see Photo 3.6-2) presents an obstruction to aircraft operating at low altitudes (i.e., below 500 feet [152 meters] above ground level) within Restricted Areas 7203X and 7203A. Strobe lighting marks the antenna array to ensure the antennas are visible to aircraft.

Marking and lighting the proposed communication towers in accordance with Federal Aviation Administration requirements, and publishing an avoidance area around the munitions storage area would minimize potential long-term impacts. Therefore, under Tinian Alternative 1, less than significant impacts to airspace and aircraft safety would occur from the additional airspace obstructions.

4.6.3.1.2 Saipan

Tinian Alternative 1 has the potential of impacting the airspace associated with aircraft operations at Saipan International Airport. No additional air traffic is proposed for Saipan International Airport. Impacts could result from an increase in operations at Tinian North Field, and establishment of the proposed Restricted Areas 7203A/B/C/W and the Tinian Military Operations Area. Impacts to commuter flights between Tinian and Saipan are discussed in Section 4.6.3.1.2.3, *Restricted Area 7203.*

4.6.3.1.2.1 Increased Operations at Tinian North Field

Tinian North Field is located under the Saipan International Airport's approach corridor to Runway 07. Under Tinian Alternative 1, there would be an increase of 2,222 annual operations (Table 4.6-3) at North Field for a total of 2,420 operations (an average of 17 per day during the 20 weeks of live-fire training). Approximately 25% (700 annual or five per night during the 140 days of training) of the operations would be expected to occur during the hours of 10:00 p.m. to 7:00 a.m., the primary time when commercial large passenger jet or jetliners are arriving and departing Saipan International Airport. Section 4.5, *Noise,* Table 4.5-11, provides detailed information on proposed military operations and the type of aircraft proposed for use at Tinian North Field.

Table 4.6-3. North Field Annual Operations[1]

Existing Operations	*Proposed Operations*	*Change in Operations*
198	2,420	+2,222

Note: [1]Operations include departures, arrivals and closed patterns. Closed patterns count as two airport operations, one approach and one departure.

As indicated in Section 3.6.4.3, *Saipan International Airport*, there are approximately 175 operations on an average annual day at Saipan International Airport. Nine flights are the result of scheduled daily international arrivals and departures. Major airlines scheduled arrivals typically occur between the hours of 1:00 a.m. and 9:00 a.m. local time with the majority arriving before 5:00 a.m. Departures occur between the hours of 2:00 a.m. and 6:00 p.m. with approximately half occurring before 6:00 a.m. (FlightStats 2014). The remaining operations are the result of air taxi, general aviation and military operations, primarily those transitioning between Saipan and Tinian (discussed above). The 2014 to 2040 year-over-year growth rate estimated by the Federal Aviation Administration's Terminal Area Forecast civilian aircraft indicates operations at Saipan International Airport are projected to increase by approximately 1% each year until 2040 when they project 110,348 annual operations (302 operations per day) for arrivals and departures (Federal Aviation Administration 2014). A 1% increase would not be expected to change the results of this analysis.

Existing procedures used to manage aircraft operations and deconflict military and civilian aircraft would be expected to continue. Arrivals and departures would be within Saipan International Airport's Class E airspace where Saipan Air Traffic Control would be responsible for coordinating the movement of air traffic to ensure that aircraft maintain minimum separation for safety. Aircraft performing local training at North Field would continue to maintain radio contact with Saipan Air Traffic Control to ensure de-confliction with civilian carriers' en route to Saipan International Airport. Unscheduled large commercial jets and jetliners requiring access to Saipan International Airport would have priority over military training. Saipan Air Traffic Control would continue to advise civilian aircraft flying under visual flight rules between islands about activity in the area, and all pilots (military and civilian) would be responsible for following see-and-avoid procedures. The addition of 17 aircraft operations per day at North Field during the 140 days of live-fire training and the need to maintain contact with Saipan Air Traffic Control would result in a minimal increase in the number of aircraft requiring handling by Saipan Air Traffic Controllers. Scheduling of aircraft arrivals and departures to deconflict with Saipan commercial large passenger jets and jetliners would minimize any impacts and result in less than significant impacts to Saipan Air Traffic Control as a result of increased operations at Tinian North Field.

4.6.3.1.2.2 Tinian Military Operations Area

Saipan International Airport is located beneath the Tinian Military Operations Area. Their Class D airspace would not intersect with the proposed Tinian Military Operations Area. Class E airspace extends the Saipan Class D airspace by approximately 8 nautical miles (15 kilometers) to the southwest and approximately 5 nautical miles (9 kilometers) to the northeast as shown in Figure 3.6-5 (Section 3.6, *Airspace*). The Class E extension airspace begins at 700 feet (213 meters) MSL and extends up to 4,500 feet (1,372 meters) MSL. The Class E airspace to the north and southwest intersects with the Tinian Military Operations Area.

Saipan's Class E airspace is used to support published approaches and standard instrument departures for Saipan International Airport by major airlines and large commercial jets. It is not used to support commuter aircraft flying under visual flight rules between Islands. As indicated above, there are nine scheduled daily international arrivals and departures with scheduled arrivals typically occurring between the hours of 1:00 a.m. and 9:00 a.m. local time with the majority arriving before 5:00 a.m. Departures occur between the hours of 2:00 a.m. and 6:00 p.m. with approximately half occurring before 6:00 a.m. The Tinian Military Operations Area would not be activated during periods with Saipan International Airport International flight activity and less than significant impacts would be expected. Impacts to commuter aircraft would be the same as discussed above for Tinian.

4.6.3.1.2.3 Restricted Area 7203

Saipan International Airport and their Class D airspace are located outside of proposed Restricted Area 7203. The Class E airspace that extends the Saipan Class D airspace to the southwest and all published approaches to runway 07 intersect with Restricted Areas 7203A/B/C and W. Restricted Area 7203A/B/C would not be activated during times with scheduled Saipan International Airport commercial large passenger jet and jetliner activity. Restricted Area 7203 W would be activated by Notices to Airmen as needed and would not be activated when it would interfere with scheduled commercial large passenger jet or jetliner activity. Published approaches to Runway 25 would not intersect with Restricted Area 7203. Impacts to commuter aircraft would be the same as discussed above for Tinian.

It is anticipated that proper range scheduling procedures would be in place to ensure no significant disruption of unscheduled commercial large passenger jet and jetliners into and out of Saipan International Airport. However, without mitigation, air and ground activities would have the potential to significantly impact current airspace procedures during the 140 days per year that the Restricted Areas 7203A/B/C and W are scheduled and activated for use.

Potential mitigation measures include:

- Establish a Letter of Procedure between the Federal Aviation Administration and the U.S. military that contains the procedures for access to the airspace and gives priority to large commercial aircraft. The agreement would ensure proper range scheduling procedures are in place to ensure no significant disruption of normal flights into and out of Saipan International Airport.
- Electronically monitor each training event through the use of radar and other surveillance equipment such as an expeditionary control tower (Photo 4.6-1) that would continually monitor the airspace to ensure the safety of the flying public during times when training is occurring.

Photo 4.6-1. Expeditionary Control Tower on Humvee

- Schedule and coordinate training events with Saipan International Airport arrivals and departures as to not conflict.
- Establish procedures and communications that allow for air traffic controllers and range controllers to simultaneously see the airspace and ensure priority is given to any aircraft heading to or from Saipan International Airport. In the event of an unforeseen incursion into an active restricted airspace, the simultaneous ability to monitor activities on the ground and in the air should provide the ability to stop any training in seconds.

Once the U.S. military's coordination with the Federal Aviation Administration is complete, less than significant impacts to airspace management and airport operations at Saipan would be expected. Mitigations developed during the coordination process would include the procedures necessary to ensure safe and timely access to Saipan International Airport.

4.6.3.1.2.4 Tinian Air Traffic Control Assigned Airspace

There are four commercial aviation routes (G205, A337, A221, and W21) that could be impacted by the proposed Tinian Air Traffic Control Assigned Airspace (see Figure 4.6-1). No effects to these routes would be expected when Restricted Area 7203 and/or the Tinian Military Operations Area are activated for use. There would be no effects to aircraft operating on A221 independent of impacts to the arrivals and departures to Saipan International Airport.

Airway W21 lies approximately 10 nautical miles (19 kilometers) to the west of Tinian and within the proposed Tinian Military Operations Area/Air Traffic Control Assigned Airspace. Commercial aircraft en route to and from Guam International Airport on W21 would be expected to be in Class A airspace at altitudes greater than 18,000 feet (5,486 meters) and no impacts to air traffic would be expected from activation of the Tinian Military Operations' Area. Air Traffic Control Assigned Airspace 6 begins at

36,000 feet (10,973 meters) MSL. The proposed Tinian Air Traffic Control Assigned Airspace would have a ceiling of 30,000 feet (9,144 meters) MSL, leaving a 6,000-foot (1,829-meter) gap between the two that would support commercial air traffic.

Air Traffic Control Assigned Airspace 3A, 3B, and 3C are located within 30 nautical miles but do not overlap with the proposed Tinian Air Traffic Control Assigned Airspace.

Aircraft using G205 or A337 that are currently routed to the west or east around Air Traffic Control Assigned Airspace 3A/B/C could continue to be routed around the airspace and would not be affected. The gaps between the existing and proposed airspace designated for military use would provide the airspace necessary to continue to route aircraft around the proposed airspace and no changes to the existing procedures would be expected.

The Guam Combined Center/Radar Approach Control would continue to be responsible for recalling the Air Traffic Control Assigned Airspace as needed to support commercial traffic or for re-routing aircraft around or over the Air Traffic Control Assigned Airspace. Scheduling and use of Air Traffic Control Assigned Airspace would continue to be requested from the Federal Aviation Administration on an as-needed basis. The Federal Aviation Administration would continue to release the airspace for military use only when its use would not interfere with air traffic control operations.

Impacts to civilian aircraft using commercial aviation routes G205, A337, and W21 were analyzed in the *Mariana Islands Range Complex Airspace EA/OEA* (DoN 2013). The EA/OEA found no significant impacts to commercial tracks using any of these routes because of low traffic volumes, rerouting, and/or scheduling of aircraft (DoN 2013; see Table 3.2-1). Less than significant impacts would be expected with implementation of Tinian Alternative 1.

4.6.3.2 Tinian Alternative 2

Impacts to the airspace environment would be similar to those described for Tinian Alternative 1 (Section 4.6.3.1). Impacts to each area are summarized below.

Under Alternative 2, impacts to aircraft requiring use of Tinian International Airport would be the same as Alternative 1 (Section 4.6.3.1). The increase in military air traffic would not restrict access to Tinian International Airport but civilian flights could experience delays in arrivals in departures. Aircraft transiting between Saipan and Tinian could be routed around the active airspace and add up to 12 nautical miles (22 kilometers) to their trip each way when needed unless all restricted airspace is activated at the same time. When all restricted areas are activated at the same time, single engine aircraft would not meet the minimum safety glide slope requirements and flight delays would be encountered. Indirect effects including increased fuel consumption and travel time could occur.

Existing procedures used by Saipan Air Traffic Control to manage the airspace and deconflict military aircraft using Tinian North Field and civilian aircraft would continue. Indirect effects to Saipan Air Traffic Control would occur as the increase in operations at Tinian North field would result in a minor increase in the number of aircraft requiring handling by Saipan Air Traffic Controllers.

Impacts of commercial aviation routes would be the same as Tinian Alternative 1. Release of the Air Traffic Control Assigned Airspace for military use only when it would not interfere with commercial operations would ensure no significant impacts to published commercial aviation routes.

Under Alternative 2, impacts to airspace obstructions would be similar to Tinian Alternative 1 (Section 4.6.3.1) with the following exception: the International Broadcasting Bureau would be relocated, eliminating one of the airspace obstructions and resulting in a beneficial impact to airspace obstructions. The required marking and lighting on the proposed communication tower and a published avoidance area around the munitions storage area would minimize the potential for an aircraft mishap. Beneficial impacts to aircraft safety would be expected under Tinian Alternative 2.

With implementation of one or more of the potential mitigation measures described in Section 4.6.3.1, *Tinian Alternative 1*, and continuing coordination with the Federal Aviation Administration to mitigate potential impacts to airport air traffic that would ensure safe and timely access to the airport, less than significant impacts to airspace management or aircraft operations would be expected under Tinian Alternative 2.

4.6.3.3 Tinian Alternative 3

Impacts to the airspace environment would be the same as described for Tinian Alternative 1 (Section 4.6.3.1).

With implementation of one or more of the potential mitigation measures described in Section 4.6.3.1, *Tinian Alternative 1*, and continuing coordination with the Federal Aviation Administration to mitigate potential impacts to airport air traffic that would ensure safe and timely access to the airport, less than significant impacts to airspace management or aircraft operations would be expected under Tinian Alternative 3.

4.6.3.4 Tinian No-Action Alternative

Use of airspace around Tinian during the periodic times when non-live-fire military training occurs on the Military Lease Area of Tinian would include infrequent fixed-wing and helicopter use for training and transport. These activities would be coordinated with local and regional authorities. The duration and frequency of these activities, given recent experience, would be short term. Therefore, impacts to airspace would be less than significant. As documented in the Guam and CNMI Military Relocation EIS (DoN 2010a), there would be no changes in existing airspace configurations in order to accommodate the potential future operations in the planned four live-fire training ranges (see Table 7.2-4; DoN 2010a). Airspace operations within the Mariana Islands Range Complex, would remain similar to current conditions around Tinian (DoN 2010b) airspace configurations would not be altered under the no-action alternative, and when considered collectively, there would be less than significant impacts to airspace under the no-action alternative.

4.6.3.5 Summary of Impacts for Tinian Alternatives

Table 4.6-4 provides a comparison of the potential impacts to airspace resources for the three Tinian alternatives and the no-action alternative.

Table 4.6-4. Summary of Impacts for Tinian Alternatives

Resource Area	*Tinian (Alternative 1)*		*Tinian (Alternative 2)*		*Tinian (Alternative 3)*		*No-Action Alternative*	
Airspace	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Tinian	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*NI*
Saipan	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*NI*

Legend: *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.6.3.6 Summary of Potential Mitigation Measures for Tinian Alternatives

Table 4.6-5 provides a comparison of the potential mitigation measures to airspace resources for the three Tinian alternatives and the no-action alternative.

Table 4.6-5. Summary of Potential Mitigation Measures for Tinian Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*Tinian Phase*	
			Construction	*Operation*
AIRSPACE				
Tinian The increase in military air traffic would not restrict access to Tinian International Airport. Private flights could experience minimal delays in departures and arrivals during the time when military aircraft are practicing approaches to the Tinian International Airport runway. Restricted Area 7203 was segmented to minimize impacts to commuter flight traffic between Tinian and Saipan. Civilian aircraft can be routed around the restricted airspace while staying within the minimum safety glide slope except for periods when Restricted Area 7203A/B/C/X/Y/Z/E/W are activated together. Indirect effects such as increased fuel consumption and time en route could be experienced. No impacts would be expected with activation of the Tinian Military Operations Area.	*SI mitigated to LSI*	• Establish a Letter of Procedure or Joint Use Agreement to accommodate civilian arrivals and departures into the airport. • Establish communication procedures between Tinian Range Control and Saipan International Airport Air Traffic Control to ensure priority access to Tinian International Airport for life-flight and other emergency-related activities. • Add positive control measures (e.g., air traffic control tower at Tinian, short-range radar on Tinian or Saipan that would allow air traffic controllers to see aircraft operating below 2,000 feet [609 meters]), and communications capability at Saipan or Tinian to ensure non-participating aircraft are advised of military operations. • Establish communication procedures to provide immediate feedback between air traffic controllers and range control to accommodate smaller inter-island commuter aircraft traveling between Saipan and Tinian.		X

Table 4.6-5. Summary of Potential Mitigation Measures for Tinian Alternatives

Impacts	Category	Potential Mitigation Measures	Tinian Phase: Construction	Tinian Phase: Operation
Saipan Air and ground activities would have the potential to significantly impact current airspace procedures during the 140 days per year that the Restricted Areas 7203A/B/C and W are scheduled and activated for use. Restricted areas would not be activated during times with scheduled Saipan International Airport commercial large passenger jet and jetliner activity. Existing procedures used to manage aircraft operations at Tinian North Field and deconflict military and civilian aircraft would be expected to continue.	*SI mitigated to LSI*	• Establish a Letter of Procedure between the Federal Aviation Administration and the U.S. military that contains the procedures for access to the airspace and gives priority to large commercial aircraft. The agreement would ensure proper range scheduling procedures are in place to ensure no significant disruption of normal flights into and out of Saipan International Airport. • Electronically monitor each training event through the use of radar and other surveillance equipment such as an expeditionary control tower that would continually monitor the airspace to ensure the safety of the flying public during times when training is occurring. • Schedule and coordinate training events with Saipan International Airport arrivals and departures as to not conflict. Establish procedures and communications that allow for air traffic controllers and range controllers to simultaneously see the airspace and ensure priority is given to any aircraft heading to or from Saipan International Airport. In the event of an unforeseen incursion into an active restricted airspace, the simultaneous ability to monitor activities on the ground and in the air should provide the ability to stop any training in seconds.		X

Legend: *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.6.4 Pagan

There would be no differences in proposed airspace configurations and designations between the two action alternatives so the discussion below applies to both Pagan Alternatives 1 and 2. In addition to the proposed airspace, use of chaff and flares are proposed for use in offshore areas of Warning Area 14 and Restricted Areas 7204A/B/C under both alternatives.

For each Pagan Alternative, effects are discussed in the areas of airspace management (i.e., how the airspace would be managed to support all users) and the number of aircraft needing access to the airspace (operations). For the airspace designated for military use, effects are discussed based on the connection to other airspace and the ability for the Federal Aviation Administration to manage the airspace in a manner that supports all users of the airspace, additionally use of chaff and flares are discussed as it relates to flight safety. Airspace obstructions are included to cover construction of the proposed communications tower that would require Federal Aviation Administration review to ensure marking in support of airspace safety.

As shown in Chapter 2, *Proposed Action and Alternatives*, Figure 2.5-5, there are two types of Special Use Airspace proposed for Pagan: Warning Areas 14 Low and 14 High, and four Restricted Areas (R-7204A, R-7204B, R-7204C and R-7204D). Each individual proposed airspace segment would be activated as needed based on the training being accomplished. Joint Region Marianas, would be responsible for scheduling the airspace and ensuring Notices to Airmen are issued prior to activation.

The warning areas would be activated when needed for ship-to-shore, air-to-ground, and supersonic aircraft operations. The restricted areas would be activated either independently or together as needed when training with live munitions during ground based training, air-to-ground training, and ship-to-shore training. Maximum altitude for the restricted areas would vary from 4,000 feet (1,219 meters) above ground level to 30,000 feet (9,144 meters) MSL depending upon which systems/activities have been scheduled. Communications equipment would be in place supporting real-time communications between onsite range users, onsite range safety personnel, the Marine Corps Range Control Facility, and air traffic control facilities.

4.6.4.1 Pagan Alternative 1

4.6.4.1.1 Restricted Area

Pagan Airfield lies within Restricted Area 7204B and aircraft not participating in military activities would be prohibited from accessing the airfield when activated for military use. In 2007 there were only 10 aircraft operations recorded for Airfield (detailed information is presented in Table 3.2-1 of Appendix O, *Transportation Study*). Pagan Airfield is located in uncontrolled (Class G) airspace and there are no published approaches or air traffic control services for use of the airspace surrounding the airfield. Pilots of the rare civilian aircraft that might require use airfield are required to use see-and-avoid visual flight rules. Active management of the airspace by the U.S. military during times when training is occurring would minimize any potential impacts to aircraft needing access to the Pagan Airfield. Less than significant impacts would be expected for civilian aircraft desiring to use Pagan Airfield based on the low number of operations.

4.6.4.1.2 Warning Area

As shown in Figure 4.6-1, two existing commercial aviation routes cross within the proposed Warning Area 14, A337, and G205. Aviation route A337 is within 23 nautical miles (43 kilometers) of Pagan and G205 lies within 40 nautical miles (74 kilometers). Neither airway would be impacted if Restricted Area 7204 were activated independently of the warning area. When proposed Warning Area 14 High and Low are activated together, aircraft using these routes could be re-routed around the warning area or Warning Area 14 High could be recalled by air traffic control to allow aircraft to fly over the active airspace.

Air Traffic Control Assigned Airspace 3A lies approximately 60 nautical miles (111 kilometers) south of Pagan and its northern border forms the southern border of proposed Warning Area 14. Air Traffic Control Assigned Airspace 3A is scheduled for use by Joint Region Marianas and controlled by the Federal Aviation Administration Guam Combined Center/Radar Approach Control. Air Traffic Control Assigned Airspace 3 is scheduled for use approximately 160 days per year (see Table 3.6-1). If Warning Area 14 were activated at the same time as Air Traffic Control Assigned Airspace 3, aircraft flying on A337 that have been re-routed to the east around Air Traffic Control Assigned Airspace 3 could experience additional re-routing. Air Traffic Control Assigned Airspace 3 and Warning Area 14 could be scheduled for use during the same time frame or independent of each other. The ongoing coordination with the Federal Aviation Administration would be used to ensure the safe and efficient use of airspace needed to route commercial aircraft outside of the warning area in a manner that would minimize both direct and indirect impacts to commercial aircraft and aviation routes to being less than significant.

Under the proposed action, maximum use of Warning Area 14 would be up to 112 days per year and for as long as 22 hours per day (see Tables 2.5-1 and 2.5-2 for additional details on proposed aircraft operations and munitions use). As described in 3.6.4.4, *Airspace Designated for Military Use*, use of Air Traffic Control Assigned Airspace 3 requires at least one aircraft to continuously monitor the appropriate Guam Combined Center/Radar Approach Control frequency for immediate recall of the altitude/airspace as needed to support commercial air traffic.

Airspace management and commercial operations could be impacted as a result of multiple flight information regions (Guam Combined Center/Radar Approach to the south and Seattle Air Route Traffic Control Center around Pagan and to the north). To minimize impacts from Pagan Alternative 1, coordination with the Federal Aviation Administration is in progress to establish procedures for use, including the possibility of installing long-range radar that could be used to modify flight information region boundaries. Therefore, less than significant impacts to airspace are expected under Pagan Alternative 1.

4.6.4.1.3 Airspace Obstructions

The proposed construction of a field ammunition staging area would result in a restriction to flights arriving and departing the Pagan Airfield. Flight restrictions prohibit flights below 500 feet (152 meters) above ground level over ammunition magazines. Aircraft would need to be routed around the field ammunition staging area or be at altitudes greater than 500 feet (152 meters) above ground level. During times when the military is not training, live munitions would not be stored in the staging area and no restrictions would be required. Because live munitions would not be stored when the RTA is inactive, no impacts would be expected to the few civilian aircraft that use the Pagan airfield.

4.6.4.1.4 Use of Chaff and Flares

Under this alternative, aircraft using Warning Area 14 and Restricted Area 7204 A/B/C would train using electromagnetic countermeasures such as RR-188 Chaff and MJU-10 Flares. It is estimated that approximately 2,400 self-protection chaff and 2,400 flares would be deployed on an annual basis. Flare use would be limited to areas over water and above 500 feet (152 meters) MSL.

Modern chaff (known as “angel hair” chaff) is thinner than a fine human hair and normally ranges in length from 0.3 to 1.0 inch (7.6 to 25.4 millimeters). Chaff is made as small and light as possible so that it would disperse quickly and remain in the air long enough to confuse enemy radar. The chaff proposed for use contains fibers configured to reduce interference with radars operated by the Federal Aviation Administration throughout the National Airspace System. New Federal Aviation Administration radars are sensitive enough to detect chaff so communication of when and where aircraft are training with chaff permits the Federal Aviation Administration to identify and differentiate chaff from natural weather events (such as thunderstorms) (Air Force 2011). Chaff used for training does not interfere with radio communications.

Defensive flares are not explosive; they are magnesium pellets that, when deployed, burn for a short period (approximately 5 seconds) at approximately 1,202 degrees Fahrenheit (650 degrees Celsius). The burn temperature is hotter than the exhaust of an aircraft engine and, therefore, attracts and decoys heat-seeking weapons and sensors targeted on the aircraft. Flares would be ejected downward from altitudes greater than 500 feet (152 meters) and drop behind the aircraft. They burn out after falling approximately 500 feet (152 meters).

Use of chaff and flares would not interfere with the management of the airspace, and no cases of an aircraft being struck by a residual piece of a defensive countermeasure have ever been recorded (Air Force 2011).

No impacts to other users of the airspace would be expected from the use of chaff and flares associated with Pagan Alternative 1.

4.6.4.2 Pagan Alternative 2

Impacts to the airspace environment would be the same as described for Pagan Alternative 1 (Section 4.6.4.1). Less than significant impacts would be expected for civilian aircraft desiring to use Pagan Airfield based on the low number of operations. No impacts to other users of the airspace would be expected from the use of chaff and flares. Based on the availability of airspace in the region and the ability for Air Traffic Control to recall airspace as needed for commercial operations, less than significant impacts to commercial aviation routes would be expected with implementation of Pagan Alternative 2.

4.6.4.3 Pagan No-Action Alternative

Under the no-action alternative, no changes in existing airspace would occur. Airspace around Pagan would remain as Class G airspace. Special Use Airspace would not be needed to accommodate operations on Pagan. Commercial air traffic would not be required to deviate from published commercial aviation routes. Airspace operations within the Mariana Islands Range Complex would remain similar to current conditions. Airspace configurations would not be altered under the no-action alternative, and when considered collectively, there would be less than significant impacts to airspace under the no-action alternative.

4.6.4.4 Summary of Impacts for Pagan Alternatives

Table 4.6-6 provides a comparison of the potential impacts to airspace resources for the two Pagan alternatives and the no-action alternative.

Table 4.6-6. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Airspace	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Pagan	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*

Legend: *LSI* = less than significant impact; *NI* = no impact.

4.7 LAND AND SUBMERGED LAND USE

Section 4.7 addresses potential impacts on land and submerged land use and jurisdictional control. As previously discussed in Chapter 3, land ownership and control include a variety of real estate instruments that convey jurisdictional authority for a given area. Associated with this are differing regulatory requirements for land-based use versus submerged land use. Another important consideration is the understanding that the U.S. federal government does not own land in the CNMI; however, the U.S. does own submerged lands. Though the U.S. federal government can own land in the CNMI, it is U.S. policy to obtain the least interest in the property that will accomplish the public purpose. To that end, jurisdictional control of land in the CNMI is acquired by the U.S. federal government via real estate agreements.

Other resource sections of this EIS/OEIS distinguish construction impacts from operation impacts. Although the actual land acquisition (real estate agreements, such as long-term leases) negotiations would occur prior to the construction, these impacts are long-term and are described as operation impacts. Therefore, construction activities associated with all proposed alternatives would result in no impacts for land and submerged land use that are not otherwise described below as operation impacts.

4.7.1 Approach to Analysis

The analysis of land use compatibility considers existing land uses that would be limited or precluded by the proposed action. The impacts of reasonably foreseeable projects and future land uses that would be precluded by the proposed action are addressed in Chapter 5, *Cumulative Impacts.* Incompatibility of the proposed action with the CNMI plans and policies are discussed in Chapter 6, *Additional Considerations Required by NEPA*. Changes in land uses and management that could directly impact other resource areas are discussed in the respective sections including: Section 4.15, *Socioeconomics and Environmental Justice*, Section 4.5, *Noise*, Section 4.8, *Recreation*, Section 4.9, *Terrestrial Biology*, and Section 4.10, *Marine Biology.* For the purposes of this EIS/OEIS, these impacts are considered indirect impacts under land use and the reader is referred to those other sections. Direct impacts are discussed in this section.

The impact assessment criteria used to evaluate impacts to land and submerged land use is as follows:

- Incompatibility with current or planned land or submerged land use, including potential noise impacts (based on compatible use thresholds)
- New restrictions on public access to land and submerged land
- Change in existing land use that is valued by the community
- Change in federal jurisdictional control of land and submerged land

The significance of impacts was determined based on the degree of change. Public scoping comments and existing CNMI government land use plans were considered in the evaluation and rationale for assigning significance levels to potential impacts. Impacts to land use were considered significant if:

- There are any incompatibilities with current or planned land or submerged land use
- Land uses outside the project area would be constrained by the proposed action

- Public access to land or submerged land that is valued by the community is restricted by the proposed action
- The proposed action reduces or eliminates an existing land use that is unique or important to the community
- Substantial increase in acreage of land or submerged land under federal jurisdictional control

4.7.2 Resource Management Measures

Resource management measures that are applicable to land and submerged land use include the following avoidance and minimization measures:

- Minimize land acquisition (acreage)
- Coordination with the Federal Aviation Administration and the Commonwealth Ports Authority to minimize potential impacts to existing operations at the Tinian International Airport
- Implementation of noise abatement measures
- RTA management
- Military traffic, specifically tracked vehicles, would be routed away from the population center of San Jose
- Preparation of an access plan to ensure that local and federal partners have continued access

4.7.3 Tinian

4.7.3.1 Tinian Alternative 1

4.7.3.1.1 Land Acquisition (Jurisdictional Control)

The U.S. currently has a real estate agreement for nearly two-thirds of Tinian (i.e., the Military Lease Area). During the planning process for the development of the alternatives on Tinian, efforts were made to minimize the acreage of land required for acquisition (see Section 2.3, *Alternatives Development*). However, Tinian Alternative 1 would require acquisition or re-acquisition of lands within and outside of the Military Lease Area.

4.7.3.1.1.1 Land Acquisition (Jurisdictional Control) Within the Military Lease Area

The International Broadcasting Bureau site is located within the Military Lease Area. The current reserved area for the International Broadcasting Bureau is 866 acres (350 hectares). However, the fenced boundary of the facility currently used by the International Broadcasting Bureau is 317 acres (128 hectares). Under Tinian Alternative 1, the International Broadcasting Bureau site would continue to operate and its operations would be limited to the 317-acre (128-hectare) fenced site. Although this reduction of the International Broadcasting Bureau reserved area is considered a change in jurisdictional control, the 549-acre (222-hectare) area that would be returned for use by the federal government is within the Military Lease Area.

As discussed in Section 2.4, *Tinian Alternatives,* Tinian Alternative 1 would require improvements to existing roadways within the Military Lease Area. The federal government transferred jurisdictional control of the public roadways within the Lease Back Area back to the CNMI. Improvements to the public roadways within the Military Lease Area would require a review of the 1999 amendment to the

1984 Tinian lease agreement which addresses roadway ownership and maintenance. A transfer of the public rights-of-way back to the federal government would constitute a change in jurisdictional control.

Since the areas associated with the International Broadcasting Bureau and the public rights-of-way that would be returned for use by the federal government are within the Military Lease Area, the change in jurisdictional control would not result in a significant impact. Therefore, Tinian Alternative 1 would result in a less than significant impact to land use with regard to changes in jurisdictional control.

4.7.3.1.1.2 Land Acquisition (Jurisdictional Control) Outside the Military Lease Area

As shown in Figure 4.7-1, additional lands outside of the Military Lease Area would be acquired or reacquired through long-term real estate agreements. Some of these areas were once a part of the Military Lease Area (prior to 1994). Since the 1975 Covenant and Technical Agreement (see Appendix K, *Summary of Historical Land Use Agreements between the U.S. and the CNMI*), some areas covered under the original lease were returned to the CNMI government through lease amendments in 1993 and 1999 (e.g., Tinian International Airport) and would need to be "reacquired" to support the proposed action (Northern Mariana Islands 1975a, 1975b). Both the Tinian International Airport (formerly known as West Field) and the Port of Tinian are public lands currently under the jurisdiction and control of the CNMI Port Authority. The federal government would reacquire management control over an estimated 460 acres (186 hectares) at the Tinian International Airport and 7 acres (3 hectares) of land (parcels) at the Port of Tinian. In total, 467 acres (189 hectares) of land would transfer to federal jurisdictional control, which is 3% of total land on Tinian. Because of the large amount of land already under federal jurisdictional control, the re-acquisition of 3% of the total land on Tinian would not represent a significant impact. Therefore, Tinian Alternative 1 would result in a less than significant impact to land use with regard to changes in jurisdictional control.

4.7.3.1.2 Submerged Land Acquisition (Jurisdictional Control)

Under Tinian Alternative 1 there would be no change in the jurisdictional control of submerged lands around Tinian. Although areas at the Port of Tinian would be added as part of the new real estate interest for military training on Tinian, the waters of the Port of Tinian (i.e., the harbor) would remain within the jurisdictional control of the CNMI government. Therefore, land acquisition under Tinian Alternative 1 would result in no impact to submerged land use with regard to changes in jurisdictional control.

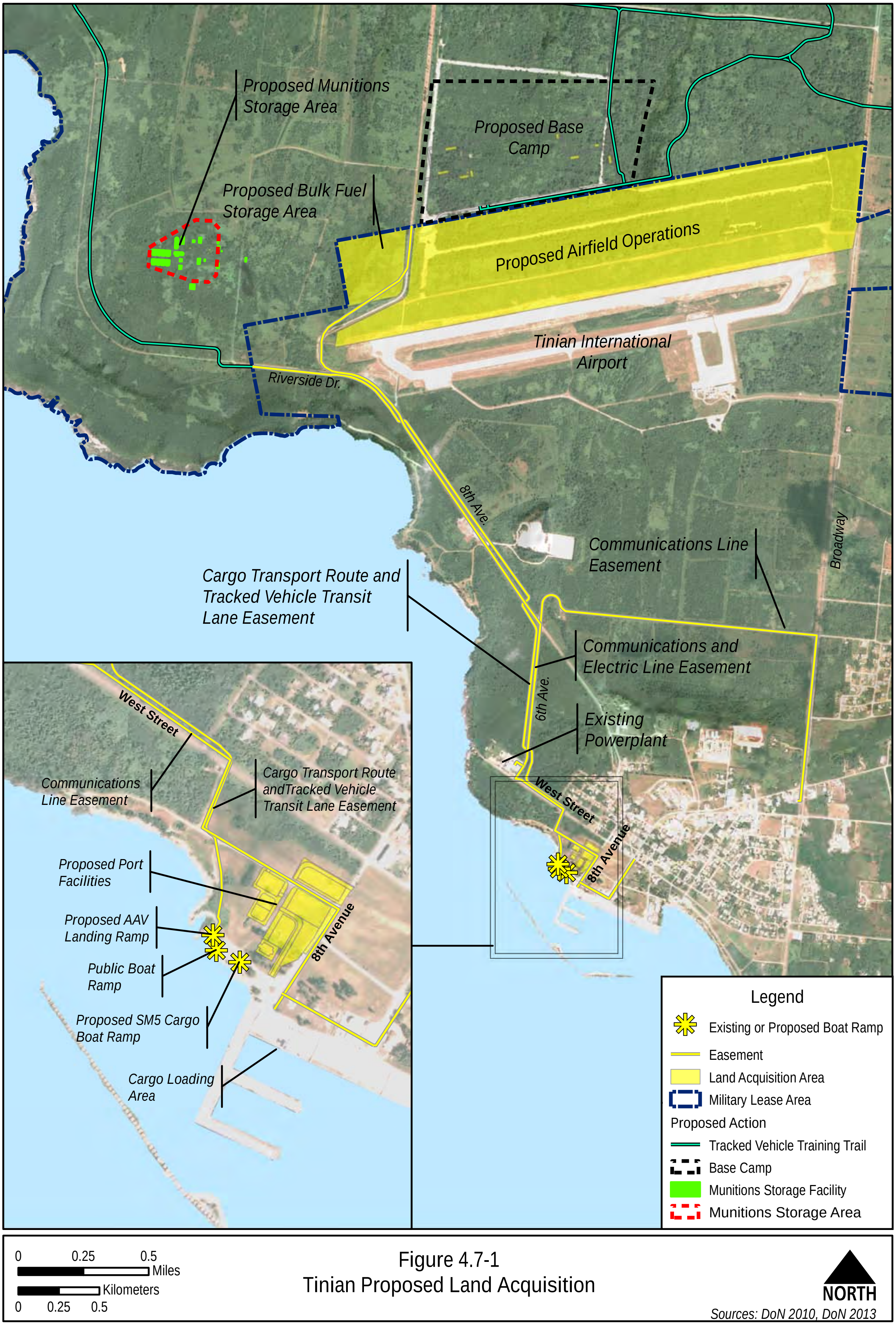


Figure 4.7-1
Tinian Proposed Land Acquisition

4.7.3.1.3 Land Use

4.7.3.1.3.1 Land Use Within the Military Lease Area

Existing and Planned Land Use

As discussed in Section 3.7, *Land and Submerged Land Use*, and shown in Figure 3.7-5, there are multiple current land uses within the Military Lease Area. These include the Exclusive Military Use Area, the International Broadcasting Bureau site, the Tinian Military Retention Land for Wildlife Conservation, and the cattle grazing in the Lease Back Area.

Under Tinian Alternative 1, military training would continue to occur within the Exclusive Military Use Area (i.e., northern portion of the Military Lease Area). This would include live-fire and non-live-fire military training, which is consistent with its intended use. While the military training would increase under Tinian Alternative 1, there are no adjacent designated land uses that would be impacted by the increase in training tempo, and the base camp and other aspects of the proposed action that are proposed along the southern boundary of the Military Lease Area would be compatible with the adjacent rural homesteads and farms.

Under Tinian Alternative 1, the International Broadcasting Bureau installation would remain at its current location. As a quasi-industrial office installation, there is no direct land use conflict between the International Broadcasting Bureau installation and the proposed action under Tinian Alternative 1.

The Tinian Military Retention Land for Wildlife Conservation is a conservation area for the protection of threatened and endangered wildlife. The proposed military training under Tinian Alternative 1 would not be compatible with the existing conservation land use.

Until 2014, the Lease Back Area (i.e., southern portion of the Military Lease Area) supported approximately 2,375 acres (961 hectares) of annual agricultural grazing permits under the Leaseback Agreement between the CNMI and U.S. Although the lease back agreement expired, most of the ranchers still occupy and have been using the land on a month-to-month lease. In January 2015, the lease was extended until the summer of 2016. Under Tinian Alternative 1, land within the Military Lease Area would be removed from agricultural and cattle grazing use.

Tinian Alternative 1 operations would result in land use incompatibilities associated with the Tinian Military Retention Land for Wildlife Conservation and the agricultural and cattle grazing activities in the Lease Back Area. Therefore, Tinian Alternative 1 would result in a significant impact to land use associated with the current and planned land use within the Military Lease Area. With the following potential mitigation measures, the impact to the Tinian Military Retention Land for Wildlife Conservation and the agricultural and cattle grazing would be less than significant.

Potential Mitigation Measures include:

- Four areas are being assessed as potential conservation areas for the protection of the Tinian monarch and other wildlife species (Section 4.9, *Terrestrial Biology;* Figure 4.9-2). These areas may also be used for additional natural resource conservation actions such as forest enhancement and/or invasive species control. The Department of Defense is coordinating with the Federal Aviation Administration and the U.S. Fish and Wildlife Service on these potential conservation areas.

- The DoN has identified and proposed a total of 2,554 acres (1,034 hectares) of land for grazing areas within the Military Lease Area. Of this total 1,010 acres (409 hectares) would be unencumbered and 1,544 acres (625 hectares) would be encumbered by surface danger zones (Figure 4.7-2).

It is likely that the potential mitigation measure regarding conservation areas for the Tinian monarch and other wildlife species would be required as part of section 7 consultation under the Endangered Species Act. The potential mitigation measure for the impact to the Tinian Military Retention Land for Wildlife Conservation would require mitigation monitoring. The DoN would prepare a Forest Enhancement/Restoration and Monitoring Plan that would provide detailed guidance on proposed forest enhancement activities on Tinian as well as long-term monitoring of the success of the proposed forest enhancement measures.

It is likely that the potential mitigation measure identifying grazing areas would be implemented since cattle grazing is important to the local community (see Section 3.15, *Socioeconomics and Environmental Justice*). Mitigation monitoring would not be required for the proposed grazing areas.

Potential impacts to threatened and endangered wildlife associated with the Tinian Military Retention Land for Wildlife Conservation are discussed in Section 4.9, *Terrestrial Biology*. Section 4.15, *Socioeconomics and Environmental Justice*, discusses the potential socioeconomic impacts related to agriculture, including cattle grazing.

4.7.3.1.3.2 Public Access

The Military Lease Area southern boundary would be fenced to restrict access during training activities. Public access is currently restricted within the Military Lease Area during training exercises. Training and access restrictions tend to be limited to the Exclusive Military Use Area. The proposed action would increase the frequency and duration of the public access restrictions, and public access to certain areas (e.g., High Hazard Impact Area) would be prohibited at all times. Areas within the Military Lease Area that would be restricted, including North Field, historic and cultural sites, and beaches, are areas that are valued by the community.

International Broadcasting Bureau staff would also be subject to access restrictions. International Broadcasting Bureau staff would have to request access to the facility during training events. The DoN would work with the International Broadcasting Bureau and ensure access to the facility to minimize any impact to International Broadcasting Bureau operations.

Tinian Alternative 1 operations would result in access restrictions to areas that are valued by the community. Therefore, Tinian Alternative 1 operations would result in significant impacts to land use associated with public access within the Military Lease Area.

The impacts of public access restrictions on uses and resources, such as recreation and socioeconomics, are discussed in their respective resources sections (Section 4.8, *Recreation*, and Section 4.15, *Socioeconomics and Environmental Justice*).

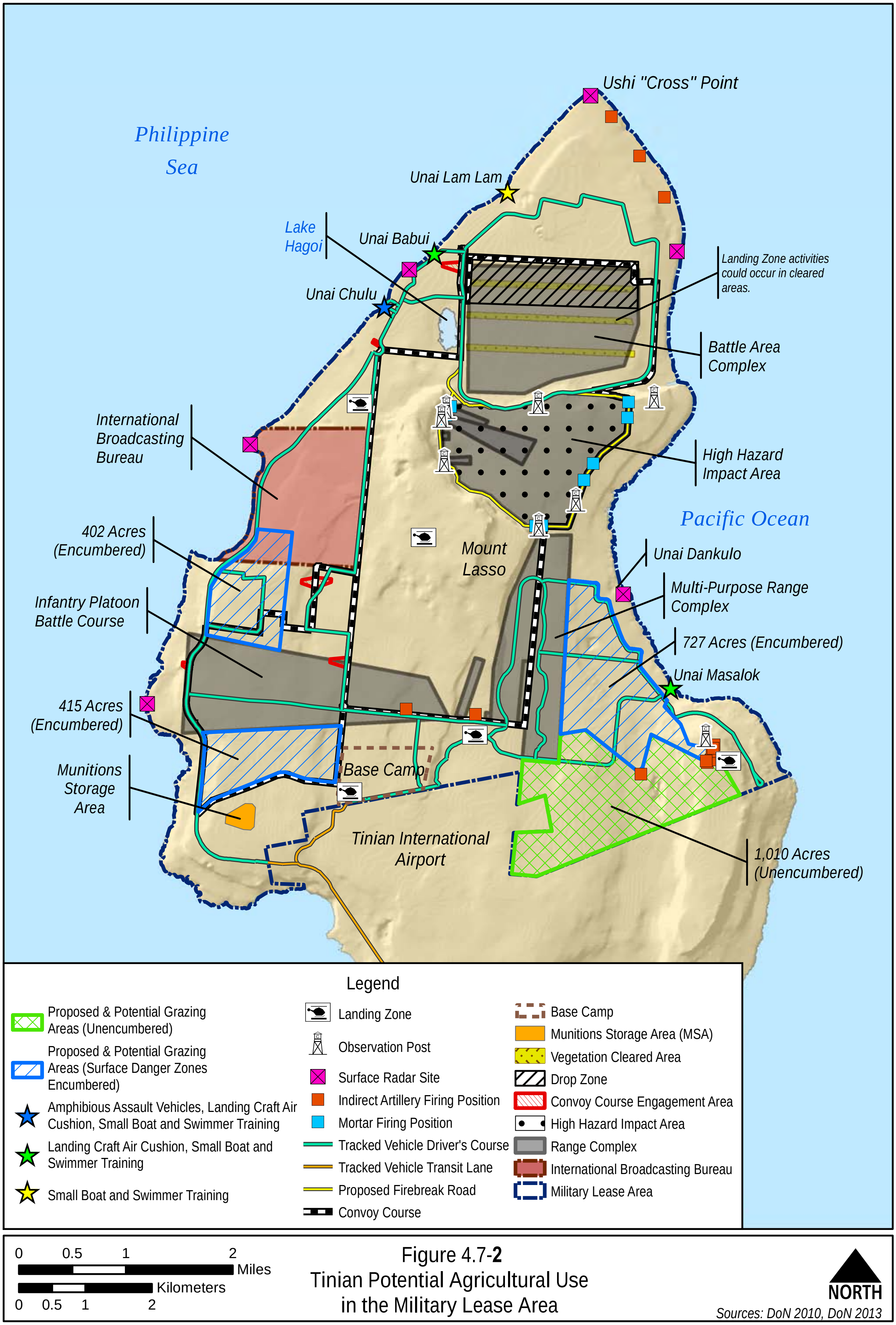


Figure 4.7-**2**
Tinian Potential Agricultural Use in the Military Lease Area

Sources: DoN 2010, DoN 2013

4.7.3.1.3.3 Land Use Outside the Military Lease Area

Existing and Planned Land Use

As discussed in Section 4.7.3.1.1, *Land Acquisition (Jurisdictional Control),* Tinian Alternative 1 would require a change in jurisdictional control of 460 acres (186 hectares) at the Tinian International Airport and 7 acres (3 hectares) at the Port of Tinian.

Land at the Tinian International Airport would need to be reacquired to support proposed improvements. Federal Aviation Administration and Unified Facilities Criteria spacing requirements for airfield operations and facilities dictate the amount of land required for reacquisition. The following improvements and facilities are proposed at the Tinian International Airport:

- Tactical aircraft parking ramp
- Cargo aircraft parking ramp
- Connecting taxiways
- Ordnance arming and de-arming pads
- Hot cargo (i.e., munitions) pad/combat aircraft loading area
- Expeditionary/temporary refueling area
- Arresting gear pads
- Munitions holding pads
- Access roads connecting to the airfield
- LHD Pad (Simulated Flight Deck)
- Flight Carrier Landing Practice Pad

All proposed improvements and facilities are consistent and compatible with existing land uses at the Tinian International Airport. There would be no significant impacts to land use at the Tinian International Airport and some of the proposed improvements would be beneficial to the CNMI airport operations. As discussed in Section 4.13, *Transportation,* close coordination with the Federal Aviation Administration and the Commonwealth Ports Authority (who operate the airport), would ensure that the military operations have limited impacts to existing operations at the Tinian International Airport.

The Port of Tinian currently operates as the only water-based supply point to the island. Nearly all of the supplies brought to Tinian come by way of barge or boat through the Port of Tinian. The existing fuel storage area (owned by Mobil Gas) is the only fuel storage area on the island and provides fuel to the several gas stations on the island. Moving inland from the Port of Tinian (north of West Street) is the most densely populated residential area on the island. Current plans call for a large subdivision (currently platted, but not built), east of 6th Avenue and north of West Street.

Land at the Port of Tinian would need to be acquired to support the following proposed improvements and facilities:

- Biosecurity building
- Vehicle and equipment wash down area
- Vehicle inspection area
- Bulk fuel storage facility
- Parking

- Stormwater retention pond
- Cargo inspection and holding area
- Land improvements in the vicinity of the existing old public boat ramp (to facilitate egress from ramp to roadway)

All proposed improvements and facilities are consistent and compatible with existing land uses at the Port of Tinian.

The primary proposed cargo transport route and tracked vehicle transit lanes were sited to shift the military traffic away from the population center of San Jose. Based on these efforts, the proposed transit corridor for the tracked vehicles to drive from the boat ramp to the Military Lease Area is consistent and compatible with current land uses.

Operations associated with Tinian Alternative 1 would be compatible with existing land uses outside the Military Lease Area. Therefore, Tinian Alternative 1 operations would result in less than significant impacts to land use associated with current and planned land use outside the Military Lease Area.

Public Access

Operations associated with Tinian Alternative 1 would not result in any additional public access restrictions outside the Military Lease Area. Therefore, Tinian Alternative 1 operations would result in no impact to land use associated with public access outside the Military Lease Area.

Noise

Training activities under the proposed action would result in elevated noise levels outside the Military Lease Area on Tinian and in the southwestern portion of Saipan. However, noise levels would be below the compatible use threshold. Tinian Alternative 1 aircraft operations would introduce direct noise impacts to 10 residences in the Marpo Heights area. Training that generates elevated noise levels would be discontinuous and affected land users would be notified in advance of scheduled training. Therefore, Tinian Alternative 1 operations would result in less than significant impacts to adjacent land uses due to elevated noise levels.

See Section 4.5, *Noise,* for a discussion of potential noise impacts resulting from the proposed action.

4.7.3.1.4 Submerged Land Use

4.7.3.1.4.1 Current and Proposed Submerged Land Use

The proposed action would affect coastal uses and resources that are subject to Coastal Zone Management Act federal consistency requirements. The proposed action would be consistent to the maximum extent practicable with the enforceable policies of the CNMI Bureau of Environmental and Coastal Quality.

The proposed action would affect the designated Areas of Particular Concern, as defined by the CNMI Bureau of Environmental and Coastal Quality. Both of the CNMI Areas of Particular Concern and the proposed training areas are shown in Figure 4.7-3. Tinian Alternative 1 would affect the Port and Industrial, Shoreline, Coastal Hazards and Lagoon and Reef Areas of Particular Concern at the Port of Tinian and Tinian Harbor. Because Areas of Particular Concern are CNMI designations, not federal designations, they are considered during the coastal zone consistency determination.

0 0.5 1 2 Miles

0 0.5 1 2 Kilometers

Figure 4.7-**3**
Tinian All Action Alternatives
Areas of Particular Concern

NORTH

Data Sources: DoN 2010, DoN 2013

The proposed action would be consistent to the maximum extent practicable with the Coastal Zone Management Act and the enforceable policies of the CNMI Bureau of Environmental and Coastal Quality. Therefore, operation under Tinian Alternative 1 would result in less than significant impacts to submerged land uses subject to the Coastal Zone Management Act.

4.7.3.1.4.2 Public Access

Submerged lands adjacent to the Military Lease Area would remain under federal jurisdictional control. However, the public access to submerged lands (and the waters above) would be restricted during training events 20 weeks per year. Although there are restrictions that occur with the current level of training, the restricted access would increase in frequency and duration under the proposed action. However, the areas of submerged land that would be restricted are not unique. Therefore, Tinian Alternative 1 operations would result in less than significant impacts to the public access of submerged lands.

The impacts of public access restrictions on uses/resources, such as recreation and marine transportation are discussed in their respective resources sections, Section 4.8, *Recreation,* and Section 4.13, *Transportation.*

4.7.3.2 Tinian Alternative 2

The impacts to land and submerged land use resulting from implementation of Tinian Alternative 2 would be similar to those described in Section 4.7.3.1, *Tinian Alternative 1*. However, land use impacts related to the International Broadcasting Bureau site would be different from those associated with Tinian Alternative 1.

Tinian Alternative 2 would be incompatible with the operation of the International Broadcasting Bureau site located within the Military Lease Area. Within the 8 to 10 year construction period after the Record of Decision and prior to the construction of the southern Battle Area Complex (Range Complex C), the International Broadcasting Bureau facility would cease operations within the Military Lease Area. As necessary, the facility would be relocated outside of the Military Lease Area. The relocation alternatives would be evaluated and would be addressed in another NEPA document (see Section 4.18, *Programmatic Analysis of Future Potential Project Components*). Tinian Alternative 2 would result in the elimination of an existing land use. Therefore, Tinian Alternative 2 would result in a significant impact to land use associated with current and planned uses within the Military Lease Area.

Implementation of Tinian Alternative 2 would result in less than significant impacts to land use with regard to changes in jurisdictional control, to current and planned land use outside the Military Lease Area, to adjacent land uses due to elevated noise levels, and to submerged land use subject to the Coastal Zone Management Act.

Implementation of Tinian Alternative 2 would result in significant but mitigable impacts to current and planned land use within the Military Lease Area.

Implementation of Tinian Alternative 2 would result in a less than significant impact to submerged land use associated with public access.

Implementation of Tinian Alternative 2 would result in no impact to submerged land use with regard to changes in jurisdictional control and no impact to land use outside the Military Lease Area associated with public access.

4.7.3.3 Tinian Alternative 3

The impacts to land and submerged land use resulting from implementation of Tinian Alternative 3 would be the same as those described in Section 4.7.3.2, *Tinian Alternative 2*.

Implementation of Tinian Alternative 3 would result in less than significant impacts to land use with regard to changes in jurisdictional control, associated with current and planned land use outside the Military Lease Area, to adjacent land uses due to elevated noise levels, and to submerged land use subject to the Coastal Zone Management Act.

Implementation of Tinian Alternative 3 would result in significant but mitigable impacts to current and planned land use within the Military Lease Area.

Implementation of Tinian Alternative 3 would result in a less than significant impact to submerged land use associated with public access.

Implementation of Tinian Alternative 3 would result in no impact to submerged land use with regard to changes in jurisdictional control and no impact to land use outside the Military Lease Area associated with public access.

4.7.3.4 Tinian No-Action Alternative

The periodic non-live-fire military training exercises that occur in the Military Lease Area on Tinian consist of troop maneuvering, ground vehicle movements, and helicopter and fixed-wing aircraft operations. This existing non-live-fire military training would continue on Tinian in the Military Lease Area. Several short term military training exercises involving troop maneuvering, vehicular movements, and helicopter/fixed-wing aircraft have occurred on Tinian in the 2012 to 2014 timeframe. There are short term restrictions on public access to the Military Lease Area during these training events. The four live-fire training ranges envisioned in the Guam and CNMI Military Relocation EIS (DoN 2010a) would be established, temporarily restrict public access, and reduce the number of agricultural permits allotted to local residents. However, no changes in land ownership would occur and lands set aside for military use would remain unchanged (see Table 8.2-4; DoN 2010a). No impacts were identified under land use in the Mariana Islands Range Complex EIS/OEIS (see Section 3.12.6; DoN 2010b). Therefore, under the no-action alternative, less than significant impacts to land and submerged land use would be anticipated.

4.7.3.5 Summary of Impacts for Tinian Alternatives

Table 4.7-1 provides a comparison of the potential impacts to land and submerged land use resources for the three Tinian alternatives and the no-action alternative.

Table 4.7-1. Summary of Impacts for Tinian Alternatives

Resource Area	*Tinian (Alternative 1)*		*Tinian (Alternative 2)*		*Tinian (Alternative 3)*		*No-Action Alternative*	
Land Use	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Land Acquisition (Jurisdictional Control)	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*
Submerged Land Acquisition (Jurisdictional Control)	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*LSI*
Land Use Within the Military Lease Area – Existing and Planned Land Use	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*LSI*
Land Use Within the Military Lease Area – Public Access	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*LSI*
Land Use Outside the Military Lease Area – Existing and Planned Land Use	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*
Land Use Outside the Military Lease Area – Public Access	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*LSI*
Land Use Outside the Military Lease Area – Noise	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*
Submerged Land Use – Existing and Planned Land Use	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*
Submerged Land Use – Public Access	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*

Legend: *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.7.3.6 Summary of Potential Mitigation Measures for Tinian Alternatives

Table 4.7-2 provides a summary of the proposed mitigation measures for land and submerged land use resources for the three Tinian alternatives.

Table 4.7-2. Summary of Potential Mitigation Measures for Tinian Alternatives

Impacts	***Category***	***Potential Mitigation Measures***	***Tinian Phase***	
			Construction	***Operation***
LAND AND SUBMERGED LAND USE				
Land Use Within the Military Lease Area – Existing and Planned Land Use There would be land use incompatibilities associated with the Tinian Military Retention Land for Wildlife Conservation and the agricultural and cattle grazing activities in the Lease Back Area.	*SI mitigated to LSI*	• Four areas are being assessed as potential conservation areas for the protection of the Tinian monarch and other wildlife species (Section 4.9, *Terrestrial Biology*, Figure 4.9-2). These areas may also be used for additional natural resource conservation actions such as forest enhancement and/or invasive species control. The Department of Defense is coordinating with the Federal Aviation Administration and the U.S. Fish and Wildlife Service on these potential conservation areas. • The DoN has identified and proposed a total of 2,554 acres (1,034 hectares) of land for grazing areas within the Military Lease Area. Of this total 1,010 acres (409 hectares) would be unencumbered and 1,544 acres (625 hectares) would be encumbered by surface danger zones.		X

Legend: *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.7.4 Pagan

4.7.4.1 Pagan Alternative 1

4.7.4.1.1 Land Acquisition (Jurisdictional Control)

There are currently no federal lands or privately owned lands on Pagan. The CNMI government owns all of Pagan. The federal government would seek to acquire a real estate interest for the entire island of Pagan (approximately 11,794 acres [4,773 hectares]) from the CNMI government. This would result in a substantial increase of acreage under federal jurisdictional control. Therefore, implementation of Pagan Alternative 1 would result in a significant impact to land use with regard to changes in jurisdictional control.

4.7.4.1.2 Submerged Land Acquisition (Jurisdictional Control)

As discussed in Section 3.7, *Land and Submerged Land Use*, the Territorial Submerged Lands Act was amended to convey certain submerged lands to the CNMI government, which included submerged lands around Pagan. The submerged lands around Pagan are now owned by the CNMI government. The federal government would not acquire the submerged lands around Pagan, but would exercise control over surface water during periods of military training to ensure security and safety of the public. There would be no change in jurisdictional control over submerged land around Pagan. Therefore, Pagan Alternative 1 operations would result in less than significant impacts to submerged land use with regard to changes in jurisdictional control.

4.7.4.1.3 Land Use

4.7.4.1.3.1 Current and Planned Land Use

As described in Section 3.7, *Land and Submerged Land Use*, the existing land use is primarily idle (unused) public land. There is no CNMI land use designation for Pagan, so it is therefore assumed to be conservation. During Pagan Alternative 1 operations, proposed training within High Hazard Impact Area would not be compatible with the existing conservation land use. Therefore, Pagan Alternative 1 operations would result in a significant impact to existing conservation land use.

See Section 4.9, *Terrestrial Biology*, for the discussion of the potential impacts to terrestrial biology. See Chapter 5, *Cumulative Impacts*, for a discussion of potential planned land uses, including pozzolan mining and resettlement.

4.7.4.1.3.2 Public Access

Since 1981, Pagan has been largely closed to public access due to volcanic risk. Under the proposed action, the isthmus and northern portion of the island of Pagan would be placed off limits to the public during live-fire training events 16 weeks per year. The remainder of the year all areas of the island, except the High Hazard Impact Areas, would be accessible to the public. While unauthorized (i.e., no use permits obtained from the CNMI government), individual visitors use the land for subsistence. In addition, scientific research and data collection does occasionally take place. There are also some recreation uses, including a few recent ecotourism visits, as discussed in Section 3.8, *Recreation*.

However, current and planned visits to Pagan are infrequent. Therefore, Pagan Alternative 1 operations would result in less than significant impacts to land use associated with public access.

4.7.4.1.4 Submerged Land Use

4.7.4.1.4.1 Current and Planned Submerged Land Use

The proposed use of submerged land by the U.S. military for amphibious training exercises would constitute a change in submerged land use from the present use, conservation. Given the military use would be for 16 weeks per year, other (non-U.S. military) uses could occur during the remainder of the year. Although proposed training would not be consistent with the existing conservation submerged land use, it would still be partially compatible given the limited time that training activities would occur. Therefore, operations associated with Pagan Alternative 1 would result in less than significant impacts to existing submerged land conservation uses.

The proposed action would affect coastal uses and resources that are subject to Coastal Zone Management Act federal consistency requirements. The proposed action would be consistent to the maximum extent practicable with the enforceable policies of the CNMI Bureau of Environmental and Coastal Quality.

The proposed action would affect the designated Areas of Particular Concern, as defined by the CNMI Bureau of Environmental and Coastal Quality. Both of the CNMI Areas of Particular Concern and the proposed training areas are shown on Figure 4.7-4. Pagan Alternative 1 would affect Shoreline and Lagoon and Reef Areas of Particular Concern. Because Areas of Particular Concern are CNMI designations, not federal designations, they are considered during the coastal zone consistency determination.

The proposed action would be consistent to the maximum extent practicable with the Coastal Zone Management Act and the enforceable policies of the CNMI Bureau of Environmental and Coastal Quality. Therefore, operation under Pagan Alternative 1 would result in less than significant impacts to submerged land uses subject to the Coastal Zone Management Act.

The impact on the corals, beaches, and the marine environment are discussed in Section 4.10, *Marine Biology*.

4.7.4.1.4.2 Public Access

For safety reasons, public access to the waters above submerged lands would be restricted during training exercises 16 weeks per year. Danger zones would be instituted to restrict ocean areas, as described in Chapter 2, *Proposed Action and Alternatives*. Since Pagan and the submerged land surrounding the island are infrequently visited, Pagan Alternative 1 would result in less than significant impacts to submerged land associated with public access.

0 0.5 1 Mile

0 0.5 1 Kilometer

Figure 4.7-4
Pagan All Action Alternatives
Areas of Particular Concern

NORTH

Source: USGS 2010

4.7.4.2 Pagan Alternative 2

The impacts to land and submerged land use resulting from implementation of Pagan Alternative 2 would be similar to those described under Pagan Alternative 1 (see Section 4.7.4.1, *Pagan Alternative 1*).

Implementation of Pagan Alternative 2 would result in significant impacts to land use associated with changes in jurisdictional control and current (i.e., conservation) and planned land use.

Implementation of Pagan Alternative 2 would result in less than significant impacts to submerged land use with regard to changes in jurisdictional control, submerged land use associated with current and planned land use, and land and submerged land use associated with public access.

4.7.4.3 Pagan No-Action Alternative

As noted in Chapter 2, the no-action alternative for Pagan would involve no live-fire military training on the island. Periodic visits for eco-tourism, scientific surveys and military use for search and rescue training would be expected to continue, have minimal disruptions to existing conditions and no impacts on the use of land or submerged land on Pagan.

4.7.4.4 Summary of Impacts for Pagan Alternatives

Table 4.7-3 provides a comparison of the potential impacts to land and submerged land use resources for the two Pagan alternatives and the no-action alternative.

Table 4.7-3. Summary of Impacts for Pagan Alternatives

Resource Area	*Pagan (Alternative 1)*		*Pagan (Alternative 2)*		*No-Action Alternative*	
Land Use	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Land Acquisition (Jurisdictional Control)	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*NI*
Submerged Land Acquisition (Jurisdictional Control)	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*
Land Use – Current and Planned Use	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*NI*
Land Use – Public Access	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*
Submerged Land Use – Current and Planned	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*
Submerged Land Use – Public Access	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*

Legend: *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.8 RECREATION

Section 4.8 describes the potential impacts to recreational resources as a result of the proposed action. Restrictions on physical access to recreational resources during the construction and operational phases of the various alternative actions are the most quantifiable and direct anticipated impact. Recreation sites offshore that are encumbered by danger zones would also be subject to impacts from training. These impacts would be more pronounced on the island of Tinian because the island is populated and relies heavily on tourism. Visitors and residents regularly visit recreational, historical, and cultural sites around Tinian. A reduction in access to these sites may have an impact to tourism. Indirect impacts to the enjoyment of recreational resources may also occur, particularly to those resources located outside the Military Lease Area. Pagan is officially uninhabited and does not contain any official recreational areas, although there have been discussions about developing Pagan as an eco-tourism destination and a staging area for visitors to the Marianas Trench National Marine Monument area.

4.8.1 Approach to Analysis

The impact analysis used available data (e.g., field reconnaissance, agency and stakeholder interviews, commercial recreation and tour operator's interviews, existing documentation) and conservative assumptions (e.g., no access at all during the live-fire training periods on Tinian and Pagan) for reduction in recreational use under each alternative. Information from the socioeconomic impact analysis in Section 4.15, *Socioeconomics and Environmental Justice* was also used to prepare this recreational resource analysis. Existing baseline data for the impact analysis are limited because the CNMI agencies and organizations do not collect comprehensive visitor data (e.g., user counts, visitor satisfaction, user comments, and visitor demands).

Both direct and indirect impacts were analyzed. Direct impacts include the following:

- The extended closure and loss of public access, either permanently or intermittently, to recreational resources during construction or operation.
- Training noise considered incompatible with land uses such as parks and playgrounds (as described in Section 4.5, *Noise*).
- Modification to and reduction in quantity, quality, and diversity of recreational opportunities and options.
- Potential destruction, damage or modification to the physical condition of recreational resources located within training areas.

Indirect impacts include the following:

- Increased demand for, and pressure on, recreational resources outside the Military Lease Area.
- Change in the quality of the visitor experience as a result of: (1) permanent or intermittent restricted access to recreational opportunities, and (2) modified or improved access corridors.
- Increase in user conflicts as recreational sites outside of the Military Lease Area experience increased crowding and modified usage.

As discussed in Section 3.8.2, *Regulatory Framework,* several entities are responsible for the management and maintenance of tourist sites and recreational areas on Tinian and Pagan. However, the island of Tinian and the CNMI government have no specific regulatory standards or guidance with regard to recreational resources. Therefore, for the purpose of this analysis, the project alternatives would cause a significant impact to recreational resources if they would:

- Substantially limit or prohibit access to recreational resources
- Substantially permanently or intermittently reduce the number of available recreational opportunities
- Substantially reduce or exceed the capacity of a recreation resource
- Cause substantial conflicts between recreation users
- Cause substantial physical deterioration of recreational resources
- Result in a substantial modification to the user experience across each recreation site
- Have noise impacts at recreation sites greater than the following, which are based on the noise zones used to determine land use compatibility with parks and playgrounds (see Section 3.5.2, *Noise, Regulatory Framework)*:
    - 75 decibels A-weighted (small-caliber weapons and aircraft noise)
    - 70 decibels C-weighted (large-caliber weapons)
    - 104 decibels Peak

4.8.2 Resource Management Measures

Resource management measures that are applicable to recreational resources include the following:

- The DoN would provide proposed training schedules to the U.S. Coast Guard who would issue and broadcast a Notice to Mariners that will identify the location of the danger zones and direct vessel operators to navigate clear of the danger zones during specified time periods.

- Trained observers, or surface radar, would scan the danger zones prior to and during live-fire training to ensure that there are no vessels or individuals within or approaching the danger zone. If vessels or individuals are at risk from operation of the range, the vessel would be contacted via marine radio and instructed to vacate the area and/or alter its course to avoid the danger zone. If required, the range would suspend activities until the vessel has cleared the danger zone.

- The DoN would develop and implement a construction management plan and appropriate traffic management strategies to minimize impacts of construction on access to recreational resources near the construction areas.

- The DoN would prepare an access plan that would detail provisions for public access to the RTA. These provisions would include a range control facility and dedicated range scheduler that would be in place to assess public access in real-time and provide advance notice of restricted public access dates, times, and areas. Range control and the scheduler would coordinate public access directly with the Tinian Mayor’s Office and other interested parties, such as ranchers and entities within the tourism industry. The access plan would also detail access procedures that would be implemented to ensure safety and provide guidance and direction.

4.8.3 Tinian

As discussed in Section 3.8, *Recreation*, Tinian contains the following recreational opportunities:

- Twelve historic and cultural sites
- Eight beaches and parks
- Ocean-based resources, including snorkeling and diving (five sites), recreational fishing, and boating
- Scenic points
- Seven annual events

The majority of these recreational opportunities are located within the Military Lease Area. Specifically, there are 10 historic and cultural sites, 6 beaches and parks, 3 scenic points, and 5 annual events located within the Military Lease Area. In addition, four of the five dive sites would be encumbered by danger zones.

4.8.3.1 Tinian Alternative 1

4.8.3.1.1 Construction Impacts

The construction phase would include various forms of grading, drainage engineering, land clearing, utility installation, and roadway improvements. Construction would take place over a period of 8 to 10 years and would be intermittent. Construction materials and equipment would come through the Port of Tinian and through Tinian International Airport. Materials would be delivered to the construction sites via surface roadways, primarily along an upgraded 8th Avenue. Materials would also be delivered via 72nd Street, 86th Street, and the former runways of North Field.

Introducing slow-moving construction vehicles to the roadways in the Tinian RTA and constructing roads and training facilities would impact the public's access to all recreational resources in the Military Lease Area. The increased traffic and slow operation of construction vehicles could result in negative impacts to visitor access to, and their overall experience of these resources. As previously mentioned, construction would take place on an intermittent basis over a period of 8 to 10 years. Therefore, construction activities would not impede access on a daily basis for the entire construction period.

Use of these roads during construction would require roadway improvements to support heavy construction vehicles. These roadway improvements and upgrades would remain in place upon completion of construction. Therefore, depending on location, Tinian Alternative 1 would improve access to various recreational resources during those times the resources are accessible to the public. This improved access to recreational resources is discussed in detail in the *Roadway and Access Improvements* section below.

Dive sites are primarily accessed via tourist boat operators based at the Port of Tinian; therefore, access to dive sites would not be impacted by land-based construction projects. Boating and diving could be impacted by the increased port congestion and disruption of port traffic, as a result of construction materials passing through the port, and the construction of port and associated roadway improvements. However, increased activity at the port associated with construction would be relatively short-lived and the effects would be temporary.

Unai Chulu would require in-water construction of a landing ramp and removal of areas of limestone on the beach to facilitate access for Amphibious Assault Vehicles. The beach would be closed during construction, which would displace potential visitors. However, the closure would be temporary, and construction is only expected to last up to 8 months.

As discussed in Section 4.3, *Water Resources,* construction activities would disturb sediments and increase turbidity, which could cause an indirect impact to nearshore waters at nearby beaches or dive spots. The construction would be relatively short-lived, and the effects would be temporary; therefore, the indirect impact to nearby beaches or dive sites would be reduced and potentially eliminated.

Tinian Alternative 1 construction activities would preclude access to Unai Chulu during the construction period. As discussed in Section 3.8.4.2, *Beaches and Parks*, Unai Chulu is the only beach within the Military Lease Area that is recommended by the Tinian Dynasty to visitors. It is also known to attract visitor groups for entertainment and picnics. Due to the loss of access, Tinian Alternative 1 construction activities would have a significant impact to Unai Chulu. Although construction would limit or prohibit access to recreational resources within the construction area, this impact would be temporary. Therefore, Tinian Alternative 1 construction activities would result in less than significant direct or indirect impacts to recreational resources.

4.8.3.1.2 Operation Impacts

Tinian Alternative 1 operations would have direct impacts to recreational resources. The most substantial impact to recreation from the training operations would be the closure of the Military Lease Area for up to 20 weeks of training per year, with some areas inaccessible to the public on a year-round basis (i.e., the entire High Hazard Impact Area, the Munitions Storage Area, the base camp, all fenced and gated training areas, Surface Radar, and the range Observation Posts). In general, public access would be allowed to all other locations when training is not occurring. It is envisioned that public access to some or all areas of the RTA, with the exceptions mentioned above, would occur during a couple of daylight hours on a nearly daily basis during the 20 weeks of live-fire training. A range control facility and dedicated range scheduler would be in place to assess public access in real-time and to provide advance notice of public access dates, time frames, and areas. Range control and the scheduler would coordinate public access directly with the Tinian Mayor's Office and other interested parties, such as ranchers and entities within the tourism industry. Access procedures would be implemented to ensure safety and provide guidance and direction. Since the majority of the recreational opportunities on Tinian are located within the Military Lease Area, the limited access would substantially reduce recreational opportunities. The specific impacts and level of significance for each category of recreational resources are discussed in the subsections, below.

4.8.3.1.2.1 Historic and Cultural Sites

Ten of the 12 historic and cultural sites on Tinian are located within the Military Lease Area. Of these 10 historic and cultural sites, 8 would be inaccessible 20 weeks per year during training. Two resources, the Shinto Shrine and the Hinode American Memorial, are located within the proposed High Hazard Impact Area (Range Complex A); therefore, they would be inaccessible year-round. In addition, the High Hazard Impact Area would receive artillery, mortars, aerial gunfire, missiles, rockets, and inert aviation ordnance, which would lead to the physical damage and/or destruction of these two resources.

Since 10 of the 12 historic and cultural sites on Tinian are within the Military Lease Area, Tinian Alternative 1 operations would reduce recreational opportunities associated with historic and cultural sites. As discussed in Section 3.8.4, *Tinian,* there were over 54,000 visitors to Tinian in 2013, and the majority of the visitors are there to visit the historic and cultural sites (DoN 2014).

Tinian Alternative 1 operations would result in the following significant impacts to historic and cultural sites:

- Substantially limit or prohibit access to 10 of the 12 historic and cultural sites on Tinian
- Substantially reduce the number of available recreational opportunities associated with historic and cultural sites on an intermittent basis
- Cause substantial physical deterioration to two historic and cultural sites

Therefore, Tinian Alternative 1 operations would result in significant direct impacts to historic and cultural sites during operation.

Potential mitigation measures, which are detailed below, include scheduling of training events to avoid holidays and annual events and mitigation measures determined as part of the Section 106 process. However, even with mitigation measures, impacts to recreation opportunities (i.e., visitation) to historic and cultural sites would be significant due to intermittent reduction of public access during the 20 weeks of live-fire training, particularly access to the North Field National Historic Landmark and other World War II-era sites.

Potential Mitigation Measures include:

- In as much as possible, training would be scheduled around peak tourist holidays, such as the three World War II anniversaries.
- There is no mitigation currently proposed to minimize this impact to the Shinto Shrine and Hinode American Memorial. The DoN is consulting with the CNMI Historic Preservation Officer and other interested parties regarding impacts to the Shinto Shrine and Hinode American Memorial as part of the Section 106 process (see Appendix N, *Cultural Resources Technical Memo* for a discussion of the consultation process). Potential mitigation will be determined through this consultation process.

Mitigation monitoring would not be required for the development of an access plan or scheduling of training events to avoid holidays. Mitigation monitoring would be required for mitigation measures determined through the Section 106 consultation process. It is likely that these proposed potential mitigation measures would be implemented since tourism is the base of the Tinian economy and visitors tend to participate in multiple activities while on Tinian that include island tours within the Military Lease Area (see Section 3.15, *Socioeconomics and Environmental Justice)*.

4.8.3.1.2.2 Beaches and Parks

There are eight beaches and parks open to the public on Tinian. Five of these beaches are located within the Military Lease Area and would be closed periodically during some portion of each training week up to 20 non-continuous weeks per year. These include the following:

- Unai Lam Lam
- Unai Babui

- Unai Chulu
- Unai Dankulo
- Unai Masalok

All but Unai Dankulo would be used for tactical amphibious training that would involve combat swimmers and small boats coming ashore. In addition to small boat and swimmer training, Unai Babui, Unai Chulu, and Unai Masalok would include amphibious landing training using Landing Craft Air Cushion vessels. With resource management measures (see Section 4.8.2, *Resource Management Measures*), including restoration of beach topography with hand-held tools, tactical amphibious training involving the swimmers, small boats, and Landing Craft Air Cushion vessels would not result in substantial changes to the physical shoreline and wave activity.

Unai Chulu would also include a landing area for Amphibious Assault Vehicles. Unai Chulu would be altered to allow Amphibious Assault Vehicles to come ashore. However, the in-water landing ramp and cleared area of the beach would not impede recreational users from utilizing the resource during non-training times.

There are three publicly accessible beaches and parks on Tinian located outside the Military Lease Area: Kammer Beach, Taga Beach, and Tachogna Beach. These are the most visited beaches on Tinian by both tourists and residents because they are located in San Jose and are near the Dynasty Hotel and Casino where 90% of the visitors to Tinian stay (DoN 2014). These beaches are also the only beaches on Tinian that have shaded picnic sites and pavilions. With other beaches and recreation sites closed in the Military Lease Area during training, these beaches may experience an increase in visitors, including tourists and residents. This could result in the increased use of facilities, parking, and crowding of the shoreline and nearshore waters. The potential crowding and modified usage of beaches and parks outside the Military Lease Area could result in an increase in user conflicts and competition for limited recreational resources. However, because the beaches and parks within the Military Lease Area are generally not heavily frequented, the increase in visitors to the beaches and parks outside the Military Lease Area would be small. Therefore, the capacity of the beaches and parks outside the Military Lease Area to absorb additional users would likely not be exceeded, nor is it expected that there would be substantial conflicts between recreation users. Nevertheless, Tinian Alternative 1 operations would result in the following significant impacts to beaches and parks:

- Substantially limit or prohibit access to five of the eight beaches and parks on Tinian
- Substantially reduce the number of available recreational opportunities associated with beaches and parks on an intermittent basis

Therefore, Tinian Alternative 1 operations would result in significant direct impacts to the recreational use of beaches during operation. Tinian Alternative 1 operations would result in less than significant indirect impacts to beaches outside the Military Lease Area due to increased use of these beaches during training periods when beaches within the Military Lease Area are inaccessible.

4.8.3.1.2.3 Ocean-based Resources

The presence of danger zones, which would be located over shorelines and open ocean areas, would require the closure of offshore areas to the public during active training periods (i.e., up to 20 non-continuous weeks per year). This would include four popular snorkeling and diving sites located just offshore of the west coast of Tinian:

- Dump Coke North
- Dump Coke South
- Tinian Grotto
- Fleming Point

The intermittent, temporary loss of access during active training periods (i.e., 20 non-continuous weeks per year) to four of the five popular snorkeling and diving sites would increase demand on the remaining one remaining snorkeling and dive site: Two Corals. This indirect impact could in turn change the quality of the visitor experience because of overcrowding of this location, although it is not expected to exceed the capacity of the resource. However, the increased use of Two Corals could result in a substantial increase in user conflicts and negatively impact the quality of the visitor experience to these sites.

Additionally, shoreline locations used for recreational fishing are primarily located south of Dump Coke South and north of the Two Corals (Turtle Cove) diving sites on the west side of Tinian. All of these recreational shoreline fishing locations would be within danger zones and closed to the public during training activities (i.e., 20 non-contiguous weeks per year).

Tinian Alternative 1 operations would result in the following significant impacts to ocean-based resources:

- Substantially limit or prohibit access to four of the five popular snorkeling and diving sites
- Substantially limit or prohibit access to popular shoreline fishing locations
- Substantially reduce the number of available recreational opportunities associated with ocean-based resources on an intermittent basis
- Cause substantial conflicts between users of ocean-based resources due to overcrowding
- Result in a substantial modification to the user experience of ocean-based resources

Therefore, Tinian Alternative 1 operations would result in significant direct and indirect impacts to ocean-based recreational resources during operation.

4.8.3.1.2.4 Scenic Points

As discussed in Section 3.12, *Visual Resources,* there are several scenic points on Tinian, including Mount Lasso and Ushi "Cross" Point. Many of the scenic points also include a historic or cultural component and are described in Section 3.8.4.1, *Historic and Cultural Sites*. Impacts to these sites are discussed above in Section 4.8.3.1.2.1, *Historic and Cultural Sites.*

The Blow Hole is located within the Military Lease Area; therefore, access to the Blow Hole would be restricted 20 non-continuous weeks per year during training events. The Blow Hole is one of the most recognized and visited sites on the island of Tinian. There is no other accessible natural feature similar to it that replicates the experience for a visitor.

Tinian Alternative 1 operations would result in the following significant impacts to scenic points:

- Substantially limit or prohibit access to scenic points

- Substantially reduce the number of available recreational opportunities associated with scenic points on an intermittent basis

Therefore, Tinian Alternative 1 operations would result in significant direct impacts to scenic points during operation.

4.8.3.1.2.5 Annual Events

The annual Tinian Hot Pepper Festival, also known as the Pika Festival, along with other festivals and sporting events, are held at various locations on Tinian throughout the year. Closing various Tinian recreational resources for up to 20 weeks per year during training operations could result in a reduction of visitor attendance at these events, which would result in a decrease in quality of the visitor experience. Training operations and the closure of the Military Lease Area which is used for festivals and sporting events could impact annual events. Additionally, depending on dates and durations of training operations, danger zone restrictions could also impact the hosting of recreational and sport fishing events.

Tinian Alternative 1 operations would result in the following significant impacts to annual events:

- Substantially limit or prohibit access to areas used for annual events
- Result in a substantial modification to the user experience of visitors to annual events

Therefore, Tinian Alternative 1 operations would result in significant direct and indirect impacts to annual events from lack of access into the Military Lease Area.

Through implementation of proposed potential mitigation measures, including development of a training schedule and coordination with event sponsors, impacts to annual events would be less than significant.

Potential Mitigation Measures include:

- In as much as possible, training would be scheduled around peak tourist holidays, such as the three World War II anniversaries, and annual events. In as much as possible, the DoN would coordinate with event sponsors to ensure that training events do not occur during annual events.

Mitigation monitoring would not be required. It is likely that the proposed potential mitigation measures would be implemented since tourism is the base of the Tinian economy and visitors tend to participate in multiple activities while on Tinian that include island tours within the Military Lease Area (see Section 3.15, *Socioeconomics and Environmental Justice)*.

4.8.3.1.2.6 Training Noise Impacts

As discussed in Section 4.5, *Noise,* there would be potential noise impacts associated with training activities. Noise would originate from small-caliber weapons, large-caliber weapons, and aircraft. Although noise levels within the Military Lease Area would exceed the thresholds for compatible use with recreation areas, these areas would be closed to the public during training (i.e., noise-producing events).

Noise levels above the threshold for compatible use at recreation areas outside the Military Lease Area and surface danger zones would include the following:

- Noise from large-caliber weapons would be greater than 70 decibels C-weighted over a small area of the Pacific Ocean between Ushi "Cross" Point and the Blow Hole (see Figure 4.5-3). Boating and recreational fishing may occur within this area during training events.
- Peak sound levels would be greater than 115 decibels over both the Philippine Sea on the west side of the Military Lease Area, the Pacific Ocean on the east side of the Military Lease Area, and north of Tinian to Saipan (see Figure 4.5-5).

Sustained sound levels from large-caliber weapons and Peak sound levels during training may result in a loss of enjoyment for boaters and potential success for fishermen. However, there are other boating and fishing areas around the southern part of Tinian that could be utilized during training events. Therefore, Tinian Alternative 1 operations would result in less than significant direct impacts to recreational resources from noise.

4.8.3.1.2.7 Roadway and Access Improvements

There are two primary roads leading from San Jose into the Tinian RTA: 8th Avenue and Broadway Avenue. While some of the major roads and trails in the Military Lease Area may be accessible when training is not occurring, Broadway Avenue from just south of the Shinto Shrine to north of the American Memorial traffic circle would be closed to the public on a year-round basis. This closure would prevent access to recreational resources via Broadway Avenue north of the American Memorial traffic circle, even when those northern resources are open to the public. Visitors' sole access to the northern sites would be via 8th Avenue.

As described in Section 2.4, *Tinian Alternatives*, numerous trails and roadways would be improved or upgraded as an action common to all Tinian alternatives. Although some of the roadways would not be intended for public use, some roadways would be improved for public access. Specifically, road improvements for public use within the Military Lease Area would provide beneficial impacts as follows:

- 8th Avenue, repair existing road for public use. This upgrade would improve north-south travel and access to the Seabees Monument, Japanese Internment Camp, Mount Lasso, 509th Composite Group Camp, and the North Field National Historic Landmark, as well as Unai Chulu, Unai Babui, and Unai Lam Lam
- Riverside Drive and Lennox Avenue, repair existing road for public use. This upgrade would improve access to Unai Chulu, Unai Babui, and Unai Lam Lam
- 86th Street, repair existing road for general use. This upgrade would improve east-west cross connections between 8th Avenue and Broadway Avenue

The closure of Broadway Avenue would impede access to recreational resources north of the American Memorial traffic circle; however, access would be available via 8th Avenue. Additionally, improved roadways would facilitate better access to recreational sites within the Military Lease Area and result in a beneficial impact when public access is permissible. Therefore, the closure of Broadway Avenue would result in a less than significant indirect impact to recreational resources.

4.8.3.2 Tinian Alternative 2

4.8.3.2.1 Construction Impacts

The impacts to recreational resources from construction activities associated with Tinian Alternative 2 would be the same as those described for Tinian Alternative 1. See Section 4.8.3.1, *Tinian Alternative 1*, for a discussion of impacts. Construction activities associated with Tinian Alternative 2 would result in less than significant direct or indirect impacts to recreational resources.

4.8.3.2.2 Operation Impacts

The impacts to recreational resources from Tinian Alternative 2 operations would be similar to those described for Tinian Alternative 1. See Section 4.8.3.1, *Tinian Alternative 1*, for a discussion of impacts. However, noise impacts to recreational resources from Tinian Alternative 2 operations would be slightly different from those associated with Tinian Alternative 1.

Impacts to recreational resources from noise associated with Tinian Alternative 2 operations would be mostly the same as those described for Tinian Alternative 1. Under Tinian Alternative 2 noise from large-caliber weapons greater than 70 decibels C-weighted would expand further over the Philippine Sea on the west side of Tinian than it would for Alternative 1. However, this area is within the danger zone and would be closed to the public during training events and would not result in additional impacts to recreational resources. Therefore, Tinian Alternative 2 operations would result in less than significant impacts to recreational resources from noise.

Tinian Alternative 2 operations would have direct and indirect significant impacts to recreational opportunities associated with historic and cultural sites, beaches and parks within the military lease area, ocean-based resources, and scenic points.

Tinian Alternative 2 would have significant impacts to annual events. Through implementation of potential mitigation measures, including coordination with event sponsors, impacts to annual events would be less than significant.

Tinian Alternative 2 operations would result in less than significant impacts to beaches and parks outside the military lease area.

Tinian Alternative 2 would result in less than significant impacts from the closure of Broadway Avenue. The other roadway and access improvements would have beneficial impacts to recreational resources.

4.8.3.3 Tinian Alternative 3

4.8.3.3.1 Construction Impacts

The impacts to recreational resources from construction activities associated with Tinian Alternative 3 would be the same as those described for Tinian Alternative 1. See Section 4.8.3.1, *Tinian Alternative 1*, for a discussion of impacts from construction activities. Construction activities associated with Tinian Alternative 3 would result in less than significant direct or indirect impacts to recreational resources.

4.8.3.3.2 Operation Impacts

The impacts to recreational resources from the Tinian Alternative 3 operations would be the same as those described for Tinian Alternative 1, with the exception of impacts associated with training noise. See Section 4.8.3.1, *Tinian Alternative 1,* for a discussion of impacts to recreational opportunities associated with historic and cultural sites, beaches and parks, ocean-based resources, scenic points and annual events, as well as roadway and access improvements. See Section 4.8.3.2, *Tinian Alternative 2,* for a discussion of training noise impacts.

Tinian Alternative 3 operations would have direct and indirect significant impacts to recreational opportunities associated with historic and cultural sites, beaches and parks, ocean-based resources, scenic points, and annual events. Through implementation of proposed potential mitigation measures, including coordination with event sponsors, impacts to annual events would be less than significant.

Tinian Alternative 3 operations would have less than significant indirect impacts to recreational resources from noise. Although noise from large-caliber weapons greater than 70 decibels C-weighted would expand outside the Military Lease Area, the area that would be impacted is within the danger zone and would be closed to the public during training events.

Tinian Alternative 3 operations would result in less than significant indirect impacts from the closure of Broadway Avenue. The other roadway and access improvements would have beneficial impacts to recreational resources.

4.8.3.4 Tinian No-Action Alternative

Areas within the Military Lease Area that are in use during the periodic non-live-fire military training exercises that have and would continue to occur on Tinian would not be accessible to the public. These periodic non-live-fire military training exercises are of short duration and any lack of access would be temporary and not be significant to the overall recreational use of the Military Lease Area. As addressed in the Guam and CNMI Military Relocation EIS (DoN 2010a), four planned live-fire military training ranges would be established on Tinian. There would be less than significant impacts on access to recreational pursuits (see Table 9.2-4; DoN 2010a). Also, less than significant impacts to recreational resources would be incurred by the Mariana Islands Range Complex training (see Section 3.17.4; DoN 2010b). Therefore, under the no-action alternative, less than significant impacts to recreational resources would be anticipated.

4.8.3.5 Summary of Impacts for Tinian Alternatives

Table 4.8-1 provides a comparison of the potential impacts to recreational resources for the three Tinian alternatives and the no-action alternative.

Table 4.8-1. Summary of Impacts for Tinian Alternatives

Resource Area	*Tinian (Alternative 1)*		*Tinian (Alternative 2)*		*Tinian (Alternative 3)*		*No Action Alternative*	
Recreation	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Recreation (Construction Only)	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*
Historic and Cultural	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*LSI*
Beaches and Parks	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*LSI*
Ocean-based Resources	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*LSI*
Scenic Points	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*LSI*
Annual Events	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*LSI*
Training Noise Impacts	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*
Roadway and Access Improvements	*Not applicable*	*BI/LSI*	*Not applicable*	*BI/LSI*	*Not applicable*	*BI/LSI*	*Not applicable*	*LSI*

Legend: *BI* = beneficial impact; *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.8.3.6 Summary of Potential Mitigation Measures for Tinian Alternatives

Table 4.8-2 provides a summary of the proposed mitigation measures for recreational resources for the three Tinian alternatives.

Table 4.8-2. Summary of Potential Mitigation Measures for Tinian Alternatives

Impacts	***Category***	***Potential Mitigation Measures***	***Tinian Phase***	
			Construction	***Operation***
RECREATION				
Historic and Cultural Attractions Due to restricted access, there would be significant impacts to: recreational opportunities associated with historic and cultural attractions (10 of 12 sites). These impacts would remain significant even with the implementation of the proposed mitigation measures.	*SI*	• In as much as possible, training would be scheduled around peak tourist holidays, such as the three World War II anniversaries. • There is no mitigation currently proposed to minimize this impact to the Shinto Shrine and Hinode American Memorial. The DoN is consulting with the CNMI Historic Preservation Officer and other interested parties regarding impacts to the Shinto Shrine and Hinode American Memorial as part of the Section 106 process (see Appendix N, *Cultural Resources Technical Memo* for a discussion of the consultation process). Potential mitigation will be determined through this consultation process and could include documentation and relocation of the Shinto Shrine and Hinode American Memorial.		X
Annual Events Closure of recreational areas on Tinian during training operations could result in reduced event attendance. Impacts would be mitigated to less than significant with implementation of the proposed mitigation measures.	*SI mitigated to LSI*	In as much as possible, the DoN would coordinate with event sponsors to ensure that training events do not occur during annual events.		X

Legend: *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.
Note: Mitigation measures only change the significance of impacts where noted.

4.8.4 Pagan

4.8.4.1 Pagan Alternative 1

Pagan is officially uninhabited and does not contain any official recreational areas. Nevertheless, as noted in Section 3.8, *Pagan*, there have been discussions about developing Pagan as an eco-tourism destination and a staging area for visitors to the Marianas Trench National Marine Monument area.

4.8.4.1.1 Construction Impacts

The type and extent of construction on Pagan would be limited, as there would be no permanent buildings proposed as part of either alternative on Pagan. Construction would occur over an 8 to 10 year period; however, the majority of the construction would occur in the first few years as part of training activities. The public would be restricted from accessing areas where construction is occurring. These access restrictions would be temporary and intermittent. Therefore, Pagan Alternative 1 would result in less than significant impacts to recreational resources during construction activities.

4.8.4.1.2 Operation Impacts

Pagan Alternative 1 operations would result in the permanent closure of the High Hazard Impact Area, restricted access and intermittent closure of the northern portion of the island, and establishment of a 3-mile (4.8-kilometer) perimeter danger zone offshore of the northern part of the island during 16 weeks of training per year. The closure of the northern portion of the island during training events would preclude any recreational activities during that time. As discussed in Section 3.8.5, *Pagan,* the island is officially uninhabited and there are no formally identified recreational facilities or activities on Pagan. However, there are occasional recreational visitors to the island. These are generally individuals from other islands in the CNMI who may use the island for hunting, camping, or other cultural and spiritual pursuits. Other visitors are part of ecotourism groups with a pre-planned agenda and have only occurred three times over the past year, as discussed in Section 3.8.5, *Pagan*.

Since there are no formally identified recreational facilities on Pagan, and Pagan only hosts occasional recreational visitors, Pagan Alternative 1 operations would not substantially limit or prohibit access to recreational resources, nor would it substantially reduce the number of recreational opportunities. Therefore, Pagan Alternative 1 operations would result in less than significant impacts to recreational resources during operation.

4.8.4.2 Pagan Alternative 2

4.8.4.2.1 Construction Impacts

The impacts to recreational resources resulting from Pagan Alternative 2 construction activities would be the same as those discussed in Section 4.8.4.1.1, *Pagan Alternative 1, Construction Impacts.* Implementation of Pagan Alternative 2 would result in less than significant impacts to recreational resources during construction.

4.8.4.2.2 Operation Impacts

The impacts to recreational resources resulting from Pagan Alternative 2 operations would be similar to those discussed in Section 4.8.4.1.2, *Pagan Alternative 1, Operation Impacts.* However, less of southern Pagan would be encumbered by the surface danger zones, which would allow visitors additional areas of access. Therefore, Pagan Alternative 2 operations would result in less than significant impacts to recreational resources during operation.

4.8.4.3 Pagan No-Action Alternative

There would be no impacts to the recreational opportunities on Pagan under the no-action alternative. There would be the same potential for use of Pagan for periodic eco-tourism visits under this alternative as currently exists.

4.8.4.4 Summary of Impacts for Pagan Alternatives

Table 4.8-3 provides a comparison of the potential impacts to recreational resources for the two Pagan alternatives and the no-action alternative.

Table 4.8-3. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Recreation	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Recreation (General)	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*

Legend: *LSI* = less than significant impact; *NI* = no impact.

4.9 TERRESTRIAL BIOLOGY

Section 4.9 describes the specific direct and indirect impacts on terrestrial biological resources that could result from implementation of the proposed action. Both the construction and operation elements of the proposed action have the potential to impact the terrestrial biological resources of both Tinian and Pagan.

4.9.1 Approach to Analysis

A variety of laws, regulations, Executive Orders, plans, and policies, such as the Endangered Species Act and the Migratory Bird Treaty Act, are applicable to evaluating the proposed action impacts for terrestrial biology. A complete listing of applicable regulations is provided in Appendix E, *Applicable Federal and Local Regulations*.

The terrestrial biology impact analysis addresses potential effects to vegetation communities, wildlife, and special-status species (i.e., species protected by federal or local law). Representations of the Tinian and Pagan RTAs and their associated support facilities/infrastructure construction footprints (described in Chapter 2, *Proposed Action and Alternatives*) were quantified using Geographic Information System analysis. Training area disturbance footprints were also accounted for to ensure that the full range of potential impacts was identified. Under the proposed action, impacts may be either temporary (reversible) or permanent (irreversible). Direct and indirect impacts are distinguished as follows.

Direct impacts occur at the same place and/or time as actions generated by proposed construction (e.g., ground-disturbing activities) and training operations (e.g., range use). These impacts may include, but are not limited to, the following:

- Permanent loss of habitat due to vegetation removal during construction
- Temporary loss of habitat due to vegetation removal during construction (e.g., some areas would be revegetated after construction), noise, lighting, and/or human activity
- Permanent loss of habitat due to human activity, noise, and/or lighting that could prevent a wildlife species, including special-status species, from occupying otherwise suitable habitat
- Temporary or permanent injury or mortality of wildlife or special-status species caused by the action and occurring at the same time and place as the action
- Permanent or temporary loss of habitat due to potential wildfires generated by training activities

Direct impacts from construction ground disturbance and operational vegetation clearing were assumed within all areas labeled as facility footprints and as "Vegetation Maintenance" in Appendix F, *Geology and Soils Technical Memo*.

Indirect impacts are caused by or result from project-related activities, are usually later in time, and are reasonably foreseeable. Potential causes of indirect impacts include, but are not limited to, the following:

- Introduction of new or increased dispersal of existing non-native, invasive species within the CNMI

- Permanent or temporary loss of habitat due to potential wildfires generated by training activities (e.g., increased erosion, spread of invasive species)
- Pollutants that are released during military training
- Temporary or permanent impacts on reproductive success or survival of wildlife or special-status species caused by the action but occurring later in time

Indirect impacts from construction ground disturbance and operational vegetation clearing were assumed within all areas labeled as facility footprints and as “Vegetation Maintenance” in Appendix F, *Geology and Soils Technical Memo*.

General principles used to evaluate impacts are:

- The extent, if any, that the action would result in substantial loss or degradation of habitat or ecosystem functions (natural features and processes) essential to the persistence of native flora or fauna populations
- The extent, if any, that the action would diminish the population size, distribution, or habitat of special-status species or regionally important native plant or animal species
- The extent, if any, that the action would permanently degrade ecological habitat qualities that special-status species depend upon, and which partly determines the species’ prospects for conservation and recovery
- The extent, if any, that the action would be likely to jeopardize the continued existence in the wild of any species listed or proposed for listing under the Endangered Species Act

Specific evaluation criteria are discussed below. If significant impacts were determined, then mitigation may be proposed to minimize or offset the impacts.

4.9.1.1 Vegetation Communities

To determine whether impacts to vegetation communities were significant, a vegetation base map was overlaid onto the footprint of proposed ground disturbance using a Geographic Information System. This impact quantification focused on areas of high- and medium-intensity disturbance (i.e., vegetation removed [high] or habitat changed [medium]), with the rarity of the affected plant community taken into consideration in making an impact determination.

Native limestone forests are especially important because they retain the functional habitat for native species, particularly special-status species, and because restoration to replace cleared, native forest would be a decades-long process. Similarly, wetlands provide required habitat for native wildlife and special-status species and provide important hydrologic functions. Impacts to vegetation communities were evaluated for significance primarily based on the extent and landscape context (i.e., fragmentation) of temporary or permanent loss of primary limestone forest or wetland communities.

4.9.1.2 Native Wildlife

To identify potential impacts to wildlife, the activities associated with the proposed action were considered in the context of affected species’ life history and ecology (e.g., nesting behavior and habitat, foraging habitat, mobility, and migration). An action would be considered significant if there was physical loss of or exclusion from required habitat, death, or decreased productivity of native wildlife populations. Assessment of the likelihood of these impacts was based on information from published scientific literature and the knowledge of subject matter experts.

Impacts were determined significant if native wildlife species are present and the proposed project would result in the decrease in population sizes or distributions of regionally important native wildlife species (excluding special-status wildlife species that are addressed separately below). Potential causes of impacts to native wildlife may include, but are not limited to:

- Permanent removal or degradation of a natural community or ecosystem that would substantially decrease the size or distribution of wildlife populations
- Permanent loss of vegetation or wildlife habitat identified as declining or rare in the region (i.e., native limestone forest and wetlands)
- Permanent loss or long-term disruption of a regionally important wildlife movement corridor.
- Inadvertent introduction of the brown treesnake to Tinian or Pagan by personnel, equipment, or supply movement from Guam
- Disruptions of key elements of the life history (e.g., breeding, nesting, foraging, resting) of wildlife species from human activities such as noise or lights

4.9.1.3 Special-status Species

Similar to the criteria applied to evaluate impacts to wildlife, the significance of impacts to special-status species were based on the presence of these species and the anticipated level of disturbance to the areas where they are present. The presence of species and their estimated densities were determined based on field surveys and wildlife inventories. A base map of this information was overlaid onto the footprint of potential disturbance from construction and operation, and the magnitude of impacts was then identified.

4.9.1.3.1 Endangered Species Act-listed Species

In accordance with section 7 of the Endangered Species Act of 1973 (16 U.S. Code 1531 *et seq.*), a Biological Assessment is being prepared to analyze the potential effects of Department of Defense actions on listed threatened and endangered species and those proposed for listing under the jurisdiction of the U.S. Fish and Wildlife Service. Section 7(a)(2) of the Endangered Species Act requires federal agencies to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any federally threatened or endangered species or result in the destruction or adverse modification of critical habitat. In accordance with Section 102 of NEPA, the Department of Defense is in section 7 consultation with the U.S. Fish and Wildlife Service regarding the potential impacts from actions proposed under the preferred alternative presented in this EIS/OEIS on Endangered Species Act-listed species and is in section 7 conference for those species proposed to be listed. Those species that are addressed in the section 7 consultation and conference process with the U.S. Fish and Wildlife Service are as follows:

- Mariana fruit bat – threatened
- Mariana common moorhen – endangered
- Micronesian megapode – endangered
- Green turtle (nesting) – threatened

- Hawksbill turtle (nesting) – endangered
- Humped tree snail – proposed endangered
- Slevin's skink – proposed endangered
- Pacific sheath-tailed bat – proposed endangered
- *Heritiera longipetiolata* – proposed endangered
- *Dendrobium guamense* – proposed endangered
- *Solanum guamense* – proposed endangered
- *Tuberolabium guamense* – proposed endangered
- *Cycas micronesica* – proposed threatened
- *Bulbophyllum guamense* – proposed endangered

Impacts of the proposed action under section 7 of the Endangered Species Act are analyzed as impacts to individuals (as defined by "take" under the Endangered Species Act). In contrast, analysis of impacts to species under NEPA, presented here, relates to the impacts on populations of these species. The proposed avoidance, minimization, and mitigation measures described in this EIS/OEIS to benefit Endangered Species Act-listed and proposed species are preliminary, are focused on population-level benefits, and may be revised or augmented to further minimize impacts to individuals during Endangered Species Act section 7 consultation.

4.9.1.3.2 Migratory Bird Treaty Act-listed Species

The Migratory Bird Treaty Act prohibits the taking, killing, or possession of migratory birds unless permitted by regulation. An activity has a significant effect if, over a reasonable period, 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. In 2007, the U.S. Fish and Wildlife Service finalized a rule authorizing the Department of Defense to "take" migratory birds in the course of military readiness activities, as directed by the 2003 National Defense Authorization Act. 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).

For the purposes of this EIS/OEIS, the operation of the proposed Tinian and Pagan RTAs is considered a military readiness activity and the construction of the proposed Tinian and Pagan RTAs is considered a non-military readiness activity. The Department of Defense must confer and cooperate with the U.S. Fish and Wildlife Service on developing and implementing conservation measures to minimize or mitigate adverse effects of a military readiness activity if that activity has a significant adverse effect on a population of a migratory bird species. Migratory bird conservation relative to non-military readiness activities is addressed separately in a Memorandum of Understanding developed in accordance with Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds.

Potential causes of impacts to special-status species may include, but are not limited to:

- Permanent removal or degradation of a natural community or ecosystem that would substantially decrease the population size or distribution of any special-status species
- Permanent loss of or decrease in populations or habitat of any Endangered Species Act-listed species, any species that has been proposed for listing under the Endangered Species Act, any Migratory Bird Treaty Act-protected species, any CNMI-listed species, or any CNMI Species of Special Conservation Need
- Permanent loss or long-term disruption of a regionally important corridor for the movement of any special-status species
- Inadvertent introduction of the brown treesnake to Tinian or Pagan by personnel, equipment, or supply movement from Guam
- Disruptions of key elements of the life history (e.g., breeding, nesting, foraging, resting) of any population of a special-status species from noise, lighting, or other components of the action

4.9.2 Resource Management Measures

Resource management measures that are applicable to terrestrial biological resources include the following:

4.9.2.1 Avoidance and Minimization Measures

- *Bird/Animal Aircraft Strike Hazard Plan.* Preparation and implementation of a Bird/Animal Aircraft Strike Hazard Plan. The plan would include safeguards for aircraft and flight crews, and would decrease impacts to wildlife and special-status species by avoiding and minimizing potential aircraft strikes of birds and other animals.
- *Range Environmental Vulnerability Assessment.* Preparation of a Range Environmental Vulnerability Assessment to assess the potential impacts to human health and the environment from live-fire training operations. The purpose of the Range Environmental Vulnerability Assessment is to identify whether there is a release or a substantial threat of a release of munitions constituents from the operational range or range complex areas to off-range areas and determine if the release causes an unacceptable risk to human health and/or the environment (see Appendix D, *Best Management Practices,* for further details).
- *Range Fire Management Plan.* Preparation and implementation of a Range Fire Management Plan (within the Range Training Area Management Plan). Implementation of the plan would reduce the risk of fire originating from the RTAs, thereby minimizing potential for impacts to biological resources from fire.
- *Biosecurity.* Adherence to Commander Navy Region Marianas Instruction 3500.4A (*Marianas Training Manual*) Appendix A: Brown Treesnake Control and Interdiction Requirements; Commander Navy Region Marianas Instruction 5090.10A (*Brown Tree Snake Control and Interdiction Plan*)*;* anticipated final Joint Region Marianas Instruction 5090.4, which will replace Instruction 5090.10A; and 36 Wing Instruction 32-7004 (*Brown Tree Snake Management*) will minimize the likelihood of brown treesnake introduction to Tinian or Pagan (see Appendix L, *Biological Resources Supporting Documentation*). In addition, for CJMT activities, per Department of Defense Transportation Regulations Chapter 505 protocols, the Department of

Defense will commit to implementing 100% inspection of all outgoing aircraft and all outgoing cargo transported via ship or aircraft from Guam to Tinian or Pagan with qualified quarantine officers and dog detection teams. Repeat (redundant) 100% inspections will also be conducted on Guam within snake-free quarantine areas for all cargo transported from Guam to Tinian or Pagan. These brown treesnake sterile areas will be subject to: (1) multiple day and night searches for snakes with qualified canine interdiction teams, (2) snake trapping, and (3) human visual inspection for snakes. For all brown treesnake interdiction work, the skills and standards required to certify an inspection team as "qualified" will be agreed upon mutually by the Department of Defense, U.S. Geological Survey Biological Resources Discipline, and U.S. Fish and Wildlife Service.

The Department of Defense is a participating department in the development of the Regional Biosecurity Plan (previously referred to as the Micronesia Biosecurity Plan), with the National Invasive Species Council, U.S. Department of Agriculture Animal and Plant Health Inspection Service, U.S. Geological Survey Biological Resources Discipline, and the Smithsonian Environmental Research Center. The Regional Biosecurity Plan is intended to coordinate and integrate inter-agency non-native invasive species management efforts such as species control, interdiction, eradication, and research. When the Regional Biosecurity Plan is completed, the Department of Defense will work cooperatively with the U.S. Fish and Wildlife Service in the development and implementation of protocols for interdiction and control methods in accordance with recommendations in the plan that are determined to be applicable to CJMT activities.

4.9.2.2 Best Management Practices and Standard Operating Procedures

Best management practices and standard operating procedures that are applicable specifically to the terrestrial biology resources include:

- *Brown Treesnake Interdiction*. Joint Region Marianas has established a comprehensive brown treesnake interdiction program to ensure that military activities do not contribute to the spread of brown treesnakes to the CNMI or other locations. Interdiction requirements specified in Commander Navy Region Marianas instructions will be implemented for CJMT activities.
- *Integrated Pest Management Plan*. The U.S. military would develop and implement a comprehensive Integrated Pest Management Plan. This Plan would encompass all activities regarding the importation, handling, storage, use, and application of pesticides as well as address prevention of the introduction of potential invasive species to the CNMI.
- *Invasive Species Interdiction*. Executive Order 13112, Invasive Species, directs federal agencies to prevent the spread of any invasive species in their work. To implement this directive for CJMT activities, the Department of Defense will require development and implementation of Hazard Analysis and Control Point plans for all construction, transport, and logistics activities related to CJMT actions.

- *Biosecurity Outreach and Education*. A biosecurity outreach and education program will be implemented to inform contractors and Department of Defense civilian and military personnel about native versus non-native invasive species and the impacts of non-native invasive species on native ecosystems.
- *Regional Biosecurity Plan*. DoN funded the development of a Regional Biosecurity Plan to coordinate inter-agency invasive species management efforts, including control, interdiction, eradication, and research. Protocols for interdiction and control methods will be developed and implemented for Regional Biosecurity Plan recommendations that are applicable to CJMT activities.
- *Contractor Education Program*. The DoN has developed an education program to ensure construction contractor personnel are informed of the biological resources in the project area, including special-status species, avoidance measures, and reporting requirements.

For further details refer to Appendix D, *Best Management Practices*.

4.9.3 Tinian

4.9.3.1 Tinian Alternative 1

4.9.3.1.1 Construction Impacts

4.9.3.1.1.1 Vegetation Communities

Vegetation communities affected during construction activities associated with Tinian Alternative 1 are listed in Table 4.9-1 and shown in Figures 4.9-1a and 4.9-1b. Under this alternative, approximately 1,798 acres (728 hectares) of undeveloped or non-barren land would be impacted, representing approximately 8% of the island and 12% of the Military Lease Area. Two proposed facilities comprise approximately half of the total impacts to vegetation communities: the High Hazard Impact Area (527 acres [213 hectares]) and the Drop Zone (456 acres [185 hectares]). The majority of the impacted vegetation communities (1,737 acres [703 hectares]) are composed of tangantangan (780 acres [316 hectares] or 9% of total on island), mixed introduced forest (622 acres [252 hectares] or 9% of total on island), and herbaceous scrub (335 acres [135 hectares] or 7% of total on island). In addition, 6.3 acres (2.5 hectares), or 0.5% of total on island, of native limestone forest would be removed.

Native limestone forest has been significantly reduced on Tinian due to past activities, including widespread cultivation of non-native species (e.g., sugar cane), activities during World War II, intentional and accidental introduction of non-native plants and animals, and grazing by non-native ungulates. Limestone forests on Tinian are important because they retain the functional ecological components of native forest that provide habitat for the majority of Tinian’s native species, including Endangered Species Act-listed and proposed species, and the CNMI-listed species. These forests also help maintain water quality and reduce fire risk. Non-native plant species (e.g., tangantangan) significantly alter the native forest structure, composition, and resilience of the forest to other disturbances and also provide less suitable conditions for native flora and fauna species than a native forest (Morton et al. 2000; Tang et al. 2011; DoN 2013).

Table 4.9-1. Potential Direct Impacts to Vegetation Communities with Implementation of Tinian Alternative 1

Project Area*	Vegetation Community (acres)[1]											
	NLF	MIF	TT	HS	Cas	Coco	BS	Wet	Ag	Bar	Dev	Total
High Hazard Impact Area[2]	3.3	73.9	293.7	145.1	0	0	0	0.5[3]	0	0	11.0	527.5
Combat Pistol Range	0	2.1	0	0	0	0	0	0	0	0	0	2.1
Multi-purpose Range Complex[4]	0	8.3	0	14.3	0.6	0	0	0	0	0	0.2	23.4
Battle Sight Zero Range	0	2.1	0	0	0	0	0	0	0	0	0	2.1
Anti-armor Tracking Range (Automated)	0	6.1	2.8	6.4	0.6	0	0	0	0	0	0.2	16.1
Multi-purpose Automated Unknown Distance Range/Field Fire Range	0	9.2	0.4	21.4	0	0	0	0	0	0	0	31.0
Infantry Platoon Battle Course	0	16.2	0	6.4	0	0	0	0	0	0	0.6	23.2
Urban Assault Course (South)	0	20.1	0	0	0	0	0	0	0	0	0	20.1
Northern Battle Area Complex	0	0	9.6	0	1.6	0	0	0	0	0	0	11.2
Urban Assault Course (North)	0	0.8	12.8	0	2.0	0	0	0	0	0	0.2	15.8
Drop Zone	0	0	302.2	42.7	14.0	0	0	0	0	0	96.5	455.4
Field Artillery Indirect Fire Range (Firing Points)	0.4	18.9	32.2	14.1	1.5	0	17.0	0	0	0	0.9	85.0
Convoy Course Engagement Areas	0	11.3	15.4	1.0	2.4	0	0	0	0	0	1.0	31.1
Convoy Course	0	13.0	15.9	5.1	0.4	0.5	0	0	0	0	30.7	65.6
Tracked Vehicle Driver's Course	1.5	33.1	39.8	18.1	0.7	0.3	0.1	0	<0.1	0.1	6.4	100.1
Tactical Amphibious Landing Beach (Unai Chulu)	0	0	0.1	0.9	0	0	0	0	0	3.0	0	4.0
Landing Zones	0	7.0	5.3	6.1	0	0	0	0	0	0	1.4	19.8
Range Control Observation Points	0	1.7	9.4	3.7	0	0	<0.1	0	0	<0.1	0	14.8
Surface Radar Sites	0	0.1	0.6	0.1	0	0	0.1	0	0	<0.1	0	0.9
Roadway Improvements	0	4.0	4.4	2.4	0	0	0	0	0	0	32.4	43.2
Fences	1.1	10.9	9.0	9.0	0.1	0	0	0	0	<0.1	5.7	35.8
Munitions Storage Area	0	5.9	27.0	4.9	0	0	0	0	0	0	<0.1	37.8
Airport Improvements and Staging Area	0	147.8	0	23.3	7.9	0	0	0	0	0	48.7	227.7
Tinian Port Improvements and Staging Area	0	0	0	0	0	0	0	0	0	0	4.5	4.5
Base Camp	0	229.9	0	10.5	3.3	0	0	0	0	0	12.5	256.2
Total Impacted under Alternative 1	**6.3**	**622.4**	**780.6**	**335.5**	**35.1**	**0.8**	**17.2**	**0.5**	**<0.1**	**3.1**	**252.9**	**2,054.4**
Total on Tinian	*1,355.7*	*6,853.1*	*8,443.6*	*4,819.0*	*353.9*	*97.9*	*551.0*	*64.9*	*331.7*	*199.9*	*1,915.7*	*24,986.4*
% Impacted under Alternative 1 on Tinian	*0.5%*	*9.1%*	*9.2%*	*6.9%*	*9.7%*	*0.9%*	*3.1%*	*0.7%*	*<0.1%*	*<0.1%*	*13.2%*	*8.2%*

Notes: *Project areas are based on areas depicted and labeled in Section 2.4.
[1]NLF = native limestone forest; MIF = mixed introduced forest; TT = tangantangan; HS = herbaceous-scrub; Cas = *Casuarina* forest; Coco = coconut forest; BS = beach strand; Wet = wetlands habitat; Ag = agriculture; Bar = barren; Dev = developed; < = less than.
[2]Includes fire break/buffer, perimeter road, Hand Grenade Range, Mortar Range, Light Anti-armor Weapon Range, Grenade Launcher Range, targets for Close Air Support Range, targets for Offensive Air Support Range, targets for Field Artillery Indirect Fire Range.
[3]Although two ephemeral ponds associated with the Mahalang Complex would be impacted under Alternative 1, these are not considered wetlands.
[4]Includes Anti-armor Tracking Range, Tank/Fighting Vehicle Stationary Target Range, and Multi-purpose Range Complex.

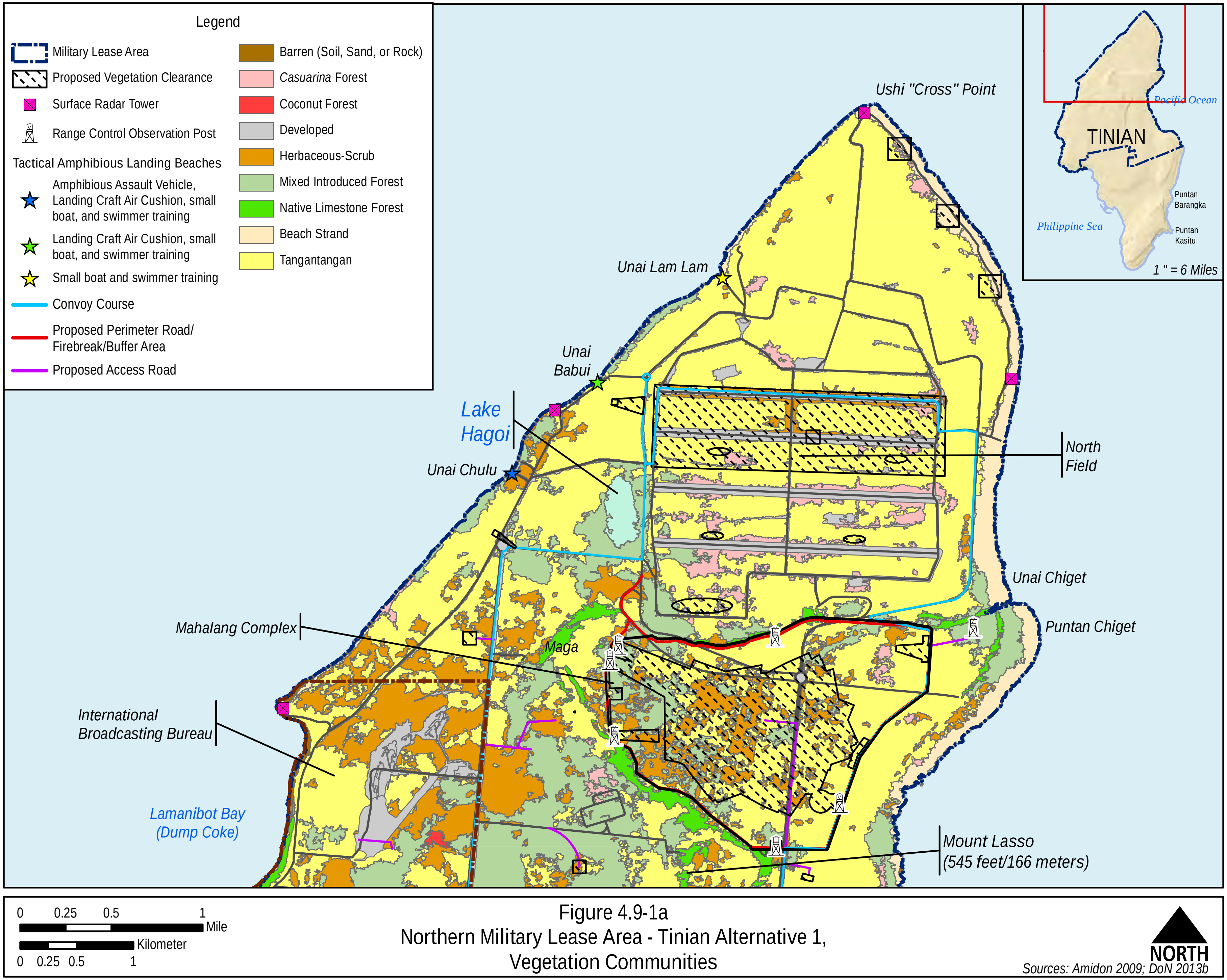


Figure 4.9-1a
Northern Military Lease Area - Tinian Alternative 1, Vegetation Communities

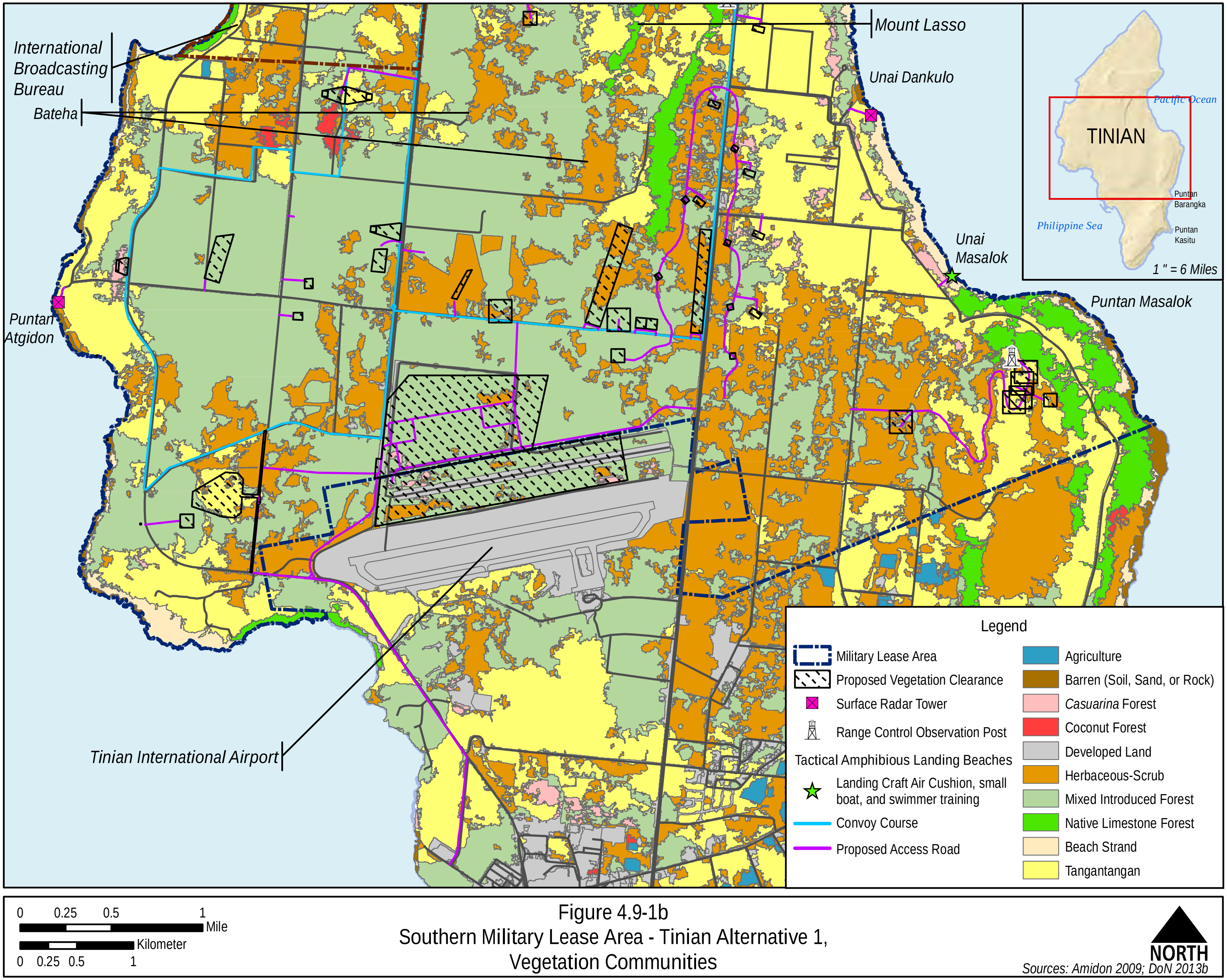


Figure 4.9-1b
Southern Military Lease Area - Tinian Alternative 1,
Vegetation Communities

Sources: Amidon 2009; DoN 2013b

Under Tinian Alternative 1, 6.3 acres (2.5 hectares) of native limestone forest, or 0.5% of the total acreage for this community on the island, would be removed, primarily within the High Hazard Impact Area (see Table 4.9-1). Therefore, given the importance of native limestone forest habitat for native species and the continuing loss of limestone forest on Tinian, the conversion of 6.3 acres (2.5 hectares) to developed area under Tinian Alternative 1 would result in significant, direct impacts to the regional vegetation community and its function.

In addition, two ephemeral ponds within the Mahalang Complex totaling less than 0.5 acre (0.2 hectare) of wetlands habitat would be lost due to construction of the hand grenade and grenade launcher ranges within the High Hazard Impact Area. Based on recent wetlands surveys on Tinian, one of these two ephemeral ponds is considered an isolated wetland that supports ephemeral wetland habitat during years of high rainfall. The loss of less than 0.5 acre (0.2 hectare) of wetland habitat would not be significant.

Mitigation measures may be implemented to mitigate potential significant direct, long-term impacts of proposed construction activities on vegetation communities with implementation of Tinian Alternative 1. To mitigate for these significant impacts to 6.3 acres (2.5 hectares) of native limestone forest, the DoN would propose to implement forest enhancement on a minimum of 6.3 acres (2.5 hectares) of mixed introduced forest. Implementation of proposed mitigation measures would reduce the impact to less than significant. Forest enhancement would include but is not limited to the following:

- Propagating, planting, and establishing dominant and rare species that are characteristic of native limestone forest habitats (e.g., *Cynometra ramiflora*, *Neisosperma oppositifolia*, *Eugenia palumbis, Guamia mariannae*, pandanus, banyan tree, and tropical almond)
- Removing non-native, invasive vegetation
- Controlling non-native predators (e.g. rats, feral cats)

The Department of Defense would prepare a Forest Enhancement/Restoration and Monitoring Plan that would provide detailed guidance on proposed forest enhancement activities on Tinian as well as long-term monitoring of the success of the proposed forest enhancement measures. Although the exact locations of the proposed forest enhancement areas have not been identified, prior to implementing any forest enhancement activities appropriate environmental compliance documentation would be prepared, including coordination with cultural resources personnel under Section 106 of the National Historic Preservation Act regarding the potential occurrence of cultural resources within any proposed forest enhancement site.

The anticipated benefit of implementing these potential mitigation measures is improved habitat quality for native flora and fauna, including wildlife and special-status species. Forest enhancement also supports natural regeneration and seed propagation, reduces erosion, and increases water retention which reduces fire risk.

4.9.3.1.1.2 Native Wildlife

Potential impacts from construction activities under Tinian Alternative 1 to native bird species on Tinian that are not listed under the Migratory Bird Treaty Act are described in this section. Impacts to native bird species protected under the Migratory Bird Treaty Act are addressed separately below in the *Special-status Species* section.

As discussed above in Vegetation Communities, a total of approximately 1,798 acres (728 hectares) of habitat for native species would be removed because of proposed construction activities under Tinian Alternative 1 (see Table 4.9-1). This is approximately 12% and 8% of the total habitat within the Military Lease Area and on all of Tinian, respectively. Table 4.9-2 provides the number of birds that may be impacted for the five monitored bird species due to the loss of 1,745 acres (706 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats. Estimated numbers were derived from the 2013 native bird surveys on Tinian (DoN 2014a).

The Tinian monarch nests in native limestone forest, mixed introduced forest, and tangantangan forest habitats. The Military Lease Area comprises roughly 66% of the current monarch habitat on the island and supports about 52% of the total monarch population (DoN 2014a). Based on estimated 2013 densities (DoN 2014a), the number of Tinian monarchs that would potentially be permanently displaced by loss of habitat through construction would be 6,600 birds (Table 4.9-2). The Tinian monarch is found only on Tinian, was previously listed as endangered under the Endangered Species Act, was delisted in 2004 (U.S. Fish and Wildlife Service 2004), and was petitioned in 2013 for relisting (Center for Biological Diversity 2013).

Table 4.9-2. Potential Direct and Permanent Impacts to Five Native Bird Species from Proposed Construction Activities under Tinian Alternative 1

Species	***Number of Birds Impacted by Removal of Habitat****				***Total***	***Estimated 2013 Total Tinian Population***	***% of Tinian Population Impacted***
	NLF	***MIF***	***TT***	***HS***			
Bridled white-eye	114	13,312	14,951	4,749	33,126	442,073	7.5%
Micronesian honeyeater	7	607	504	236	1,354	20,660	6.6%
Micronesian starling	11	1,044	1,240	578	2,873	40,489	7.1%
Rufous fantail	41	3,957	3,857	986	8,841	125,668	7.0%
Tinian monarch	29	2,764	3,164	676	6,633	91,420	7.2%

Notes: *NLF = native limestone forest, MIF = mixed introduced forest, TT = tangantangan, HS = herbaceous scrub.
Source: DoN 2014a.

The current Tinian Military Retention Land for Wildlife Conservation (or Conservation Area), which was established for the protection of Tinian monarch habitat under a previous Endangered Species Act consultation (U.S. Fish and Wildlife Service 1998; Government of the CNMI and United States of America 1999), would be impacted by proposed construction activities. Four areas are being assessed as potential conservation areas for the protection of the Tinian monarch and other wildlife species (Figure 4.9-2). These areas may also be used for additional natural resource conservation actions such as forest enhancement and/or invasive species control. The Department of Defense is coordinating with the Federal Aviation Administration and the U.S. Fish and Wildlife Service on these potential conservation areas.

Proposed construction activities would remove 1,745 acres (706 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats currently available to native birds on Tinian. In particular, the removal of forested and herbaceous scrub habitats would result in the loss of nesting, foraging, and resting areas for these bird species as well as other native wildlife species.

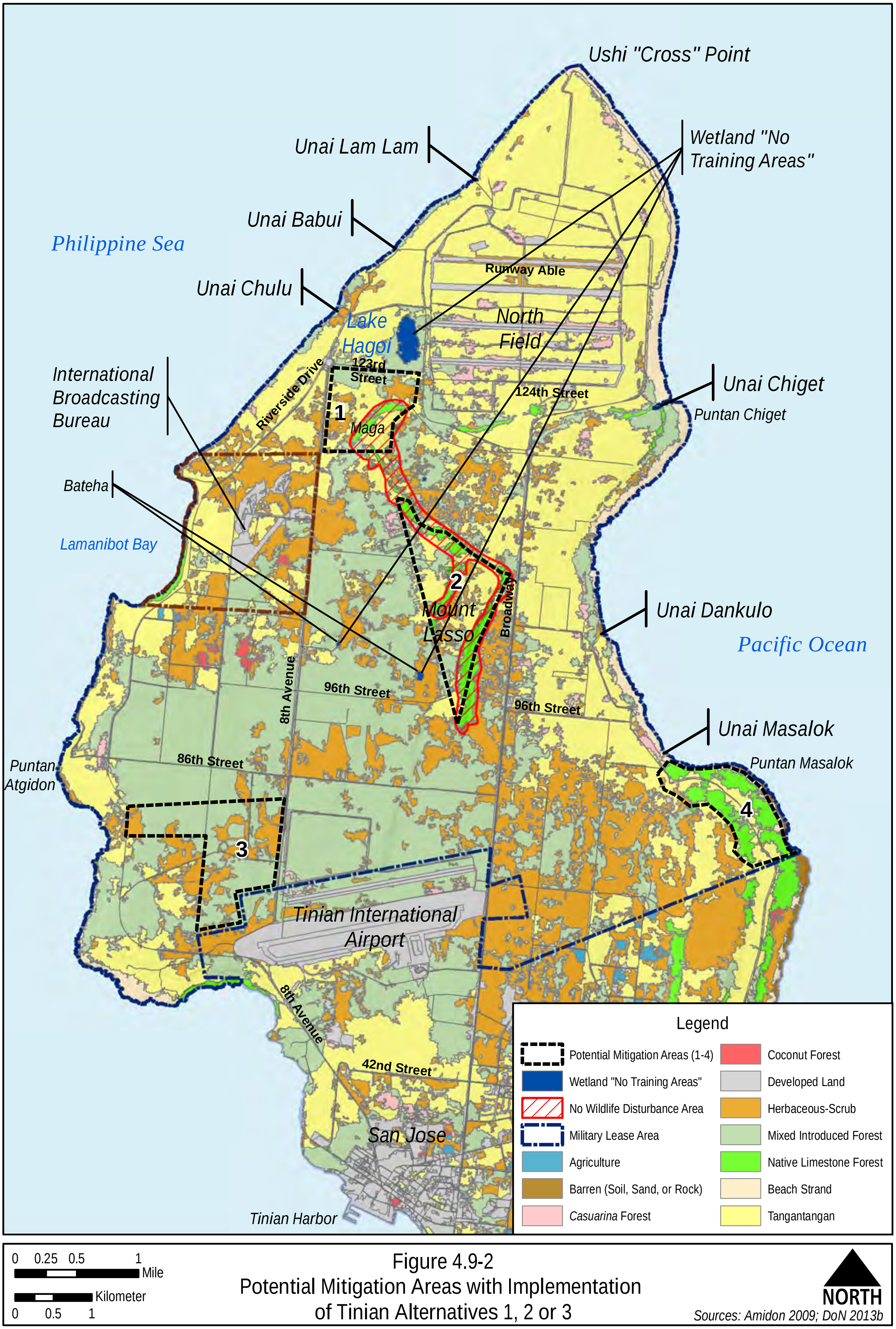


Figure 4.9-2
Potential Mitigation Areas with Implementation of Tinian Alternatives 1, 2 or 3

In addition, noise and the presence of construction equipment and human activity may cause wildlife to temporarily avoid areas in the immediate vicinity of construction activities. Nesting or breeding adults of various wildlife species may be disturbed by noise and construction activities, which may result in abandonment or depredation of eggs or young. These activities may also temporarily displace wildlife from breeding habitat, resulting in reduced breeding success. Direct mortality from construction equipment is unlikely because noise associated with pre-construction activities and human presence is likely to disperse wildlife prior to any equipment use, although vehicle traffic would increase the potential for wildlife collisions. Although construction would occur over an 8 to 10 year period, these noise impacts would be short-term and minor because only a small number of range and support facilities would be under construction at any given time. As such, these temporary direct impacts to wildlife populations from construction noise and human activities would be less than significant.

Overall, implementation of Tinian Alternative 1 would result in significant direct impacts to the populations of bridled white-eye, Micronesian honeyeater, Micronesian starling, rufous fantail, and Tinian monarch due to the permanent removal of approximately 1,745 acres (706 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats. These bird species are territorial, meaning that a minimum area is required for each bird or breeding pair for all of their foraging and nesting activities. For most animal species, and particularly within island ecosystems, available but unoccupied habitat is rare (if it does exist, it is generally very low-quality habitat). This is the case unless populations are limited not by habitat, but by predators, disease, or over-hunting. Based on available data, there is no indication that there are large areas of available but unoccupied habitat on Tinian, particularly for forest and shrub breeding bird species. For these reasons, the loss of 1,745 acres (706 hectares) of habitat would be significant, even with forest enhancement efforts. Although bird densities are higher in higher-quality habitats and more birds are expected to eventually occupy areas of proposed forest enhancement, the proposed area of forest enhancement is not large enough to make up for the overall loss of available habitat under Alternative 1. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

To mitigate the potential significant direct, long-term impacts to forested and herbaceous scrub habitats used by native bird and other wildlife species, the DoN would propose to implement forest enhancement of native limestone forest, mixed introduced forest, tangantangan forest, and herbaceous scrub habitats. This is in addition to the forest enhancement of 6.3 acres (2.5 hectares) of native limestone forest or mixed introduced forest described above in the *Vegetation Communities* section. Forest enhancement would include but is not limited to the following:

- Propagating, planting, and establishing dominant and rare species that are characteristic of native limestone forest habitats (e.g., *Cynometra ramiflora*, *Neisosperma oppositifolia*, *Eugenia palumbis*, *Guamia mariannae*, pandanus, banyan tree, and tropical almond)
- Removing non-native, invasive vegetation
- Controlling non-native predators (e.g. rats, feral cats)

Tinian Military Retention Land for Wildlife Conservation. Under Tinian Alternative 1, portions of the existing Wildlife Conservation Area would be impacted by proposed construction activities. Four areas are being considered as potential conservation areas for the protection of the Tinian monarch and other wildlife species (see Figure 4.9-2). These areas may also be used for additional natural resource conservation actions such as forest enhancement and/or invasive species control. The Department of Defense is coordinating with the Federal Aviation Administration and the U.S. Fish and Wildlife Service on these potential conservation areas.

Even with implementation of mitigation measures, impacts to native wildlife would be significant and unavoidable due to vegetation removal associated with range construction.

Mitigation monitoring would be required for these potential mitigation measures. Therefore, the DoN would prepare a Forest Enhancement/Restoration and Monitoring Plan that would provide detailed guidance on proposed forest enhancement activities on Tinian as well as long-term monitoring of the success of the proposed forest enhancement measures.

The DoN, in coordination with the U.S. Fish and Wildlife Service, would also prepare a Forest Bird Monitoring and Tinian Monarch Management Plan to monitor the potential effects of proposed CJMT activities on the Tinian monarch and other forest birds within the Military Lease Area. The proposed Management Plan would be based on continuing the forest bird surveys conducted along a series of transects surveyed in 1982, 1996, 2008, and 2013. The continued surveys would assess the species' overall status and allow evaluation of long-term trends in population size and distribution through comparison with the four previous island-wide surveys of forest birds on Tinian. The data from this monitoring effort would enable the DoN to determine if the Tinian monarch is experiencing declines in abundance or distribution. The Management Plan would also provide recommendations for habitat management to benefit the Tinian monarch population, including, for example, predator control.

4.9.3.1.1.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Based on historical data and surveys conducted in support of this EIS/OEIS, Figures 4.9-3a and 4.9-3b provide the general locations of special-status species within the Military Lease Area. Potential direct impacts to special-status species from proposed construction activities associated with Tinian Alternative 1 include the removal of habitat, fragmentation of remaining habitat, and associated noise, light, and human activities. Individual special-status species are discussed below.

Mariana Fruit Bat

Of the existing 720 acres (291 hectares) of suitable foraging and roosting habitat (i.e., native limestone forest, *Casuarina* forest, and coconut forest) for the Mariana fruit bat, proposed construction activities associated with Tinian Alternative 1 would remove approximately 45 acres (18 hectares). However, due to historic hunting pressure on the species and limited suitable habitat, the Mariana fruit bat no longer regularly occurs on Tinian. As stated in Section 3.9.4.4, the greatest number of recent sightings from Tinian occurred in 2005 when approximately five individuals were sighted in cliff-line forest in the Maga region. Surveys in 2008 resulted in no observations of fruit bats at eight separate count stations at seven locations on Tinian. Fruit bats may occasionally move between Tinian and Aguiguan, which supports a small colony, but currently there is no fruit bat population on Tinian (DoN 2014a).

Because of the rarity of occurrence of Mariana fruit bats on Tinian, the lack of fruit bat roost sites on the island, and the area of native limestone forest that would remain on Mount Lasso Ridge and elsewhere within the Military Lease Area, potential impacts to Mariana fruit bats from proposed construction activities under Tinian Alternative 1 would be less than significant.

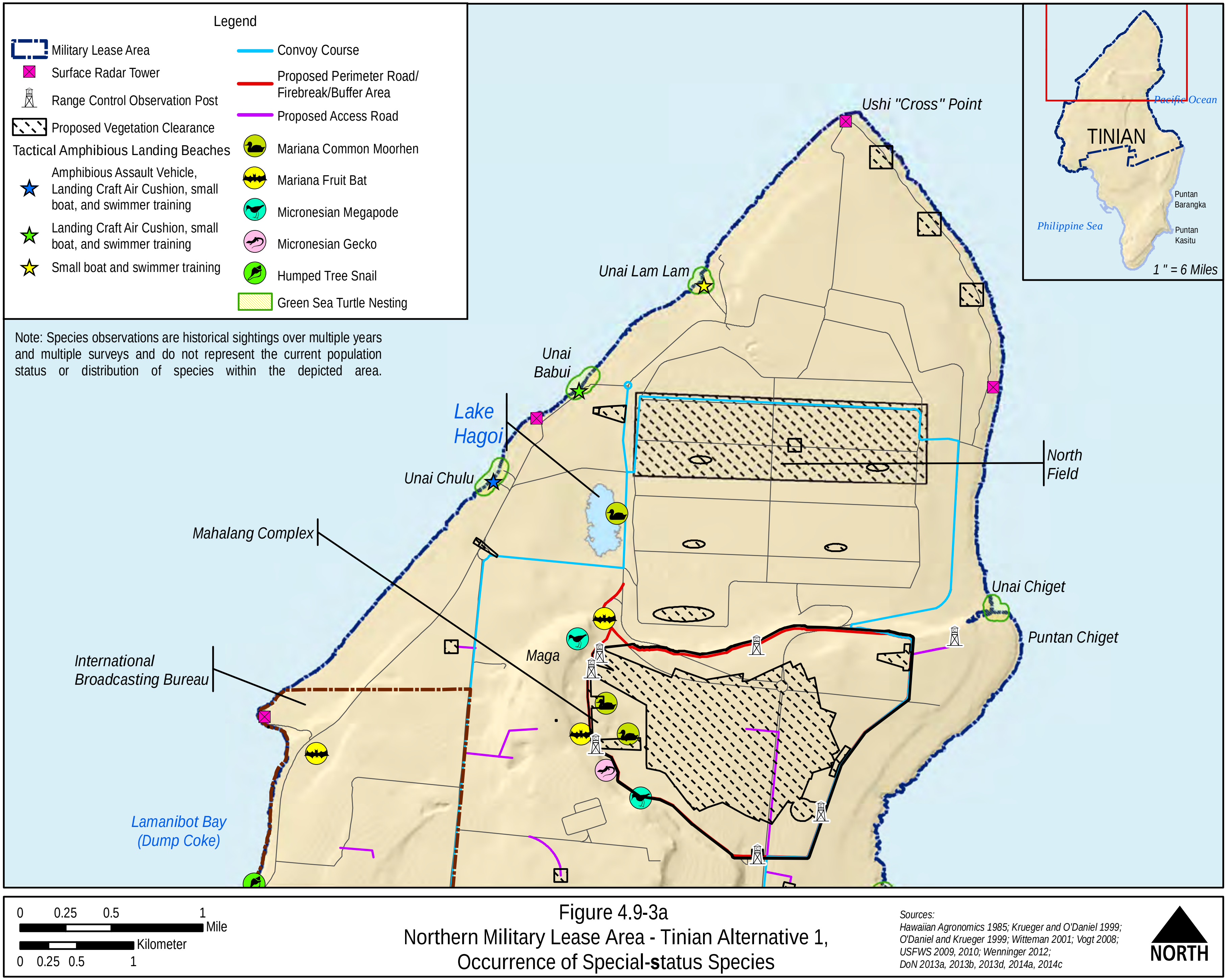
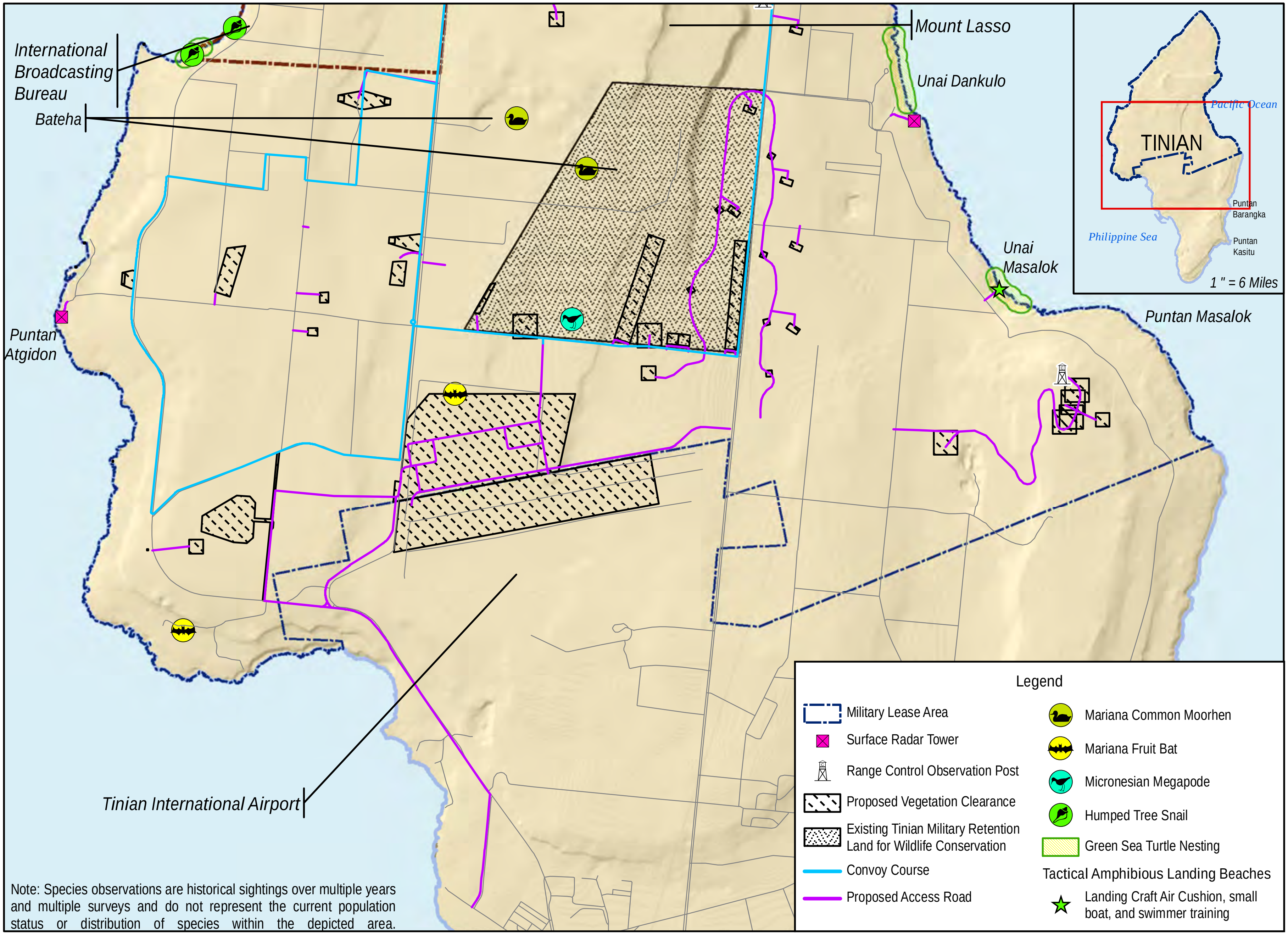


Figure 4.9-3a
Northern Military Lease Area - Tinian Alternative 1, Occurrence of Special-status Species

Sources:
Hawaiian Agronomics 1985; Krueger and O'Daniel 1999; O'Daniel and Krueger 1999; Witteman 2001; Vogt 2008; USFWS 2009, 2010; Wenninger 2012; DoN 2013a, 2013b, 2013d, 2014a, 2014c



0 0.25 0.5 1 Mile

0 0.25 0.5 1 Kilometer

Figure 4.9-3b
Southern Military Lease Area - Tinian Alternative 1, Occurrence of Special-status Species

Sources:
Hawaiian Agronomics 1985; Krueger and O'Daniel 1999; O'Daniel and Krueger 1999; Witteman 2001; Vogt 2008; USFWS 2009, 2010; Wenninger 2012; DoN 2013a, 2013b, 2013d, 2014a, 2014c

NORTH

In addition, the potential mitigation measures described above in the *Vegetation Communities* section would also result in a conservation benefit to the Mariana fruit bat due to the proposed forest enhancement of foraging habitat if Mariana fruit bats from Aguiguan or Saipan begin frequenting Tinian in the future.

Mariana Common Moorhen

Construction for road improvements and creation of training ranges on Tinian is anticipated to generate noise levels of 70-90 decibels at a distance of 50 feet (15 meters). The majority of moorhens found on Tinian are located at Lake Hagoi and the Bateha sites, which would not be directly impacted by construction. As construction activities would occur more than 50 feet (15 meters) from Lake Hagoi and the Bateha sites, moorhens using these areas would not be exposed to construction noise, such that impacts to moorhens in these areas are not anticipated.

Noise from vegetation clearing and construction of the Hand Grenade Range and Grenade Launcher Range and a perimeter road around the High Hazard Impact Area within the vicinity of the Mahalang sites may result in moorhens flushing from and temporarily avoiding the Mahalang ephemeral ponds during the wet season.

In addition, proposed construction of the Hand Grenade Range and Grenade Launcher Range within the western portion of the High Hazard Impact Area would remove two ephemeral ponds totaling less than 0.1 acre (0.04 hectare) of suitable moorhen resting and foraging habitat within the Mahalang complex (see Table 4.9-1). None of the ephemeral ponds associated with the Mahalang complex are known to support nesting moorhens, and the sites are used only during the wet season, when they retain sufficient ponded water to support resting or foraging by moorhens. Noise associated with proposed construction activities within the High Hazard Impact Area may cause moorhens to avoid the Mahalang sites; however, moorhens would likely move to available foraging or resting habitat at Lake Hagoi or the Bateha sites.

Therefore, due to the lack of construction noise impacts on moorhens at Lake Hagoi and the Bateha isolated wetlands, and the ability of moorhens to move from the Mahalang sites to Hagoi or Bateha in response to construction noise, construction activities under Tinian Alternative 1 would result in less than significant direct and indirect impacts to the Mariana common moorhen population.

Micronesian Megapode

As stated in Section 3.9.4.4, Micronesian megapodes occur in very low numbers on Tinian with only individual megapodes rarely detected during surveys of the Mount Lasso and Maga areas. Taped-playback surveys in 2013 and 2014 did not detect any megapodes within the Mount Lasso or Maga areas. Megapodes may occasionally move between Tinian and Aguiguan or Saipan, both of which support small breeding populations, but currently there is no megapode population on Tinian within the Military Lease Area.

Although a megapode within the Mount Lasso Ridge or Maga areas could potentially hear noise associated with construction activities, based on the limited use of lands within the Military Lease Area by megapodes and that the area of suitable habitat within the Mount Lasso and Maga areas would not be impacted, potential impacts to Micronesian megapodes from proposed construction activities under Tinian Alternative 1 would be less than significant.

Sea Turtles

Construction for road improvements and creation of training ranges on Tinian is anticipated to generate noise levels from 70-90 decibels at a distance of 50 feet (15 meters). The majority of proposed construction activities do not occur in proximity to beaches that may support nesting sea turtles; construction at Unai Chulu is addressed below. However, all construction activities would be carried out during daylight hours, such that exposure to construction noise for green turtles nesting on the beaches at night is not anticipated. Potential impacts to eggs or embryos within nests on beaches from construction noise is considered discountable given the distance of the nests from proposed construction activities and the fact that sound would be attenuated or prevented from reaching eggs or embryos that are buried beneath sand.

Under Tinian Alternative 1, 3.0 acres (1.2 hectares) of beach would be impacted due to disturbance resulting from the construction associated with the Tactical Amphibious Landing Beach at Unai Chulu. To minimize and avoid potential impacts from hazardous substances associated with construction equipment and vehicles, appropriate resource management measures (e.g., Spill Prevention, Control and Countermeasures Plan) would be implemented during all construction activities. Proposed construction would involve construction equipment and human activity on the beach for approximately 8 months. For this reason, it is assumed that construction at Unai Chulu would result in the loss of one turtle nesting season on this beach, as turtles would likely avoid the construction equipment and human activity. Modification of the beach slope and dunes adjacent to these areas could impact turtle nesting habitat. However, following construction, any adjacent beach strand habitat that has been altered would be restored. Although loss of sea turtle nesting habitat would occur over one nesting season at Unai Chulu, impacts would occur at the level of individual nesting turtles, and not at the population level. Therefore, construction activities under Tinian Alternative 1 would result in less than significant direct and indirect impacts to nesting sea turtles.

Assessment of potential impacts to sea turtles in the marine environment is provided in Section 4.10, *Marine Biology*.

Humped Tree Snail

The humped tree snail was historically present on Tinian and was thought to have been extirpated (i.e., no longer occurring on Tinian) until two discrete populations were discovered during surveys in June 2013 near the southern end of Lamanibot Bay, known locally as Dump Coke. Other surveys within potentially suitable native limestone habitat throughout the Military Lease Area did not detect any other living tree snails (DoN 2014a). There are no proposed construction activities within or adjacent to the Dump Coke population of humped tree snails. Therefore, construction activities under Tinian Alternative 1 would not result in any direct or indirect impacts to humped tree snails.

Heritiera longipetiolata

Within the Military Lease Area, the tree species *H. longipetiolata* has been found in coastal forests near Unai Masalok on the east coast and along the Lamanibot Bay (Dump Coke) escarpment (Hawaiian Agronomics International, Inc. 1985; DoN 2014a). There are no proposed construction activities within or adjacent to these populations. Therefore, construction activities under Tinian Alternative 1 would not result in any direct or indirect impacts to *H. longipetiolata*.

Dendrobium guamense

Currently, a single population of the orchid *D. guamense* is known from Tinian near Unai Dankulo along the east coast (U.S. Fish and Wildlife Service 2014). There are no proposed construction activities within or adjacent to this population. Therefore, construction activities under Tinian Alternative 1 would not result in any direct or indirect impacts to *D. guamense*.

4.9.3.1.1.4 Special-status Species: Migratory Bird Treaty Act-listed Species

Of the 44 native bird species that have been reported on Tinian, 39 are protected under the Migratory Bird Treaty Act. The majority are seabirds or shorebirds found primarily in coastal areas (e.g., noddies, terns, boobies, plovers, tattlers, sandpipers, herons, egrets). The Pacific golden plover is one of the most common species observed on Tinian during migration, primarily in open grassy fields and along the coast. Additional species include waterfowl or ducks, which are rare transient visitors during migration and are typically observed at Lake Hagoi, the Bateha sites, or along the coast.

As discussed above in *Vegetation Communities*, approximately 1,798 acres (728 hectares) of habitat for native species would be removed because of Tinian Alternative 1 proposed construction activities (see Table 4.9-1). Construction impacts to landbird species protected under the Migratory Bird Treaty Act would be similar to those described above for native wildlife. Table 4.9-3 provides the number of landbirds that may be impacted for three monitored Migratory Bird Treaty Act-listed species due to the loss of 1,745 acres (706 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats. The estimates of bird numbers using these habitats were derived from the 2013 native bird surveys on Tinian (DoN 2014a). The number of birds impacted was calculated by multiplying the number of acres of a specific habitat or vegetation community that would be removed by the estimated density of each species of bird within that habitat.

Table 4.9-3. Potential Direct and Permanent Impacts to Three Migratory Bird Treaty Act-listed Species from Proposed Construction Activities under Tinian Alternative 1

Species	*Number of Birds Impacted by Removal of Habitat**				*Total*	*Estimated Total Tinian Population*	*% of Tinian Population Impacted*
	NLF	*MIF*	*TT*	*HS*			
Collared kingfisher	1	60	46	51	158	2,508	6.3%
Mariana fruit-dove	1	123	98	53	275	4,042	6.8%
White-throated ground-dove	2	150	50	64	266	4,879	5.4%

Notes: *NLF = native limestone forest, MIF = mixed introduced forest, TT = tangantangan, HS = herbaceous scrub.
Source: DoN 2014a.

Proposed construction activities would remove 1,745 acres (706 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats currently available to Migratory Bird Treaty Act-listed species on Tinian. There would be no impacts to coastal or grassland habitats used by seabird or shorebird species. In particular, the removal of forested and herbaceous scrub habitats would result in the loss of nesting, foraging, and resting areas for these bird species protected under the Migratory Bird Treaty Act. In addition, nests in the immediate vicinity of construction activities may be disturbed by noise, light, and human activities and susceptible to abandonment by adults and predation of eggs or young. These activities may also temporarily displace birds from breeding habitat, resulting in reduced reproductive success. Direct mortality from construction equipment is unlikely because noise associated with pre-construction activities and human presence is likely to disperse wildlife prior to any equipment use, although vehicle traffic would increase the potential for wildlife collisions. Although construction would occur over an 8 to 10 year period, these noise impacts would be short-term and minor because only a small number of range and support facilities would be under construction at any given time. As such, these temporary and direct impacts to bird populations from construction noise and human activities would be less than significant.

Therefore, implementation of Tinian Alternative 1 and the removal of approximately 1,745 acres (706 hectares) of forested and herbaceous scrub habitats would result in less than significant impacts to Migratory Bird Treaty Act-listed species, but significant impacts to the populations of forest- and scrub-nesting Migratory Bird Treaty Act-listed species due to removal of habitat. Forest- and scrub-nesting Migratory Bird Treaty Act-listed bird species are territorial, meaning that a minimum area is required for each bird or breeding pair for all of their foraging and nesting activities. For most animal species, and particularly within island ecosystems, available but unoccupied habitat is rare (if it does exist, it is generally very low-quality habitat). This is the case unless populations are limited not by habitat, but by predators, disease, or over-hunting. Based on available data, there is no indication that there are large areas of available but unoccupied habitat on Tinian, particularly for forest and shrub breeding bird species. For these reasons, the loss of 1,745 acres (706 hectares) of habitat would be significant, even with forest enhancement efforts. Although bird densities are higher in higher-quality habitats and more birds are expected to eventually occupy areas of proposed forest enhancement, the proposed area of forest enhancement is not large enough to make up for the overall loss of available habitat under Alternative 1. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

Tinian Alternative 1 construction activities would have potential significant direct, long-term impacts on forest- and scrub-nesting Migratory Bird Treaty Act-listed species due to loss of habitat. To mitigate the potential significant direct, long-term impacts of the removal of 1,745 acres (706 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats, the DoN proposes to implement forest enhancement of native limestone forest, mixed introduced forest, tangantangan forest, and herbaceous scrub habitats. This is in addition to the forest enhancement of 6.3 acres (2.5 hectares) of native limestone forest or mixed introduced forest described above in the *Vegetation Communities* section. Forest enhancement would include but is not limited to the following:

- Propagating, planting, and establishing dominant and rare species that are characteristic of native limestone forest habitats (e.g., *Cynometra ramiflora*, *Neisosperma oppositifolia*, *Eugenia palumbis*, *Guamia mariannae*, pandanus, banyan tree, and tropical almond)
- Removing non-native, invasive vegetation
- Controlling non-native predators (e.g. rats, feral cats)

A Forest Enhancement/Restoration and Monitoring Plan would be prepared and implemented that would provide detailed guidance on proposed forest enhancement activities on Tinian as well as long-term monitoring of the success of the proposed forest enhancement measures. Although the exact locations of the proposed forest enhancement areas have not been identified, prior to implementing any forest enhancement activities appropriate environmental compliance documentation would be prepared, including coordination with cultural resources personnel under Section 106 of the National Historic Preservation Act regarding the potential occurrence of cultural resources within any proposed forest enhancement site.

In addition, the DoN, in coordination with the U.S. Fish and Wildlife Service, would prepare a Tinian Forest Bird Monitoring and Tinian Monarch Management Plan to monitor the potential effects of proposed CJMT activities on Migratory Bird Treaty Act-listed forest birds within the Military Lease Area. The proposed Management Plan would be based on continuing the forest bird surveys conducted along a series of transects surveyed in 1982, 1996, 2008, and 2013. The continued surveys would assess the overall status of Migratory Bird Treaty Act-listed forest birds and allow evaluation of long-term trends in population size and distribution through comparison with the four previous island-wide surveys of forest birds on Tinian. The data from this monitoring effort would enable the DoN to determine if the Migratory Bird Treaty Act-listed forest birds are experiencing declines in abundance or distribution.

4.9.3.1.1.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the Mariana common moorhen, Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are all CNMI-listed threatened/endangered species. These species are discussed above within the *Endangered Species Act-listed Species* section. The CNMI-listed Micronesian gecko is discussed below.

Micronesian Gecko

This gecko was believed to have been extirpated in 1946 until it was collected in 2003 in southern Tinian and in 2008 within the Mount Lasso area. The proposed construction activities would not remove native limestone forest within the Mount Lasso area, the only known location within the Military Lease Area that supports the Micronesian gecko. Potential mitigation measures described above in the *Vegetation Communities* section would also result in a conservation benefit to the Micronesian gecko. For this reason, implementing Tinian Alternative 1 would result in no impacts to the Micronesian gecko.

4.9.3.1.2 Operation Impacts

4.9.3.1.2.1 Vegetation Communities

Foot traffic associated with training in the Military Lease Area is currently an authorized, ongoing activity. Implementing Tinian Alternative 1 would increase the frequency of on-foot training throughout the Military Lease Area, although it would be concentrated within the northern Battle Area Complex, Multi-purpose Range Complex, and Infantry Platoon Battle Course. The increased foot traffic would result in the trampling and breaking of vegetation; however, vegetation cutting is not proposed within the maneuver areas, and bivouac or camping sites would only be established in the region of the base camp. In addition, in accordance with previous Endangered Species Act section 7 consultations with the U.S. Fish and Wildlife Service, Lake Hagoi and a surrounding buffer would remain a “No Training Area,” and all native limestone forest within the Military Lease Area would be designated a “No Wildlife Disturbance Area” with limited, non-invasive, on-foot military training allowed (see Figure 4.9-2) (U.S. Fish and Wildlife Service 2010).

Outside of these specially designated maneuver areas, foot traffic associated with training would occur up to 20 weeks per year. Any potential impacts to vegetation associated with foot traffic would not be significant as land training within the Military Lease Area would be short-term, infrequent, diffuse, and vary in location across training events; if trampled or broken, vegetation on Tinian is known to recover quickly; and ecosystem functions provided by the vegetation would remain intact.

Impacts to vegetation from vehicle use would be localized, as vehicle travel is restricted to existing or proposed roads and trails. Amphibious operations on the beaches would disturb beach habitat, however the DoN would use hand-tools to restore beach contours and smooth divots. Ordnance use would be limited to designated impact areas (i.e., High Hazard Impact Area, range targets, objective areas, and engagement areas) that would be cleared of vegetation during construction.

Fire potential would increase due to proposed live-fire range operations. Fire can result in direct effects to vegetation by killing or damaging individual plants; or indirect effects by increasing erosion, allowing non-native species to invade, and altering wildlife habitat by reducing food resources, breeding habitat, and shelter. Native habitats on Tinian are adapted to a humid, tropical climate and are not adapted to a fire driven ecosystem (U.S. Fish and Wildlife Service 2008). To reduce the potential for fires, designated target areas, including the High Hazard Impact Area, would be cleared of vegetation during construction and maintained to remain within 6 inches (15 centimeters) of the ground. The High Hazard Impact Area would also be surrounded by a perimeter road and firebreak, and fire prevention and management activities would be implemented upon initiation of CJMT live-fire training per a Fire Prevention and Management Plan that would be developed. This plan would outline standard procedures for safe range usage and risk reduction related to fire management (e.g., water trucks present at each range during training activities).

Potential impacts to vegetation communities from training operations would be avoided and minimized by implementing resource management measures summarized in Section 4.9.2 and presented in detail in Appendix D, *Best Management Practices*. In particular, with establishment of a firebreak around the High Hazard Impact Area, vegetation management within the associated target areas and firebreak, and implementation of a Fire Prevention and Management Plan, which establishes management and fire suppression and emergency response procedures, implementation of the training activities associated with Tinian Alternative 1 would result in less than significant direct and indirect impacts to vegetation communities.

4.9.3.1.2.2 Native Wildlife

This section describes the potential impacts to native wildlife species on Tinian from training activities under Alternative 1. Impacts to special-status species are addressed separately. Potential direct impacts to all wildlife species would result from maneuver training, munitions use (including noise), noise from aircraft overflights, aircraft strikes of native and Migratory Bird Treaty Act-listed birds, and fire. Indirect impacts to all wildlife species may result from pollutants and potential non-native species introductions.

Maneuver Training

As presented above under Vegetation Communities, disturbance from Tinian Alternative 1 foot traffic would occur throughout the Military Lease Area. Camping, ground disturbance, or direct disturbance of any wildlife species would be prohibited. While wildlife may react to military personnel moving through forest or other habitats, these reactions are expected to be insignificant as land training within the Military Lease Area would be short-term, infrequent, diffuse, and vary in location across training events.

Although vehicle maneuver training on roads could result in mortality of wildlife species, vehicle speeds would be limited to 25 miles per hour (40 kilometers per hour) or less and wildlife would be able to avoid injury by moving away from vehicles.

Munitions Use

Fragments of non-dud producing ammunition may fall within the surface danger zones; however, the likelihood of any single animal being struck is negligible. Ordnance explosions could result in direct impacts to wildlife if a species occurs within the High Hazard Impact Area during live-fire operations. However, the High Hazard Impact Area would be cleared of vegetation and would be less likely to attract wildlife species due to the decrease in habitat suitability.

Fires

Although there are no records of wildfires on Tinian resulting from U.S. military training activities (DoN 2014a), fire potential would be increased from live-fire and vehicle maneuvering operations. Indirect impacts to wildlife habitat adjacent to the High Hazard Impact Area from potential fire hazard would be reduced due to clearing of vegetation, a perimeter road and firebreak, and water trucks present at each range during operations. Fire can result in direct effects to all wildlife through mortality or smoke inhalation. Native plants, animals, and their habitats on Tinian are adapted to a humid, tropical climate and are not adapted to a fire-driven ecosystem. Fire potential is higher in non-native communities such as grasslands and tangantangan forests, particularly in the dry season (U.S. Fish and Wildlife Service 2008). The alteration or removal of habitats by fire could reduce food sources, prevent or inhibit breeding, or create competition for feeding and sheltering, particularly for species that establish discrete territories. However, due to the proposed vegetation clearing during construction, vegetation management, and the preparation and implementation of a Fire Prevention and Management Plan (see previous discussion under Vegetation Communities); the potential for wildfire outside the High Hazard Impact Area would be minimized.

Noise

Direct impacts from noise would be limited to times of active live-fire training operations, which would occur up to 20 non-consecutive weeks per year (but not 24/7). Noise modeling studies were conducted for the proposed training activities; noise levels and noise contours are provided in Section 4.5, *Noise*. Wildlife within the Military Lease Area would be exposed to noise of more than 85 decibels A-weighted day-night average sound exposure level and 104 decibels Peak level from small-caliber weapons (see Figures 4.5-1 and 4.5-2), 70 decibels C-weighted day-night average sound level and 130 decibels Peak level from large-caliber weapons (see Figures 4.5-3 and 4.5-4), and 75-80 decibels (A-weighted) noise levels from aircraft operations, primarily adjacent to the Tinian International Airport (see Figure 4.5-6).

It is important to note that all operational noise disturbances would be temporary and would not be continuous for several reasons. First, the type of activity (small- and large-caliber firing, and aircraft overflights) consists of non-continuous events. Second, training events would only occur up to 20 non-consecutive weeks per year. Third, some ranges would likely not be used on any given training day.

No noise studies have been conducted specifically on wildlife species present on Tinian; however, noise studies have been conducted on the effects of military noise on wildlife species associated with other ranges that are similar to those proposed for use on Tinian. Wildlife response from noise under the proposed training activities may vary among individuals because of habituation, in which after a period of exposure to a stimulus, an animal stops responding to the stimulus. In general, a species can often habituate to human-generated noise when the noise is not followed by an adverse impact (i.e., physical injury).

In addition to noise level, the frequency and regularity of the noise also affect species sensitivity. That is, different types of noise sources produce varied effects on different species. Noise from aircraft overflights may not produce the same response from a wildlife species as noise from a land-based source such as a vehicle, chainsaw, or gunshot. Wildlife species often do not react to a noise source when unaccompanied by a visual cue, but often do react to the visual component associated with that noise source. For example, birds may not react to just the sound of a chainsaw, but when that sound is coupled with a human walking near the bird, the bird will flush. This is also shown in reactions by various species to aircraft overflights (airplanes and helicopters). An overflight with just a sound component does not elicit a strong response, but if a bird hears and then sees the aircraft, the bird will more likely flush and move away (Manci et al. 1988; U.S. Forest Service 1992; Krausman et al. 1993; Bowles 1995).

Aircraft disturbances have been found to impact native and non-native species at an individual and community level (e.g., Gladwin et al. 1987; National Park Service 1994). Wildlife generally respond to low-altitude aircraft, although the ways in which they respond varies depending on life history, habitat, aircraft and flight activities, as well as previous exposure to aircraft (Burger 1981). Physiological and/or behavioral responses can reduce an animal's fitness and ability to survive, or increase its propensity to relocate. It is thought that low-altitude overflights can cause excessive stimulation, alertness, or stress (Manci et al. 1988; Fletcher 1990). Aircraft overflights of Lake Hagoi and the two Bateha isolated wetlands would be restricted to altitudes of greater than 500 feet (150 meters) above ground level. As such, the primary impacts to wildlife would be from noise associated with aircraft overflights.

Vanderwerf et al. (2000) studied the effects of military noise on the Oahu elepaio (*Chasiempis sandwichensis*), an endangered Pacific flycatcher in the same family as the Tinian monarch. The study provides some indirect evidence that the Tinian monarch, and other native birds, may not be highly sensitive to live-fire noise.

The study evaluated the responses of Oahu elepaio at the Schofield Barracks Range in Hawaii to 282 high explosive artillery (60-millimeter, 105-millimeter, and 155-millimeter) and demolition blasts located 330 to 3,300 feet (100 to 1,000 meters) from elepaio nests, ranging in intensity from 81 to 116 decibels A-weighted. Responses to artillery blast noise were only detected in two instances. The response was minor and short-lived in both cases; the male lowered its head and resumed preening 1-2 seconds after each blast noise had subsided. In neither instance did an elepaio flush from the nest or pause when returning to the nest in response to artillery noise. This study suggests that Oahu elepaio reproductive success is not negatively impacted by noise associated with live-fire training, particularly artillery (VanderWerf et al. 2000). It should be noted the elepaio studied at Schofield Barracks Range may be habituated to the noise associated with live-fire training and because live-fire training has not been conducted on Tinian recently, it may take some time for the birds to habituate to the noise. Birds habituate to noises and may not respond to stimuli when they do not perceive a direct threat (e.g., a visual threat connected to the noise event).

In addition to the elepaio study, coastal California gnatcatchers (*Polioptila californica*) regularly occur and nest successfully within 400 feet (122 meters) of the local Sheriff's Training Range and a Trap and Skeet Range at Marine Corps Air Station Miramar in California (DoN 2011). Furthermore, the federally listed black-capped vireo (*Vireo atricapilla*) and golden-cheeked warbler (*Dendroica chrysoparia*) are bird species that are known to nest within live-fire training ranges, including the live-fire impact area at Fort Hood in Texas, despite the occurrence of ongoing training activities similar to that proposed under Tinian Alternative 1 (U.S. Fish and Wildlife Service 2005).

A cooperative study between the Department of Defense and the U.S. Fish and Wildlife Service, assessed the response of the red-cockaded woodpecker (*Picoides borealis*) to a range of military training noise events, including artillery, small arms, helicopter, and maneuver noise (Delaney et al. 2000). The project findings show that the red-cockaded woodpecker successfully acclimates to military noise events. Depending on the noise level that ranged from innocuous to very loud, the birds responded by flushing from their nest cavities. When the noise source was closer and the noise level was higher, the number of flushes increased proportionately. In all cases, however, the birds returned to their nests within a relatively short period of time (usually within 12 minutes). Additionally, the noise exposure did not result in any mortality or statistically detectable changes in reproductive success (Delaney et al. 2000). Red-cockaded woodpeckers did not flush when artillery simulators were more than 400 feet (122 meters) away and sound exposure levels were 70 decibels.

Because training would not be continuous and wildlife species have been shown to habituate to noise associated with military live-fire training activities, there would be less than significant impacts to native wildlife species under Tinian Alternative 1.

Introduction of Non-native Species

Training activities would result in increased transport of material and personnel by ship and aircraft between Guam, other CNMI locations, and Tinian. These activities have the potential to introduce non-native invasive species that could degrade the ecosystem on Tinian. The brown treesnake is one of the most serious potential non-native species that could be inadvertently brought to Tinian. Non-native insects such as the little fire ant, coconut rhinoceros beetle, and cycad scale would also severely damage Tinian's native species and habitats. Invasive plant species (e.g., refer to Space and Falanruw 1999) also pose a risk to native wildlife. Such non-native invasive plant and animal species have the potential to increase the mortality of native species, degrade habitats by altering species composition and structure, increase rates of depredation, and increase competition between species.

Section 4.9.2, *Resource Management Measures*; Appendix D, *Best Management Practices*; and Appendix L, *Biological Resources Supporting Documentation;* provide details regarding applicable biosecurity measures that the U.S. military would implement to ensure that risk from transporting invasive species to Tinian is controlled.

Aircraft Strikes

Under Tinian Alternative 1, the potential for bird/animal aircraft strikes would increase from the current baseline with increased use of North Field and the Tinian International Airport. However, in accordance with DoN requirements, a Bird/Animal Aircraft Strike Hazard Plan would be prepared to address all aircraft operations on Tinian. This plan would be prepared to minimize the occurrence of bird/animal aircraft strikes, and would provide detailed procedures to monitor and react to heightened risk of bird/animal strikes. When risk increases, limits would be placed on low-altitude flight and some types of training. Special briefings would be provided to pilots whenever the potential exists for increased bird/animal strikes within the airspace.

With implementation of these resource management measures described above, potential direct and indirect impacts to native wildlife species from proposed operations would be less than significant.

4.9.3.1.2.3 Special-status Species: Endangered Species Act-listed Species and Proposed Species

Potential impacts to special-status species from munitions, non-native species, and potential wildfires from training activities associated with Tinian Alternative 1 would be similar to those discussed above under Native Wildlife, and would be less than significant. Impacts from noise and human activity are discussed below.

Mariana Fruit Bat

Mariana fruit bats are rare transient visitors to Tinian, possibly moving between Aguiguan and Saipan. Under Alternative 1, noise associated with live-fire training activities, physical disturbance, and habitat removal or degradation may occur in potential Mariana fruit bat habitat (i.e., native limestone forest, mixed introduced forest, *Casuarina* forest) on Tinian due to the proposed action. However, given the rarity of occurrence of fruit bats on Tinian, and that there are no known fruit bat roost sites on Tinian, exposure to these stressors would be discountable or insignificant.

Based on the limited use of Tinian by Mariana fruit bats, Tinian Alternative 1 training activities would result in less than significant direct and indirect impacts.

Mariana Common Moorhen

The majority of moorhens found on Tinian are located at Lake Hagoi, with some use of the Bateha sites and ephemeral ponds at the Mahalang complex. Lake Hagoi and the two Bateha isolated wetlands would remain designated by Department of Defense as "No Training Areas" (see Figure 4.9-2). The only military training activities in a "No Training Area" are troop and vehicle movements along established boundary roads, and ground disturbance and vegetation removal of any kind would be prohibited. To avoid and minimize effects to the Mariana common moorhen at Lake Hagoi, the DoN has established a 215-acre (87-hectare) "No Training Area" around Lake Hagoi. The "No Training Area" is bounded by existing roads, with the closest road within 246 feet (75 meters) of the wetland.

Noise levels from munitions training and aircraft operations were modeled for Lake Hagoi, the Mahalang complex, and the two Bateha isolated wetlands to assess potential effects to Mariana common moorhens. At Lake Hagoi, noise from small-caliber weapons training would expose moorhens to 63 decibels A-weighted day-night average sound level and 108 decibels Peak noise levels (see Figures 4.5-1 and 4.5-2 and Table 4.5-3). Noise generated by large-caliber weapons would expose moorhens at Lake Hagoi to 77 decibels C-weighted day-night average sound level, and 124 decibels and 135 decibels Peak during neutral and unfavorable weather conditions, respectively (see Figures 4.5-3, 4.5-4, and 5.4-5 and Tables 4.5-7 and 4.5-9). Aircraft operations would result in 63 decibels A-weighted day-night average sound level for Lake Hagoi (see Figure 4.5-6 and Table 4.5-13). Sound levels from large-caliber weapons training on Tinian may cause periodic startle responses or flushing of moorhens at Lake Hagoi. Effects of these responses may include altered foraging or breeding behaviors. Moorhens are not likely to flush from nests in response to these noise levels, such that effects on reproductive success are not anticipated.

At the Mahalang complex, noise from small-caliber weapons training would expose moorhens to 67 decibels A-weighted day-night average sound level and 104 decibels Peak noise levels (see Figures 4.5-1 and 4.5-2 and Table 4.5-3). Noise generated by large-caliber weapons would expose moorhens at Mahalang to 89 decibels C-weighted day-night average sound level, and 138 decibels and 147 decibels Peak during neutral and unfavorable weather conditions, respectively (see Figures 4.5-3, 4.5-4, and 5.4-5 and Tables 4.5-7 and 4.5-9). Aircraft operations would result in 65 decibels A-weighted day-night average sound level for Mahalang (see Figure 4.5-6 and Table 4.5-13). Sound levels from small- and large-caliber weapons training on Tinian may cause moorhens to flush from and avoid the Mahalang area periodically or permanently. Effects of these responses may include altered foraging behaviors, as moorhens may move to Lake Hagoi or the Bateha wetlands for foraging during the wet season.

At the two Bateha isolated wetlands, noise from small-caliber weapons training would expose moorhens to 65 and 75 decibels A-weighted day-night average sound level and 107 and 108 decibels Peak noise levels at the north and south sites, respectively (see Figures 4.5-1 and 4.5-2 and Table 4.5-3). Noise generated by large-caliber weapons would expose moorhens at the north Bateha site to 70 decibels C-weighted day-night average sound level, and 117 and 130 decibels Peak during neutral and unfavorable weather conditions, respectively (see Figures 4.5-3, 4.5-4, and 5.4-5 and Tables 4.5-7 and 4.5-9). Large-caliber weapons noise at the south Bateha site would expose moorhens to 71 decibels C-weighted day-night average sound level, and 119 and 131 decibels Peak during neutral and unfavorable weather conditions, respectively. Aircraft operations would result in 62 and 67 decibels A-weighted day-night average sound level for the north and south Bateha sites, respectively (see Figure 4.5-6 and Table 4.5-13). Sound levels from small- and large-caliber weapons training on Tinian may cause moorhens to exhibit startle behaviors or flush from the Bateha sites periodically. Effects of these responses may include altered foraging behaviors within the Bateha sites or as moorhens move to Lake Hagoi for foraging during the wet season.

Although noise may impact individual moorhens at Lake Hagoi, the Mahalang sites, and the Bateha isolated wetlands, the birds may move between sites in response to the intermittent noise events. The periods of noise disturbance from live-fire weapons training and aircraft operations on Tinian would not be continuous during any single day, all live-fire ranges and aircraft operations would not operate at the same time during any given day, and training exercises would occur approximately 20 non-consecutive weeks per year. Birds habituate to noises and may not respond to stimuli when they do not perceive a direct threat (e.g., a visual threat connected to the noise event). As stated previously under Native Wildlife, because training would not be continuous and wildlife species have been shown to habituate to noise associated with military live-fire training activities, noise impacts to the Mariana common moorhen population on Tinian are anticipated to be less than significant.

Micronesian Megapode

Under Tinian Alternative 1, native limestone forest, where megapodes are most often observed on Tinian, would be designated as a “No Wildlife Disturbance Area,” and only limited, non-invasive, on-foot military training would be allowed. As megapodes would not occur within or near live-fire ranges or the High Hazard Impact Area, there would be no potential for direct mortality from live-fire training operations. Direct impacts to megapodes on Tinian from noise would be similar to those described above for native wildlife and would be less than significant. In addition, megapodes on Farallon de Medinilla, a DoN live-fire bombing range to the north of Tinian, are subject to intensive live-fire activities and associated noise from ordnance use. Megapodes persist on Farallon de Medinilla and do not appear to be affected by noise levels associated with ordnance use.

Given the above, and the extremely rare occurrences of megapodes on Tinian, noise associated with ordnance within the Tinian Alternative 1 High Hazard Impact Area on Tinian is expected to result in less than significant direct and indirect impacts to megapodes on Tinian.

Sea Turtles

Results of noise modeling indicate that small-caliber weapons training on Tinian would expose nesting green turtles to less than 60 decibels A-weighted day-night average sound level at Unai Chiget, Unai Masalok, and Unai Lam Lam, and less than 65 decibels A-weighted day-night average sound level at Unai Chulu and Unai Dankulo. Small-caliber weapons fire would generate less than 97 decibels Peak and less than 110 decibels Peak at these same beaches. Noise generated by large-caliber weapons would potentially expose nesting green turtles to 66-78 decibels C-weighted day-night average sound level and 110 to 127 decibels and 121 to 138 decibels Peak during neutral and unfavorable weather conditions, respectively. Aircraft operations on Tinian would expose nesting green turtles to 56.7 to 66.0 decibels A-weighted Day-Night Average Sound Level.

Approximately 70% of green turtle nesting activity within the Tinian Military Lease Area over the past 4 years has occurred on Unai Dankulo. Adjacent to the proposed High Hazard Impact Area, Unai Dankulo would be exposed to noise levels from large-caliber weapons of 78 decibels C-weighted day-night average sound level and 127 and 138 decibels Peak noise during neutral and unfavorable weather conditions, respectively. Although the periods of noise disturbance from live-fire weapons training on Tinian would not be continuous, training exercises would occur approximately 20 non-consecutive weeks per year. Sound levels from large-caliber weapons training at night may cause adult turtles to avoid nesting beaches or to abandon nesting attempts during periods of training. Effects of these responses include altered nesting behavior that may reduce reproductive success.

Under Tinian Alternative 1, proposed annual amphibious operations would include 213 Amphibious Assault Vehicles landings, 72 Landing Craft Air Cushion landings, and 96 small boat landings. Activities and personnel associated with amphibious landings on Tinian would potentially disturb sea turtle nesting habitat. Noise during amphibious training activities could also startle nesting female sea turtles or prevent them from ascending the beach zone to excavate a nest. There is an elevated risk to sea turtles during nighttime training activities as sea turtle nesting occurs primarily at night. However, implementation of the training restrictions such as those described by the *Biological Opinion for the Mariana Islands Range Complex, Guam and the Commonwealth of the Northern Mariana Islands 2010-2015* (U.S. Fish and Wildlife Service 2010) would ensure that these disturbances would not affect sea turtles on the beach or their nests. Restrictions include implementing a monitoring program during amphibious training events that includes pre-event surveys to delineate boundaries around nest sites as well as postponing landing activities when a nesting sea turtle is observed on land. The DoN also uses hand-tools to restore beach contours and smooth divots that may trap hatchlings after landing activities. Further, data from the DoN's monthly monitoring program are used to prioritize beaches for landing activities that are less important to sea turtle nesting. Thus far, the DoN's implementation of avoidance and minimization measures have resulted in no takes of nesting sea turtles. Similar training and measures within the Hawaii Island Range Complex and other training locations that also support sea turtle nesting have also proven effective in protecting turtles and their nests.

Therefore, there would be less than significant direct and indirect impacts to sea turtles from military training activities associated with Tinian Alternative 1. Potential impacts to sea turtles in the Tinian marine environment are discussed in Section 4.10, *Marine Biology*.

Humped Tree Snail

Training operations under Tinian Alternative 1 would not occur within or in the vicinity of the only known populations of humped tree snails on Tinian. Therefore, there would be no impacts to humped tree snails with implementation of Tinian Alternative 1.

Heritiera longipetiolata

Training operations under Tinian Alternative 1 would not occur within or in the vicinity of the only known population of *H. longipetiolata* on Tinian. Therefore, there would be no impacts to *H. longipetiolata* with implementation of Tinian Alternative 1.

Dendrobium guamense

Training operations under Tinian Alternative 1 would not occur within or in the vicinity of the only known population of *D. guamense* on Tinian. Therefore, there would be no impacts to *D. guamense* with implementation of Tinian Alternative 1.

4.9.3.1.2.4 Special-status Species: Migratory Bird Treaty Act-listed Species

Direct and indirect impacts from operational activities on the 39 protected bird species are similar to those discussed under the *Native Wildlife* section and would be less than significant.

4.9.3.1.2.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the Mariana common moorhen, Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are all CNMI-listed threatened/endangered species. These species are discussed above within the *Endangered Species Act-listed Species* section.

Micronesian Gecko

Noise and visual stimuli associated with training activities under Tinian Alternative 1 would not affect Micronesian geckos because their known habitat on Mount Lasso would not be disturbed. Therefore, Tinian Alternative 1 operations would result in no impacts to Micronesian geckos.

4.9.3.2 Tinian Alternative 2

4.9.3.2.1 Construction Impacts

4.9.3.2.1.1 Vegetation Communities

The vegetation communities that would be impacted during proposed construction activities under Tinian Alternative 2 are shown in Figures 4.9-4a and 4.9-4b and listed in Table 4.9-4. Under Alternative 2, approximately 1,938 acres (784 hectares) of undeveloped or non-barren land would be impacted, representing approximately 8% of the island and approximately 13% of the Military Lease Area. The High Hazard Impact Area (527 acres [213 hectares]) and the Drop Zone (456 acres [184 hectares]) comprise approximately half of the total impacts to vegetation communities. The majority of the impacted vegetation communities (1,877 acres [760 hectares]) are composed of tangantangan (817 acres [331 hectares] or 10% of total on island), mixed introduced forest (693 acres [280 hectares] or 11% of total on island), and herbaceous scrub (367 acres [148 hectares] or 8% of total on island). In addition, 6.3 acres (2.5 hectares), or 0.5% of total on island, of native limestone forest would be removed, primarily within the High Hazard Impact Area (see Table 4.9-5).

As discussed previously under Alternative 1, given the importance of native limestone forest habitat for native species and the continuing loss of limestone forest on Tinian, the conversion of 6.3 acres (2.5 hectares) to developed area under Tinian Alternative 2 would result in significant direct impacts to the regional vegetation community and its function.

In addition, two ephemeral ponds within the Mahalang Complex totaling less than 0.5 acre (0.2 hectare) of wetlands habitat would be lost due to construction of the hand grenade and grenade launcher ranges within the High Hazard Impact Area. Based on recent wetlands surveys on Tinian, one of two ephemeral ponds is considered an isolated wetland that supports ephemeral wetland habitat during years of high rainfall. This loss of less than 0.5 acre (0.2 hectare) of wetland habitat would not be significant.

The same potential mitigation measures discussed previously under Alternative 1 to mitigate potential significant direct, long-term impacts of proposed construction activities on native limestone forest would be applicable under Alternative 2 (i.e., forest enhancement of 6.3 acres [2.5 hectares] of mixed introduced forest). Implementation of proposed mitigation measures would reduce the impact to less than significant. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

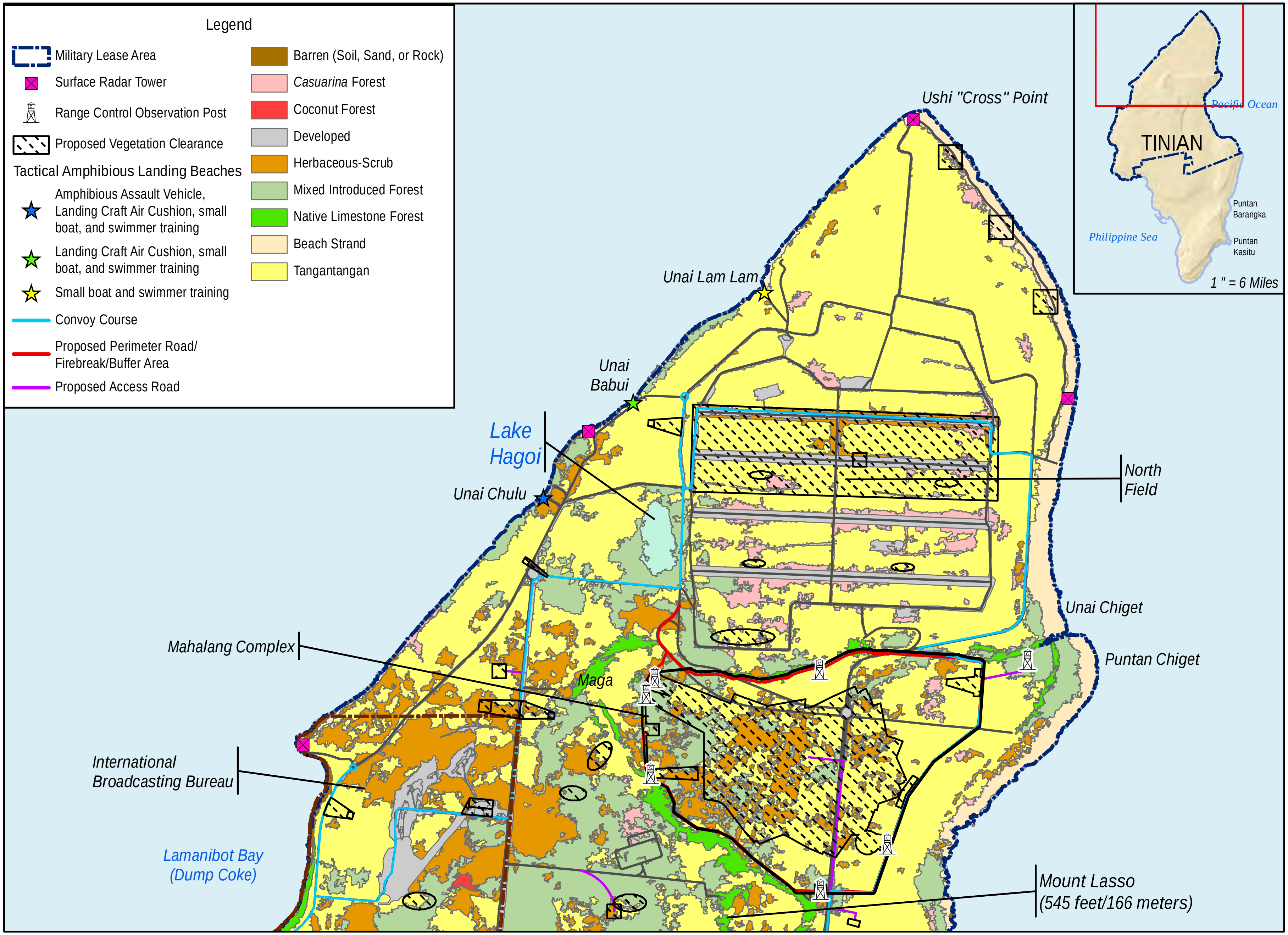


Figure 4.9-4a
Northern Military Lease Area - Tinian Alternative 2,
Vegetation Communities

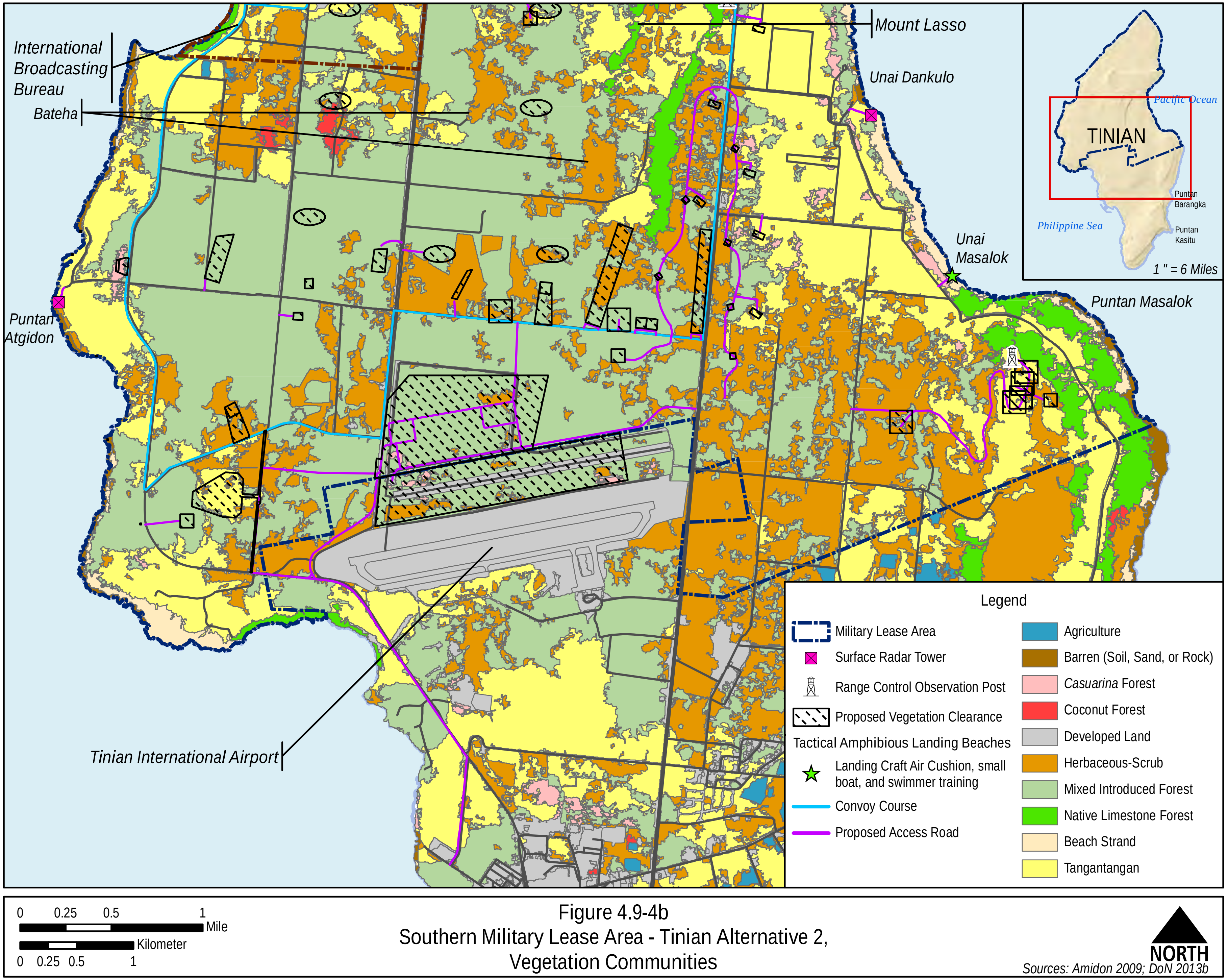


Figure 4.9-4b
Southern Military Lease Area - Tinian Alternative 2,
Vegetation Communities

Sources: Amidon 2009; DoN 2013b

Table 4.9-4. Potential Direct Impacts to Vegetation Communities with Implementation of Tinian Alternative 2

Project Area*	Vegetation Community (acres)(1)											
	NLF	MIF	TT	HS	Cas	Coco	BS	Wet	Ag	Bar	Dev	Total
High Hazard Impact Area(2)	3.3	73.9	293.7	145.1	0	0	0	0.5(3)	0	0	11.0	527.5
Combat Pistol Range (Automated)	0	2.1	0	0	0	0	0	0	0	0	0	2.1
Multi-purpose Range Complex(4)	0	6.1	2.8	6.4	0.6	0	0	0	0	0	0.2	16.1
Battle Sight Zero Range	0	2.1	0	0	0	0	0	0	0	0	0	2.1
Multi-purpose Training Range	0	8.3	0	14.3	0	0	0	0	0	0	0	22.6
Multi-purpose Automated Unknown Distance Range/Field Fire Range	0	9.2	0.4	21.4	0	0	0	0	0	0	0	31.0
Infantry Platoon Battle Course	0	16.2	0	6.4	0	0	0	0	0	0	0.6	23.2
Urban Assault Course (South)	0	20.1	0	0	0	0	0	0	0	0	0	20.1
Southern Battle Area Complex	0	69.8	11.8	12.1	0.1	2.5	0	0	0	0	0	96.3
Northern Battle Area Complex	0	0	9.6	0	1.6	0	0	0	0	0	0	11.2
Urban Assault Course (North)	0	0.8	12.8	0	2.0	0	0	0	0	0	0.2	15.8
Drop Zone	0	0.2	302.2	42.7	14.0	0	0	0	0	0	96.5	455.6
Field Artillery Indirect Fire Range (Firing Points)	0.4	18.9	32.2	14.1	1.5	0	17.0	0	0	0	0.9	85.0
Convoy Course Engagement Areas	0	13.2	34.6	22.0	2.4	0	0	0	0	0	8.6	80.8
Convoy Course	0	9.8	20.9	3.5	0.4	0	0	0	0	0	27.5	62.1
Tracked Vehicle Driver's Course	1.5	33.1	39.8	18.1	0.7	0.3	<0.1	0	0.1	0.1	6.4	100.2
Tactical Amphibious Landing Beach (Unai Chulu)	0	0	0.1	0.9	0	0	0	0	0	3.0	0	4.0
Landing Zones	0	7.0	5.3	6.1	0	0	0	0	0	0	1.4	19.8
Range Control Observation Points	0	1.7	9.4	3.7	0	0	<0.1	0	0	<0.1	0	14.8
Surface Radar Sites	0	1.8	0.6	0.1	0	0	0.1	0	0	<0.1	0	2.6
Roadway Improvements	0	4.0	4.4	2.4	0	0	0	0	0	0	32.4	43.2
Fences	1.1	10.9	9.0	9.0	0.1	0	0	0	0	<0.1	5.7	35.8
Munitions Storage Area	0	5.9	27.0	4.9	0	0	0	0	0	0	<0.1	37.8
Airport Improvements and Staging Area	0	147.8	0	23.3	7.9	0	0	0	0	0	48.7	227.7
Tinian Port Improvements and Staging Area	0	0	0	0	0	0	0	0	0	0	4.5	4.5
Base Camp	0	229.9	0	10.5	3.3	0	0	0	0	0	12.5	256.2
Total Impacted under *Alternative 2*	**6.3**	**692.8**	**816.6**	**367.0**	**34.6**	**2.8**	**17.2**	**0.5**	**0.1**	**3.1**	**257.1**	**2,198.1**
Total on Tinian	*1,355.7*	*6,853.1*	*8,443.6*	*4,819.0*	*353.9*	*97.9*	*551.0*	*64.9*	*331.7*	*199.9*	*1,915.7*	*24,986.4*
% Impacted under Alternative 2 on Tinian	*0.5%*	*10.1%*	*9.7%*	*7.5%*	*9.8%*	*2.9%*	*3.1%*	*0.7%*	*<0.1%*	*1.5%*	*13.4%*	*8.7%*

Notes: *Project areas are based on areas depicted and labeled in Section 2.4.

(1)NLF = native limestone forest; MIF = mixed introduced forest; TT = tangantangan; HS = herbaceous-scrub; Cas = Casuarina forest; Coco = coconut forest; BS = beach strand; Wet = potential wetlands; Ag = agriculture; Bar = barren; Dev = developed; < = less than.

(2)Includes fire break/buffer, perimeter road, Hand Grenade Range, Mortar Range, Light Anti-armor Weapon Range, Grenade Launcher Range, targets for Close Air Support Range, targets for Offensive Air Support Range, targets for Field Artillery Indirect Fire Range.

(3)Although two ephemeral ponds associated with the Mahalang Complex would be impacted under Alternative 2, these have not been delineated as wetlands at this time.

(4) Includes Anti-armor Tracking Range, Tank/Fighting Vehicle Stationary Target Range, and Multi-purpose Range Complex.

4.9.3.2.1.2 Native Wildlife

Potential impacts from construction activities under Tinian Alternative 2 to native bird species on Tinian that are not listed under the Migratory Bird Treaty Act are described in this section. Impacts to native bird species protected under the Migratory Bird Treaty Act are addressed separately below in the *Special-status Species* section.

As discussed above in vegetation, a total of approximately 1,938 acres (784 hectares) of habitat for native species would be removed because of proposed construction activities under Tinian Alternative 2 (see Table 4.9-4). This is approximately 13% and 8% of the total habitat within the Military Lease Area and on all of Tinian, respectively. Table 4.9-5 provides the number of birds that may be impacted for five monitored bird species due to the loss of 1,883 acres (762 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats (DoN 2014a). Estimated numbers were derived from the 2013 native bird surveys on Tinian (DoN 2014a).

Table 4.9-5. Potential Direct and Permanent Impacts to Five Native Bird Species from Proposed Construction Activities under Tinian Alternative 2

Species	*Number of Birds Impacted by Removal of Habitat**				*Total*	*Estimated 2013 Total Tinian Population*	*% of Tinian Population Impacted*
	NLF	*MIF*	*TT*	*HS*			
Bridled white-eye	114	14,821	15,938	5,269	36,142	442,073	8.1%
Micronesian honeyeater	7	675	537	262	1,481	20,660	7.1%
Micronesian starling	11	1,162	1,322	642	3,137	40,489	7.7%
Rufous fantail	41	4,405	4,111	1,093	9,650	125,668	7.6%
Tinian monarch	29	3,078	3,373	750	7,230	91,420	7.9%

Notes: *NLF = native limestone forest, MIF = mixed introduced forest, TT = tangantangan, HS = herbaceous scrub.
Source: DoN 2014a.

Under Tinian Alternative 2, approximately 7,230 Tinian monarchs would potentially be permanently displaced by loss of habitat through construction (see Table 4.9-5). Therefore, because of the amount of habitat removed and the number of birds potentially impacted, significant direct impacts to the Tinian monarch would occur under Tinian Alternative 2.

As discussed under Alternative 1 (see Section 4.9.3.1), four areas are being assessed as potential conservation areas for the protection of the Tinian monarch and other wildlife species (see Figure 4.9-2). These areas may also be used for additional natural resource mitigation measures such as forest enhancement and/or invasive species control. The Department of Defense is coordinating with the Federal Aviation Administration and the U.S. Fish and Wildlife Service on these potential conservation areas.

Similar to Tinian Alternative 1, impacts under Alternative 2 from proposed construction activities would reduce the amount of habitat available to native birds on Tinian (see Section 4.9.3.1). Therefore, the removal of approximately 1,883 acres (762 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats under Alternative 2 would result in significant, unavoidable direct impacts to the populations of bridled white-eye, Micronesian honeyeater, Micronesian starling, rufous fantail, and Tinian monarch. These bird species are territorial, meaning that a minimum area is required for each bird or breeding pair for all of their foraging and nesting activities. For most animal species, and particularly within island ecosystems, available but unoccupied habitat is rare (if it does exist, it is generally very low-quality habitat). This is the case unless populations are limited not by habitat, but by predators, disease, or over-hunting. Based on available data, there is no indication that there are large areas of available but unoccupied habitat on Tinian, particularly for forest and shrub breeding bird species.

The same potential mitigation measures discussed previously under Alternative 1 to mitigate potential significant direct, long-term impacts of proposed construction activities on native forest birds would be applicable under Alternative 2 (i.e., forest enhancement of native limestone forest, mixed introduced forest, tangantangan forest, and herbaceous scrub habitats). However, the loss of 1,883 acres (762 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitat would be significant, even with forest enhancement efforts. Although bird densities are higher in higher-quality habitats and more birds are expected to eventually occupy areas of proposed forest enhancement, the proposed area of forest enhancement is not large enough to make up for the overall loss of available habitat under Alternative 2.

In addition, mitigation monitoring would be conducted with the preparation of a Forest Enhancement/Restoration and Monitoring Plan and a Forest Bird Monitoring and Tinian Monarch Management Plan.

Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.3.2.1.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Figures 4.9-5a and 4.9-5b provide the general locations of special-status species within the Military Lease Area in relation to Tinian Alternative 2. Direct impacts to special-status species from proposed construction activities include the removal of habitat, fragmentation of remaining habitat, and associated noise, light, and human activities. Individual special-status species are discussed below.

Mariana Fruit Bat

Impacts to Mariana fruit bats resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to Mariana fruit bats from proposed construction activities under Tinian Alternative 2 would be less than significant.

Mariana Common Moorhen

Impacts to Mariana common moorhens resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts from proposed construction activities under Tinian Alternative 2 would be less than significant.

Micronesian Megapode

Impacts to Micronesian megapodes resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to Micronesian megapodes from proposed construction activities under Tinian Alternative 2 would be less than significant.

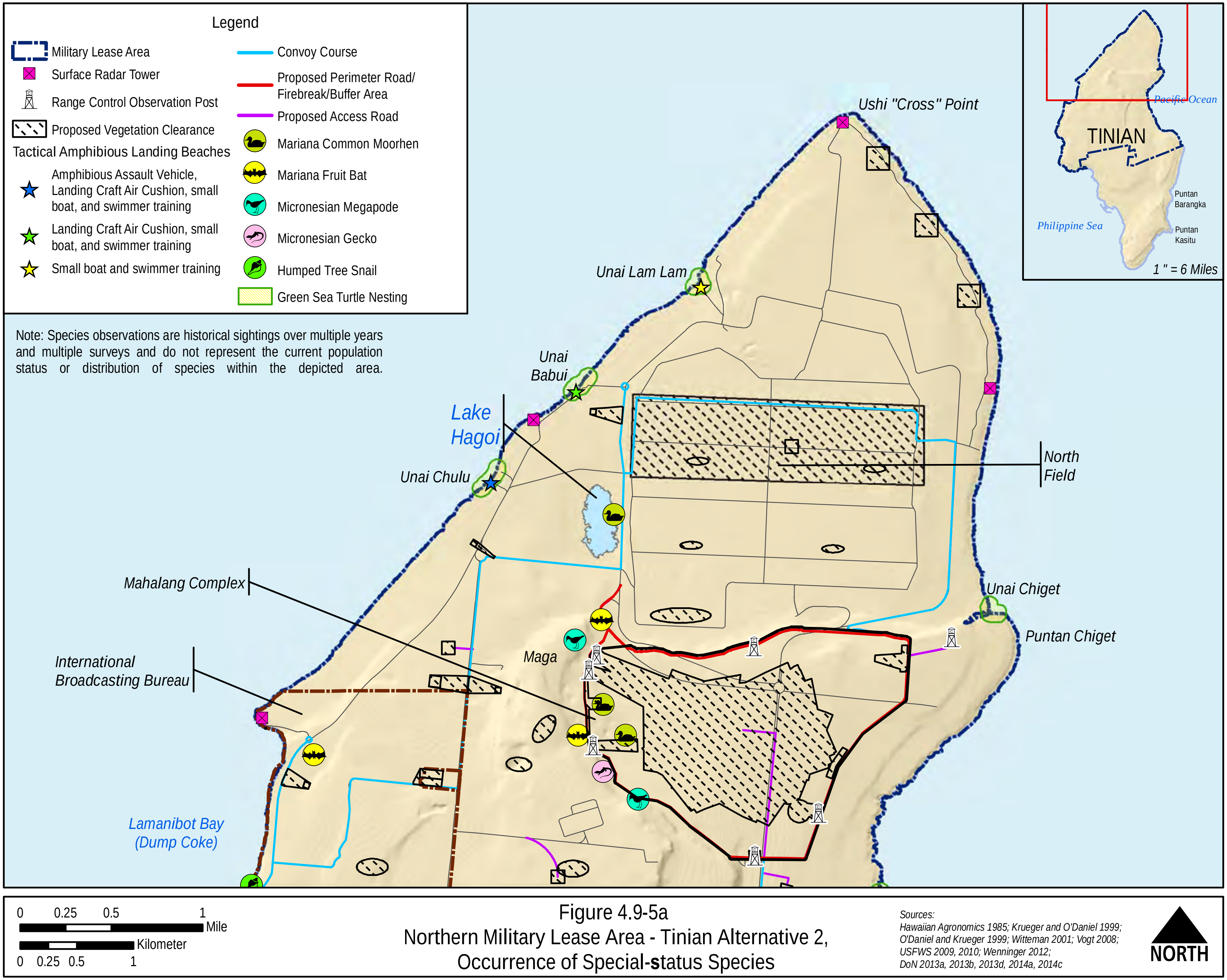
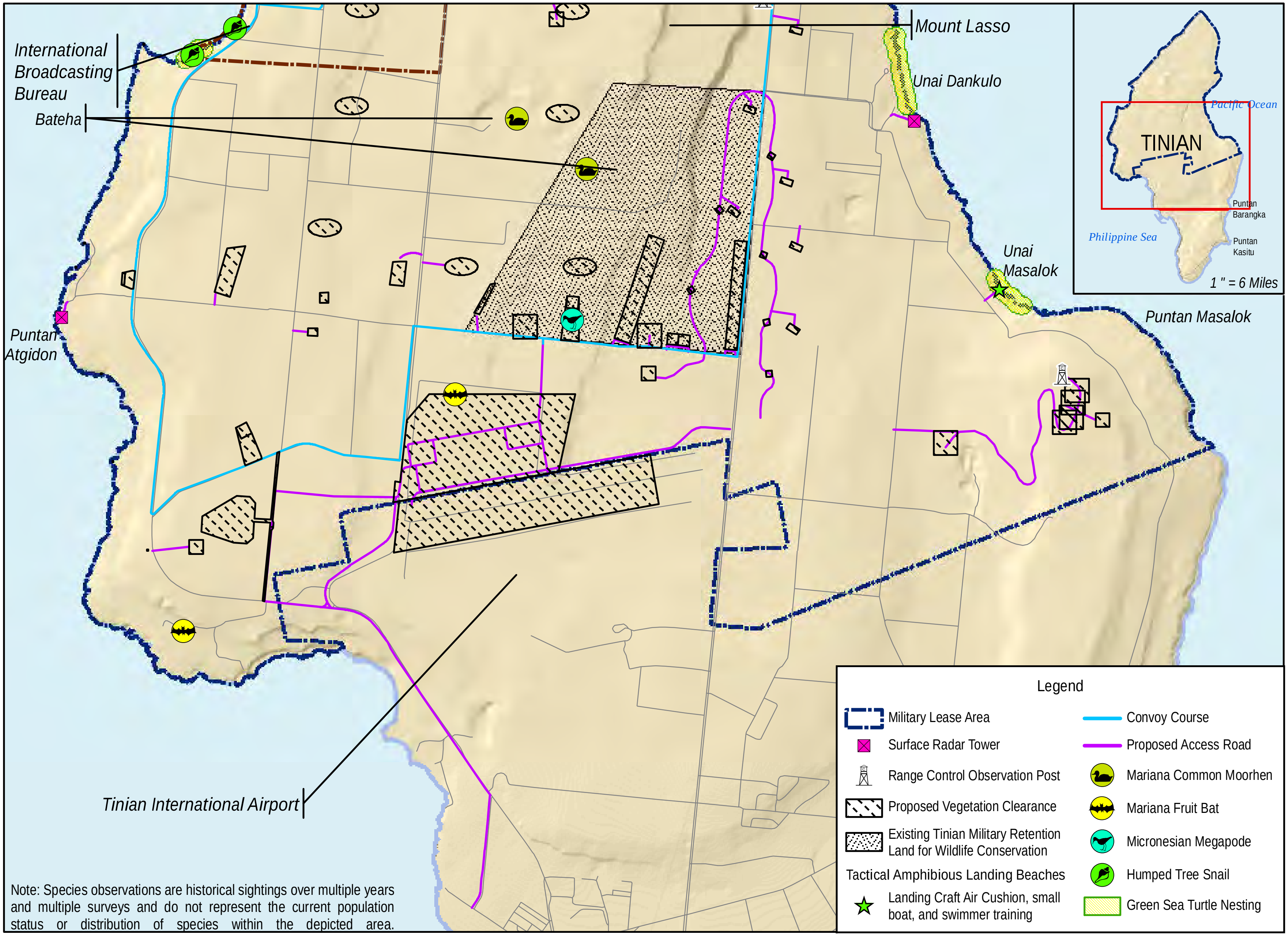


Figure 4.9-5a
Northern Military Lease Area - Tinian Alternative 2, Occurrence of Special-status Species

Sources:
Hawaiian Agronomics 1985; Krueger and O'Daniel 1999; O'Daniel and Krueger 1999; Witteman 2001; Vogt 2008; USFWS 2009, 2010; Wenninger 2012; DoN 2013a, 2013b, 2013d, 2014a, 2014c



0 0.25 0.5 1 Mile

0 0.25 0.5 1 Kilometer

Figure 4.9-5b
Southern Military Lease Area - Tinian Alternative 2, Occurrence of Special-status Species

Sources:
Hawaiian Agronomics 1985; Krueger and O'Daniel 1999; O'Daniel and Krueger 1999; Witteman 2001; Vogt 2008; USFWS 2009, 2010; Wenninger 2012; DoN 2013a, 2013b, 2013d, 2014a, 2014c

NORTH

Sea Turtles

Impacts to nesting sea turtles resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to sea turtles from proposed construction activities under Tinian Alternative 2 would be less than significant. The assessment of potential impacts to sea turtles in the marine environment is provided in Section 4.10, *Marine Biology*.

Humped Tree Snail

Impacts to humped tree snails resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to humped tree snails from proposed construction activities under Tinian Alternative 2.

Heritiera longipetiolata

Impacts to *H. longipetiolata* resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to *H. longipetiolata* from proposed construction activities under Tinian Alternative 2.

Dendrobium guamense

Impacts to *D. guamense* resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to *D. guamense* from proposed construction activities under Tinian Alternative 2.

4.9.3.2.1.4 Special-status Species: Migratory Bird Treaty Act-listed Species

As discussed above in vegetation communities, approximately 1,938 acres (784 hectares) of habitat for native species would be removed because of proposed construction activities associated with Tinian Alternative 2 (see Table 4.9-4). Table 4.9-6 provides the number of birds that may be impacted for three monitored Migratory Bird Treaty Act-listed bird species due to the loss of 1,883 acres (762 hectares) of forested and herbaceous scrub habitats (DoN 2014a).

Table 4.9-6. Potential Direct and Permanent Impacts to Three Migratory Bird Treaty Act-listed Species from Proposed Construction Activities under Tinian Alternative 2

Species	*Number of Birds Impacted by Removal of Habitat**				*Total*	*Estimated 2013 Total Tinian Population*	*% of Tinian Population Impacted*
	NLF	*MIF*	*TT*	*HS*			
Collared Kingfisher	1	67	49	57	174	2,508	6.9%
Mariana Fruit-dove	1	136	104	58	299	4,042	7.4%
White-throated Ground-dove	2	167	54	71	294	4,879	5.9%

Notes: *NLF = native limestone forest, MIF = mixed introduced forest, TT = tangantangan, HS = herbaceous scrub.
Source: DoN 2014a.

Direct and indirect impacts to Migratory Bird Treaty Act-listed bird species under Tinian Alternative 2 would be similar to those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Under Tinian Alternative 2, proposed construction activities would remove 1,883 acres (762 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats available to Migratory Bird Treaty Act-listed birds on Tinian. Therefore, implementation of Tinian Alternative 2 and the removal of approximately 1,883 acres (762 hectares) of forested and herbaceous scrub habitats would result in less than significant direct and indirect impacts to Migratory Bird Treaty Act-listed species seabirds and shorebirds, but significant direct impacts to populations of forest- and scrub-nesting bird species. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

The same potential mitigation measures discussed previously for Alternative 1 to mitigate potential significant direct, long-term impacts of proposed construction activities on Migratory Bird Treaty Act-listed species would be applicable under Alternative 2. Under Alternative 2, forest enhancement of forested and herbaceous scrub habitats would occur. However, impacts from the loss of 1,883 acres (762 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitat would be significant, even with forest enhancement efforts. In addition, mitigation monitoring would be conducted with the preparation of a Forest Enhancement/Restoration and Monitoring Plan and a Forest Bird Monitoring and Tinian Monarch Management Plan.

Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.3.2.1.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the Mariana common moorhen, Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are all CNMI-listed threatened/endangered species. These species are discussed above within the *Endangered Species Act-listed and Proposed Species* section.

Micronesian Gecko

Impacts to Micronesian geckos resulting from implementation of Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to Micronesian geckos from proposed construction activities under Tinian Alternative 2.

4.9.3.2.2 Operation Impacts

4.9.3.2.2.1 Vegetation Communities

Impacts to vegetation communities from training operations under Tinian Alternative 2 would be the same as those previously discussed for Tinian Alternative 1 (see Section 4.9.3.1). Therefore, implementation of the training activities associated with Tinian Alternative 2 would result in less than significant direct and indirect impacts to vegetation communities.

4.9.3.2.2.2 Native Wildlife

Impacts to native wildlife resulting from Tinian Alternative 2 training operations would be the same as those previously discussed for Tinian Alternative 1 (see Section 4.9.3.1). Therefore, implementation of the training activities associated with Tinian Alternative 2 would result in less than significant direct impacts to native wildlife. In addition, as discussed under Alternative 1, the DoN, in coordination with the U.S. Fish and Wildlife Service, would prepare a Tinian Forest Bird Monitoring and Tinian Monarch Management Plan to monitor the potential effects of proposed CJMT activities on Migratory Bird Treaty

Act-listed forest birds within the Military Lease Area. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.3.2.2.3 Special-status Species

Impacts to Endangered Species Act-listed and proposed species, Migratory Bird Treaty Act-listed species, and CNMI-listed species resulting from implementation of Tinian Alternative 2 would be similar to those previously discussed for Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be less than significant direct and indirect impacts to special-status species from proposed training activities under Tinian Alternative 2.

4.9.3.3 Tinian Alternative 3

4.9.3.3.1 Construction Impacts

4.9.3.3.1.1 Vegetation Communities

The vegetation communities that would be affected by Tinian Alternative 3 construction activities are shown in Figures 4.9-6a and 4.9-6b listed in Table 4.9-7. Approximately 1,914 acres (775 hectares) of undeveloped or non-barren land would be impacted, representing approximately 8% of the island and approximately 13% of the Military Lease Area. Two project areas comprise approximately half of the total impacts to vegetation communities: The High Hazard Impact Area (527 acres [213 hectares]) and the Drop Zone (456 acres [184 hectares]). The majority of the impacted vegetation communities (1,856 acres [751 hectares]) are comprised of tangantangan (799 acres [323 hectares] or 10% of total on island), mixed introduced forest (690 acres [279 hectares] or 11% of total on island), and herbaceous scrub (367 acres [148 hectares] or 8% of total on island). In addition, 6.3 acres (2.5 hectares), or 0.5% of total on island, of native limestone forest would be removed, primarily within the High Hazard Impact Area (Table 4.9-7).

As discussed previously under Alternative 1, given the importance of native limestone forest habitat for native species and the continuing loss of limestone forest on Tinian, the conversion of 6.3 acres (2.5 hectares) to developed area under Tinian Alternative 3 would result in significant direct impacts to the regional vegetation community and its function.

In addition, two ephemeral ponds within the Mahalang Complex totaling less than 0.5 acre (0.2 hectare) of wetland habitat would be lost due to construction of the hand grenade and grenade launcher ranges within the High Hazard Impact Area. Based on recent wetlands surveys on Tinian, one of these two ephemeral ponds is considered an isolated wetland that supports wetland habitat during years of high rainfall. This loss of less than 0.5 acre (0.2 hectare) of wetland habitat would not be significant.

The same potential mitigation measures discussed previously under Alternative 1 to mitigate potential significant direct, long-term impacts of proposed construction activities on native limestone forest would be applicable for Alternative 3 (i.e., forest enhancement of 6.3 acres [2.5 hectares] of mixed introduced forest). Implementation of proposed mitigation measures would reduce the impact to less than significant. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

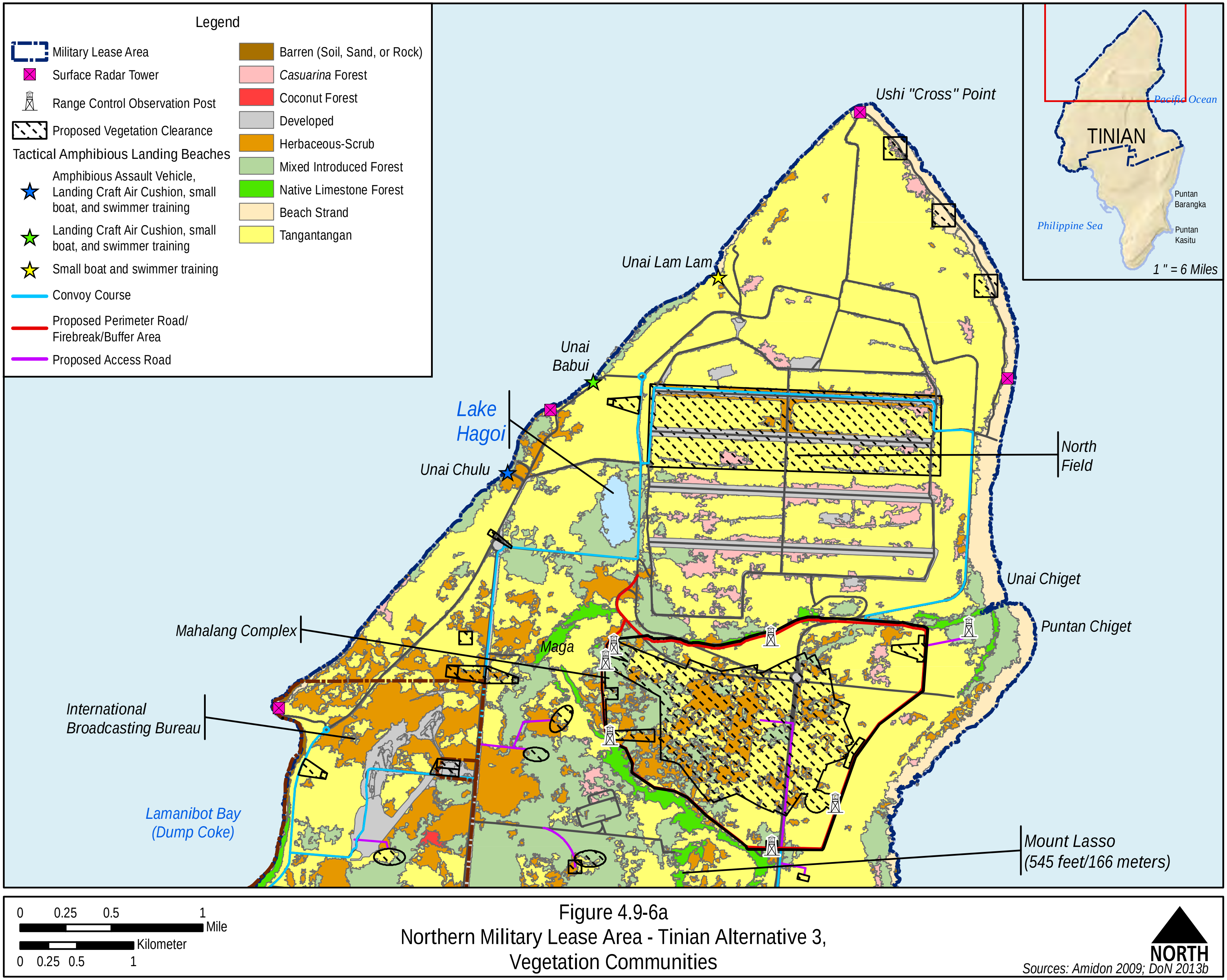


Figure 4.9-6a
Northern Military Lease Area - Tinian Alternative 3, Vegetation Communities

Sources: Amidon 2009; DoN 2013b

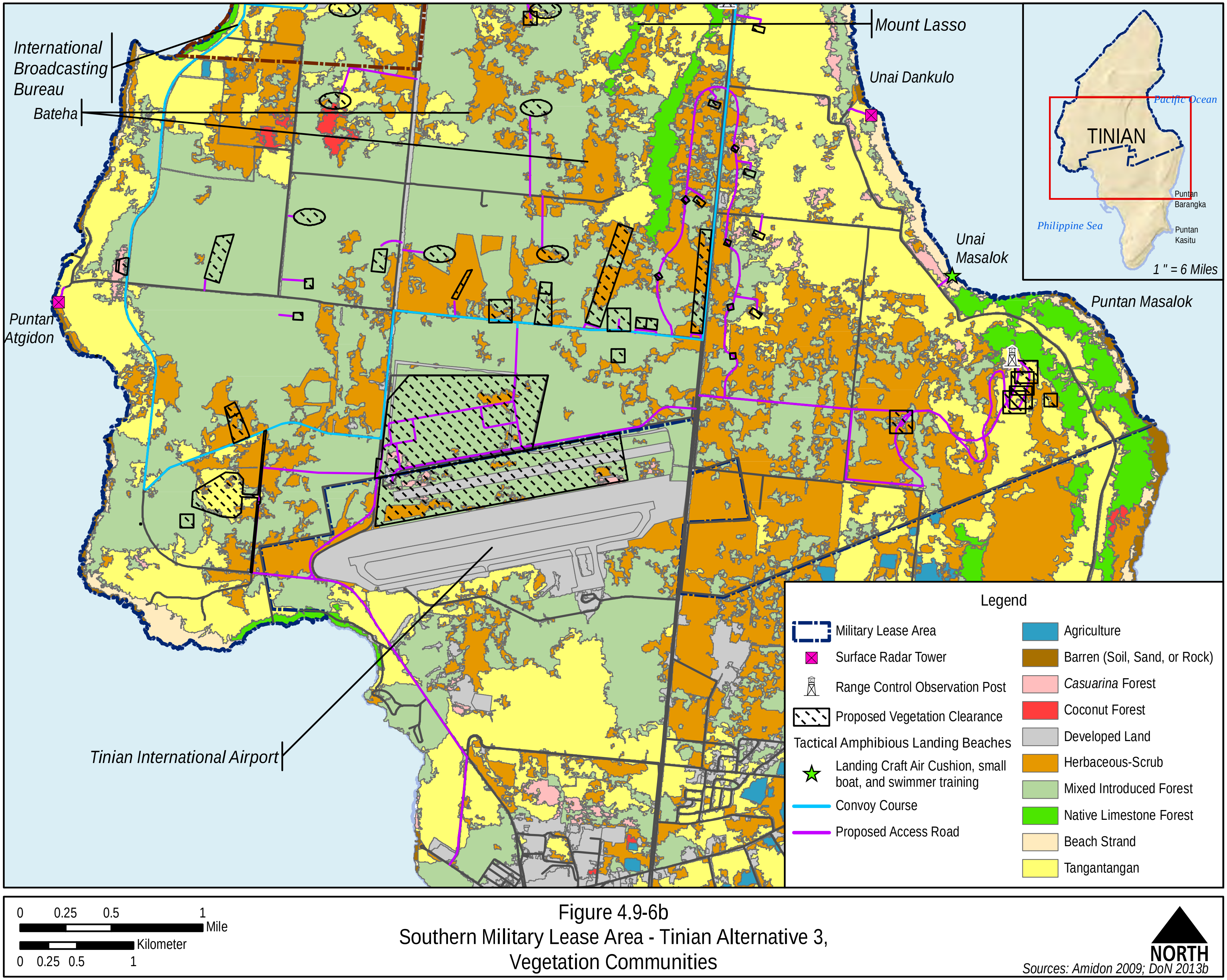


Figure 4.9-6b
Southern Military Lease Area - Tinian Alternative 3,
Vegetation Communities

Sources: Amidon 2009; DoN 2013b

Table 4.9-7. Potential Direct Impacts to Vegetation Communities with Implementation of Tinian Alternative 3

Project Area*	***Vegetation Community (acres)***[(1)]											
	NLF	***MIF***	***TT***	***HS***	***Cas***	***Coco***	***BS***	***Wet***	***Ag***	***Bar***	***Dev***	***Total***
High Hazard Impact Area[(2)]	3.3	73.9	293.7	145.1	0	0	0	0.5[(3)]	0	0	11.0	527.5
Combat Pistol Range	0	2.1	0	0	0	0	0	0	0	0	2.1	4.2
Multi-purpose Range Complex[(4)]	0	6.1	2.8	6.4	0.6	0	0	0	0	0	0.2	16.1
Battle Sight Zero Range	0	2.1	0	0	0	0	0	0	0	0	0	2.1
Multi-purpose Training Range	0	8.3	0	14.3	0	0	0	0	0	0	0	22.6
Multi-purpose Automated Unknown Distance Range/Field Fire Range	0	9.2	0.4	21.4	0	0	0	0	0	0	0	31.0
Infantry Platoon Battle Course (Automated)	0	16.2	0	6.4	0	0	0	0	0	0	0.6	23.2
Urban Assault Course (South)	0	20.1	4.6	0	0	0	0	0	0	0	0	24.7
Southern Battle Area Complex	0	69.8	11.8	12.1	0.1	2.5	0	0	0	0	0	96.3
Drop Zone	0	0.2	302.2	42.7	14.0	0	0	0	0	0	96.5	455.6
Field Artillery Indirect Fire Range (Firing Points)	0.4	18.9	32.2	14.1	1.5	0	17.0	0	0	0	0.9	85.0
Convoy Course Engagement Areas	0	13.2	34.6	22.0	2.4	0	0	0	0	0	8.6	80.8
Convoy Course	0	9.8	20.9	3.5	0.4	0	0	0	0	0	27.5	62.1
Tracked Vehicle Driver's Course	1.5	33.1	39.8	18.1	0.7	0.3	0.1		0.1	0.1	6.4	100.2
Tactical Amphibious Landing Beach (Unai Chulu)	0	0	0.1	0.9	0	0	0	0	0	3.0	0	4.0
Landing Zones	0	7.0	5.3	6.1	0	0	0	0	0	0	1.4	19.8
Range Control Observation Points	0	1.7	9.4	3.7	0	0	<0.1	0	0	<0.1	0	14.8
Surface Radar Sites	0	0.1	0.6	0.1	0	0	0.1	0	0	<0.1	0	0.9
Roadway Improvements	0	4.0	4.4	2.4		0	0	0	0	0	32.4	43.2
Fences	1.1	10.9	9.0	9.0	0.1	0	0	0	0	<0.1	5.7	35.8
Munitions Storage Area	0	5.9	27.0	4.9	0	0	0	0	0	0	<0.1	37.8
Airport Improvements and Staging Area	0	147.8	0	23.3	7.9	0	0	0	0	0	48.7	227.7
Tinian Port Improvements and Staging Area	0	0	0	0	0	0	0	0	0	0	4.5	4.5
Base Camp	0	229.9	0	10.5	3.3	0	0	0	0	0	12.5	256.2
Total Impacted under *Alternative 3*	**6.3**	**690.3**	**798.8**	**367.0**	**31.0**	**2.8**	**17.2**	**0.5**	**0.1**	**3.1**	**259.0**	**2,176.1**
Total on Tinian	*1,355.7*	*6,853.1*	*8,443.7*	*4,819.0*	*353.9*	*97.9*	*551.0*	*64.9*	*331.7*	*199.9*	*1,915.7*	*24,986.4*
% Impacted under Alternative 3 on Tinian	*0.5%*	*10.1%*	*9.5%*	*7.5%*	*9.1%*	*2.9%*	*3.1%*	*0%*	*0.0%*	*0.1%*	*13.4%*	*8.7%*

Notes: *Project areas are based on areas depicted and labeled in Section 2.4.

(1)NLF = native limestone forest; MIF = mixed introduced forest; TT = tangantangan; HS = herbaceous-scrub; Cas = *Casuarina* forest; Coco = coconut forest; BS = beach strand; Wet = potential wetlands; Ag = agriculture; Bar = barren; Dev = developed; < = less than.

(2)Includes fire break/buffer, perimeter road, Hand Grenade Range, Mortar Range, Light Anti-armor Weapon Range, Grenade Launcher Range, targets for Close Air Support Range, targets for Offensive Air Support Range, targets for Field Artillery Indirect Fire Range.

(3)Although two ephemeral ponds associated with the Mahalang Complex would be impacted under Alternative 3, these have not been delineated as wetlands at this time.

(4)Includes Anti-armor Tracking Range, Tank/Fighting Vehicle Stationary Target Range, and Multi-purpose Range Complex.

4.9.3.3.1.2 Native Wildlife

Potential impacts from construction activities associated with Tinian Alternative 3 to native bird species that are not listed under the Migratory Bird Treaty Act are described in this section. As discussed above in vegetation, a total of approximately 1,914 acres (775 hectares) of habitat would be removed because of proposed construction activities under Tinian Alternative 3 (see Table 4.9-7).

Table 4.9-8 provides the number of birds that may be impacted for five monitored bird species due to the loss of 1,862 acres (754 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats (DoN 2014a).

Table 4.9-8. Potential Direct and Permanent Impacts to Five Native Bird Species from Proposed Construction Activities under Tinian Alternative 3

Species	*Number of Birds Impacted by Removal of Habitat**				*Total*	*Estimated 2013 Total Tinian Population*	*% of Tinian Population Impacted*
	NLF	*MIF*	*TT*	*HS*			
Bridled white-eye	114	14,821	15,715	5,269	35,919	442,073	8.0%
Micronesian honeyeater	7	675	529	262	1,473	20,660	7.0%
Micronesian starling	11	1,162	1,304	642	3,119	40,489	7.6%
Rufous fantail	41	4,405	4,054	1,093	9,593	125,668	7.6%
Tinian monarch	29	3,078	3,325	750	7,182	91,420	7.8%

Notes: *NLF = native limestone forest, MIF = mixed introduced forest, TT = tangantangan, HS = herbaceous scrub.
Source: DoN 2014a.

Under Tinian Alternative 3, approximately 7,182 Tinian monarchs would potentially be permanently displaced by loss of habitat associated with construction (see Table 4.9-8). Therefore, because of the amount of habitat removed and the number of birds potentially impacted, significant direct impacts to the Tinian monarch would occur from implementation of Tinian Alternative 3.

As discussed under Alternative 1 (see Section 4.9.3.1), four areas are being assessed as potential conservation areas for the protection of the Tinian monarch and other wildlife species (Figure 4.9-2). These areas may also be used for additional natural resource mitigation measures such as forest enhancement and/or invasive species control. The Department of Defense is coordinating with the Federal Aviation Administration and the U.S. Fish and Wildlife Service on these potential conservation areas.

Similar to Tinian Alternative 1, proposed construction activities would reduce the amount of habitat available to native birds on Tinian and impacts under Alternative 3 (see Section 4.9.3.1). Therefore, implementation of Tinian Alternative 3 and the removal of approximately 1,862 acres (754 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats would result in significant direct impacts to the populations of bridled white-eye, Micronesian honeyeater, Micronesian starling, rufous fantail, and Tinian monarch. These bird species are territorial, meaning that a minimum area is required for each bird or breeding pair for all of their foraging and nesting activities. For most animal species, and particularly within island ecosystems, available but unoccupied habitat is rare (if it does exist, it is generally very low-quality habitat). This is the case unless populations are limited not by habitat, but by predators, disease, or over-hunting. Based on available data, there is no indication that there are large areas of available but unoccupied habitat on Tinian, particularly for forest and shrub breeding bird species.

The same potential mitigation measures discussed previously under Alternative 1 to mitigate potential significant direct, long-term impacts of proposed construction activities on native forest birds would be applicable under Alternative 3 (i.e., forest enhancement of native limestone forest, mixed introduced forest, tangantangan forest, and herbaceous scrub habitats). However, impacts from the loss of 1,862 acres (754 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitat would be significant, even with forest enhancement efforts. Although bird densities are higher in higher-quality habitats and more birds are expected to eventually occupy areas of proposed forest enhancement, the proposed area of forest enhancement is not large enough to make up for the overall loss of available habitat under Alternative 3.

In addition, mitigation monitoring would be conducted with the preparation of a Forest Enhancement/Restoration and Monitoring Plan and a Forest Bird Monitoring and Tinian Monarch Management Plan.

Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.3.3.1.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Figures 4.9-7a and 4.9-7b provide the general locations of special-status species within the Military Lease Area in relation to Tinian Alternative 3. Direct impacts to special-status species from proposed construction activities include the removal of habitat, fragmentation of remaining habitat, and associated noise, light, and human activities. Individual special-status species are discussed below.

Mariana Fruit Bat

Impacts to Mariana fruit bats resulting from implementation of Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to Mariana fruit bats from proposed construction activities associated with Tinian Alternative 3 would be less than significant.

Mariana Common Moorhen

Impacts to Mariana common moorhens resulting from implementation of Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to Mariana common moorhens from proposed construction activities associated with Tinian Alternative 3 would be less than significant.

Micronesian Megapode

Impacts to Micronesian megapodes resulting from implementation of Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to Micronesian megapodes from proposed construction activities associated with Tinian Alternative 3 would be less than significant.

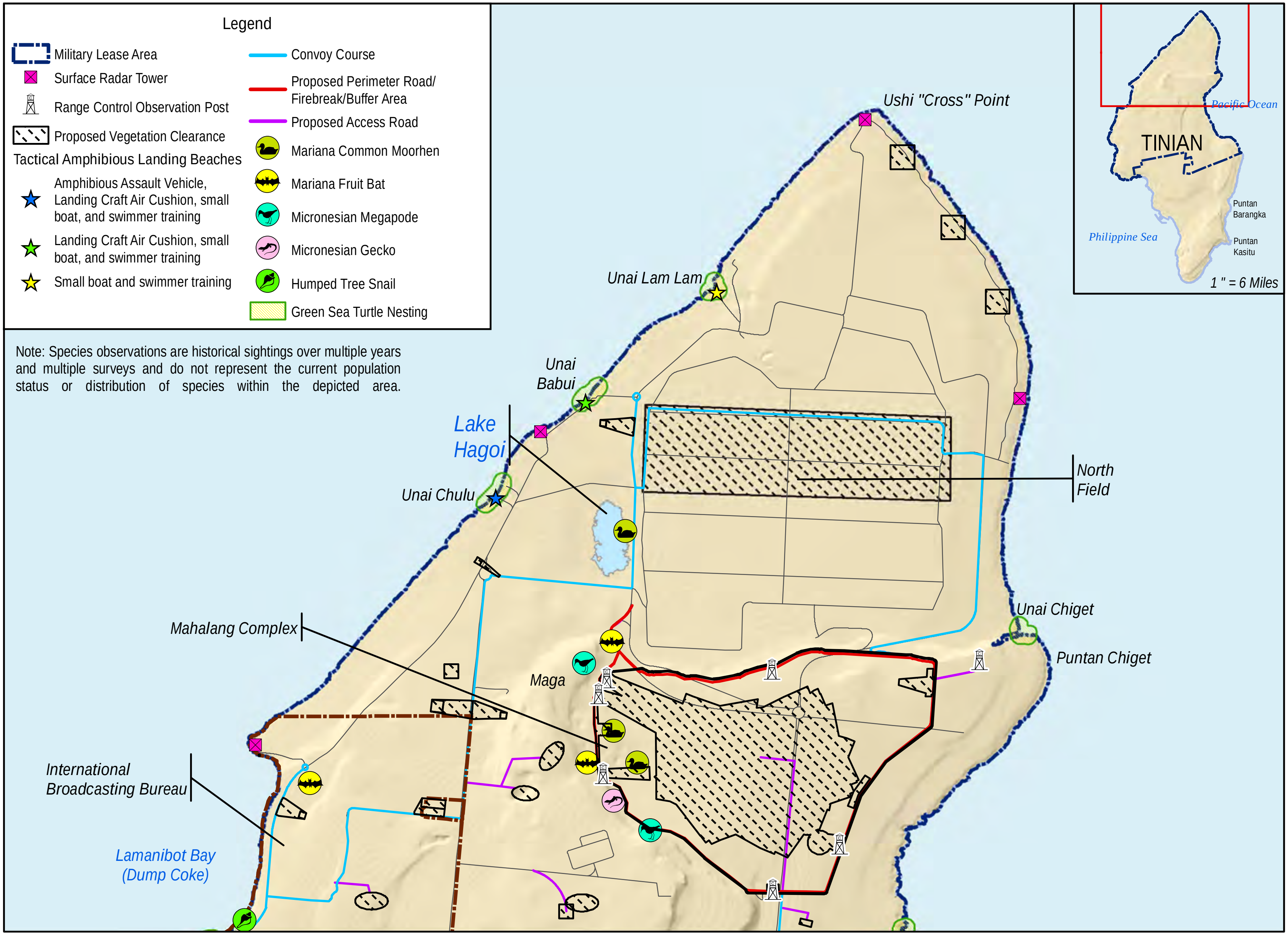


Figure 4.9-7a
Northern Military Lease Area - Tinian Alternative 3, Occurrence of Special-status Species

Sources:
Hawaiian Agronomics 1985; Krueger and O'Daniel 1999; O'Daniel and Krueger 1999; Witteman 2001; Vogt 2008; USFWS 2009, 2010; Wenninger 2012; DoN 2013a, 2013b, 2013d, 2014a, 2014c

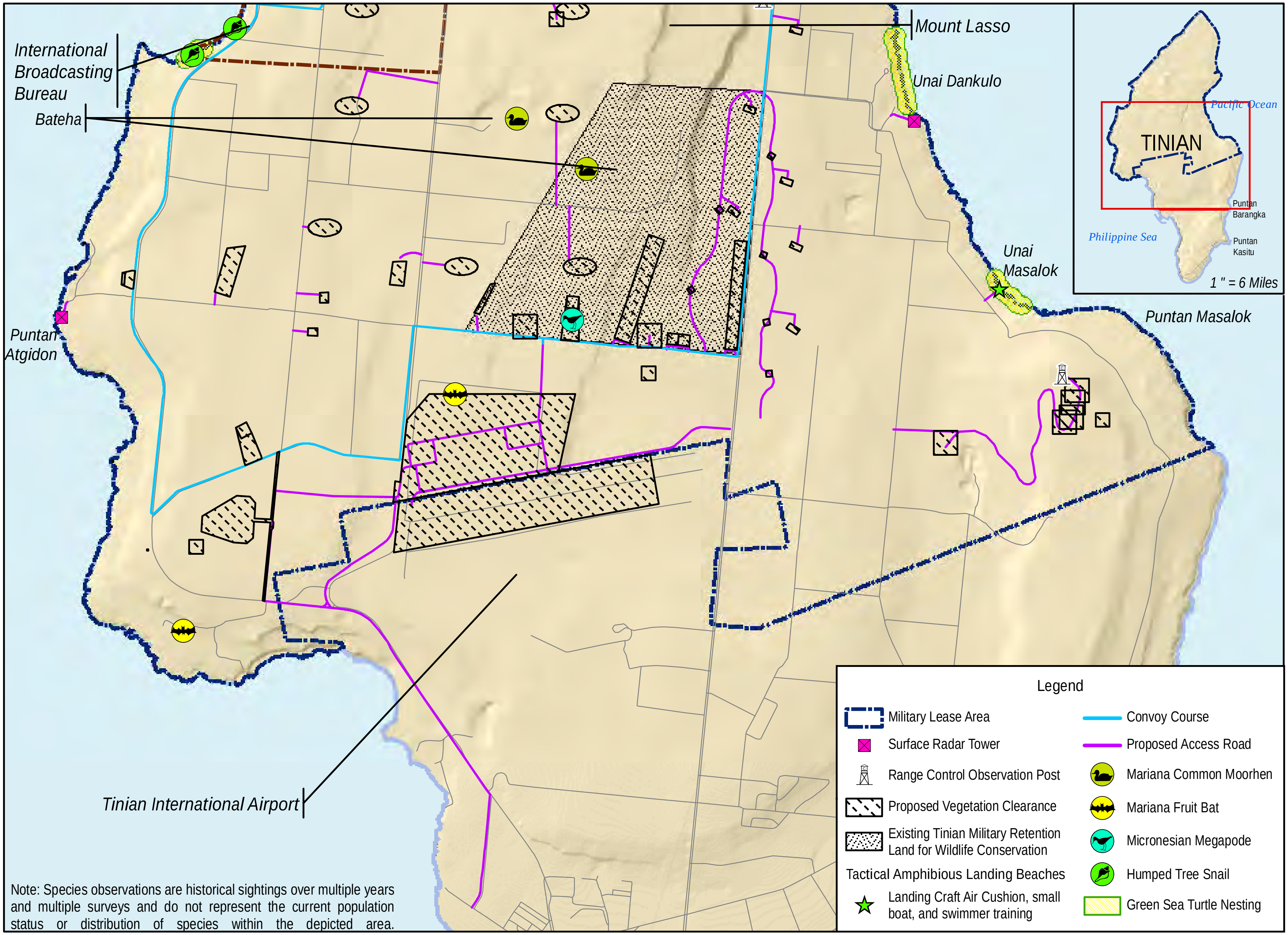


Figure 4.9-7b
Southern Military Lease Area - Tinian Alternative 3,
Occurrence of Special-status Species

Sources:
Hawaiian Agronomics 1985; Krueger and O'Daniel 1999; O'Daniel and Krueger 1999; Witteman 2001; Vogt 2008; USFWS 2009, 2010; Wenninger 2012; DoN 2013a, 2013b, 2013d, 2014a, 2014c

Sea Turtles

Impacts to nesting sea turtles resulting from implementation of Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, potential direct and indirect impacts to sea turtles from proposed construction activities associated with Tinian Alternative 3 would be less than significant. The assessment of potential impacts to sea turtles in the marine environment is provided in Section 4.10, *Marine Biology*.

Humped Tree Snail

Impacts to humped tree snails under Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to humped tree snails from proposed construction activities under Tinian Alternative 3.

Heritiera longipetiolata

Impacts to *H. longipetiolata* under Tinian Alternative 2 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to *H. longipetiolata* from proposed construction activities under Tinian Alternative 2.

Dendrobium guamense

Impacts to *D. guamense* under Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be no impacts to *D. guamense* from proposed construction activities under Tinian Alternative 3.

4.9.3.3.1.4 Special-status Species: Migratory Bird Treaty Act-listed Species

As discussed above in vegetation communities, approximately 1,914 acres (775 hectares) of habitat for native species would be removed because of proposed construction activities associated with Tinian Alternative 3 (see Table 4.9-7). Table 4.9-9 provides the number of birds that may be impacted for three monitored Migratory Bird Treaty Act-listed bird species due to the loss of 1,862 acres (754 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats (DoN 2014a).

Table 4.9-9. Potential Direct and Permanent Impacts to Three Migratory Bird Treaty Act-listed Species from Proposed Construction Activities under Tinian Alternative 3

Species	***Number of Birds Impacted by Removal of Habitat****				***Total***	***Estimated 2013 Total Tinian Population***	***% of Tinian Population Impacted***
	NLF	***MIF***	***TT***	***HS***			
Collared Kingfisher	1	67	49	57	174	2,508	6.9%
Mariana Fruit-dove	1	136	103	58	298	4,042	7.4%
White-throated Ground-dove	2	167	53	71	293	4,879	5.9%

Notes: *NLF = native limestone forest, MIF = mixed introduced forest, TT = tangantangan, HS = herbaceous scrub.
Source: DoN 2014a.

Direct and indirect impacts to Migratory Bird Treaty Act-listed species resulting from implementation of Tinian Alternative 3 would be similar to those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1). Under Tinian Alternative 3, proposed construction activities would remove 1,862 acres (754 hectares) of forested (native limestone forest, mixed introduced forest, and tangantangan) and herbaceous scrub habitats available to Migratory Bird Treaty Act-listed species on Tinian. Therefore, implementation of Tinian Alternative 3 and the removal of approximately 1,862 acres (754 hectares) of forested and herbaceous scrub habitats would result in less than significant direct and indirect impacts to Migratory Bird Treaty Act-listed seabirds and shorebirds, but significant impacts to populations of forest- and scrub-nesting bird species. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of best management practices (see Section 4.9.2).

The same potential mitigation measures discussed previously under Alternative 1 to mitigate potential significant direct, long-term impacts of proposed construction activities on Migratory Bird Treaty Act-listed species would be applicable under Alternative 3. Under Alternative 3, forest enhancement of forested and herbaceous scrub habitats would occur. However, impacts from the loss of 1,862 acres (754 hectares) of forested and herbaceous scrub habitat would be significant, even with forest enhancement efforts. In addition, mitigation monitoring would be conducted with the preparation of a Forest Enhancement/Restoration and Monitoring Plan and a Forest Bird Monitoring and Tinian Monarch Management Plan.

Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.3.3.1.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the Mariana common moorhen, Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are all CNMI-listed threatened/endangered species. These species are discussed above within the *Endangered Species Act-listed Species* section.

Micronesian Gecko

Impacts to Micronesian geckos resulting from implementation of Tinian Alternative 3 would be the same as those previously discussed under Tinian Alternative 1 (see Section 4.9.3.1).

4.9.3.3.2 Operation Impacts

4.9.3.3.2.1 Vegetation Communities

Impacts to vegetation communities from training operations associated with Tinian Alternative 3 would be the same as those previously discussed for Tinian Alternative 1 (see Section 4.9.3.1). Therefore, implementation of Tinian Alternative 3 would result in less than significant direct and indirect impacts to vegetation communities.

4.9.3.3.2.2 Native Wildlife

Impacts to native wildlife from training operations associated with Tinian Alternative 3 would be the same as those previously discussed for Tinian Alternative 1 (see Section 4.9.3.1). Therefore, implementation of Tinian Alternative 3 would result in less than significant direct impacts to native wildlife. In addition, as discussed under Alternative 1, the DoN, in coordination with the U.S. Fish and Wildlife Service, would prepare a Tinian Forest Bird Monitoring and Tinian Monarch Management Plan to monitor the potential effects of proposed CJMT activities on Migratory Bird Treaty Act-listed forest birds within the Military Lease Area. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.3.3.2.3 Special-status Species

Impacts to Endangered Species Act-listed and proposed species, Migratory Bird Treaty Act-listed species, and CNMI-listed species resulting from the implementation of Tinian Alternative 3 would be the same as those previously discussed for Tinian Alternative 1 (see Section 4.9.3.1). Therefore, there would be less than significant direct and indirect impacts to special-status species from operational activities associated with Tinian Alternative 3.

4.9.3.4 Tinian No-Action Alternative

Vegetation and ground disturbance activities would be minor and localized during the periodic non-live-fire military training exercises that occur within the Military Lease Area. Vehicular noise and air emissions would also occur during these periodic training exercises. All existing mitigation and compensation measures would be adhered to in order to minimize any adverse impacts to terrestrial biological resources, including special-status species. Biosecurity measures on Tinian are in place to minimize the introduction or spread of invasive species including the brown treesnake. The Guam and CNMI Military Relocation EIS (DoN 2010a) included the establishment of the four live-fire training ranges on Tinian that would introduce significant but mitigable impacts to native habitat and special-status species (see Table 10.2-13; DoN 2010a). No impacts to terrestrial biology resources would occur due to Mariana Islands Range Complex operations (see Table 3.11-6, *Summary of Effects to Enlisted Species Act-listed Species*, and Table 3.11-7; DoN 2010b). Therefore, overall, significant but mitigable impacts would occur under the no-action alternative.

4.9.3.5 Summary of Impacts for Tinian Alternatives

Table 4.9-10 provides a comparison of the potential impacts to terrestrial biology resources for the three Tinian alternatives and the no-action alternative.

Table 4.9-10. Summary of Impacts for Tinian Alternatives

	Tinian (Alternative 1)		*Tinian (Alternative 2)*		*Tinian (Alternative 3)*		*No-Action Alternative*	
Resource Area	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Vegetation Communities	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Native Wildlife	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Special-status Species: Endangered Species Act – Listed and Proposed Species	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode, sea turtles). NI (humped tree snail, Heritiera longipetiolata, Dendrobium guamense)*	*LSI (Mariana fruit bat, Micronesian megapode, Mariana common moorhen sea turtles). NI (humped tree snail, Heritiera longipetiolata, Dendrobium guamense)*	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode, sea turtles). NI (humped tree snail, Heritiera longipetiolata, Dendrobium guamense)*	*LSI (Mariana fruit bat, Micronesian megapode, Mariana common moorhen sea turtles). NI (humped tree snail, Heritiera longipetiolata, Dendrobium guamense)*	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode, sea turtles). NI (humped tree snail, Heritiera longipetiolata, Dendrobium guamense)*	*LSI (Mariana fruit bat, Micronesian megapode, Mariana common moorhen sea turtles). NI (humped tree snail, Heritiera longipetiolata, Dendrobium guamense)*	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode). NI (sea turtles, humped tree snail)*	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode). NI (sea turtles, humped tree snail)*
Special-status Species: Migratory Bird Treaty Act	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Special Status Species: CNMI-listed Species	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*

Legend: *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.9.3.6 Summary of Potential Mitigation Measures for Tinian Alternatives

Table 4.9-11 provides a summary of the potential mitigation measures for terrestrial biology resources for the three Tinian alternatives.

Table 4.9-11. Summary of Mitigation Measures for Tinian Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*TinianPhase*	
			Construction	*Operation*
TERRESTRIAL BIOLOGY				
Vegetation Communities *Alternatives 1, 2, and 3*: The conversion of 6.3 acres (2.5 hectares) of native limestone forest on Tinian to developed land would be unavoidable.	*SI*	• Department of Defense may implement forest enhancement on 6.3 acres (2.5 hectares) to replace the area of native limestone forest removed during construction. Forest enhancement would include removal of non-native vegetation and establishment of native species that are characteristic of native limestone forest habitats. • To avoid and minimize impacts to native limestone forest on Tinian, the Department of Defense will implement training restrictions within native limestone forest. All limestone forest habitat within the Military Lease Area will be designated as "No Wildlife Disturbance Areas," with the following actions prohibited: off-road vehicle travel; vehicle parking except on existing roads or trails; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; and aircraft landings. Any maneuvers conducted in native limestone forest will be on foot (no off-road vehicle maneuvers), and units will be tactical, with no support camps. Limestone forest "No Wildlife Disturbance Area" restrictions will be implemented upon initiation of CJMT training activities on Tinian. • Department of Defense may implement forest enhancement in areas of tangantangan or herbaceous scrub habitat to replace the forested habitats removed during construction. Forest enhancement would include removal of non-native vegetation and establishment of native species that are characteristic of native forest habitats.	X	

Table 4.9-11. Summary of Mitigation Measures for Tinian Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*TinianPhase*	
			Construction	*Operation*
Native Wildlife *Alternative 1:* The removal of 1,745 acres (706 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the Tinian monarch, and other native wildlife species would be unavoidable. *Alternative 2*: The removal of 1,883 acres (762 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the Tinian monarch, and other native wildlife species would be unavoidable. *Alternative 3*: The removal of 1,862 acres (754 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the Tinian monarch, and other native wildlife species would be unavoidable.	*SI*	• Department of Defense may implement forest enhancement in areas of mixed introduced forest, tangantangan, or herbaceous scrub habitat to replace the forest habitat removed during construction. Forest enhancement would include removal of non-native vegetation and establishment of native species that are characteristic of native forest habitats. • Department of Defense may replace the current Tinian Military Retention Land for Wildlife Conservation by establishing a conservation area(s) for the protection of the Tinian monarch and other wildlife species with one or more conservation sites within the Military Lease Area. Forest enhancement and invasive species control may also be implemented within the replacement Wildlife Conservation site(s). • To improve habitat quality for native wildlife on Tinian, the Department of Defense may implement monitoring and control of non-native invasive species within forest habitat, including control of invasive plant, mammal, and insect species. • To avoid and minimize impacts to native wildlife species that use native limestone forest on Tinian, the Department of Defense will implement training restrictions within native limestone forest. All limestone forest habitat within the Military Lease Area will be designated as “No Wildlife Disturbance Areas,” with the following actions prohibited: off-road vehicle travel; vehicle parking except on existing roads or trails; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; and aircraft landings. Any maneuvers conducted in native limestone forest will be on foot (no off-road vehicle maneuvers), and units will be tactical, with no support camps. Limestone forest “No Wildlife Disturbance Area” restrictions will be implemented upon initiation of CJMT training activities on Tinian.	X	

Table 4.9-11. Summary of Mitigation Measures for Tinian Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*TinianPhase*	
			Construction	*Operation*
Special-status Species: Endangered Species-Act-listed and Proposed Species	*LSI*	• To avoid impacts to Mariana common moorhens at the Lake Hagoi and two Bateha wetland sites, the Department of Defense will designate the three wetland sites as “No Training Areas.” Ground disturbance and vegetation removal of any kind will be prohibited within these "No Training Areas." In addition, CJMT-associated aircraft overflights of these sites will be limited to a minimum altitude of 500 feet (152 meters) above ground level. Wetland “No Training Area” restrictions would be implemented upon initiation of CJMT training activities on Tinian. • To mitigate for loss of Mariana common moorhen foraging habitat at Mahalang, the Department of Defense may implement portions of the DoN Tinian Wetlands Management Plan at Hagoi and two Bateha sites. This may include invasive plant surveys, monitoring, and control; habitat restoration and improvement; baseline surveys for moorhen predators; and predator control at Hagoi and Bateha. • To avoid and minimize impacts to special-status species that use native limestone forest on Tinian, the Department of Defense will implement training restrictions within native limestone forest. All limestone forest habitat within the Military Lease Area will be designated as “No Wildlife Disturbance Areas,” with the following actions prohibited: off-road vehicle travel; vehicle parking except on existing roads or trails; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; and aircraft landings. Any maneuvers conducted in native limestone forest will be on foot (no off-road vehicle maneuvers), and units will be tactical, with no support camps. Limestone forest “No Wildlife Disturbance Area” restrictions will be implemented upon initiation of CJMT training activities on Tinian. • To avoid and minimize impacts to nesting sea turtles, the Department of Defense will implement training protocols at all beaches used for amphibious operations on Tinian. Biologists trained in identifying sea turtle nests will survey landing beaches no		X

Table 4.9-11. Summary of Mitigation Measures for Tinian Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*TinianPhase*	
			Construction	*Operation*
		more than 6 hours prior to the first craft landing or use of other beach landing equipment. Any potential sea turtle nests will be flagged, with a buffer zone of 20 feet (6 meters) from the edge of the nesting activity (area disturbed by the turtle) to ensure complete avoidance. The flagged area will be avoided by landing craft and personnel. Beach training activities will also be coordinated with monthly sea turtle nest monitoring, during which any potential turtle nests will be flagged, with a buffer zone of 20 feet (6 meters) to ensure avoidance. If an active nest with a pre-hatch hole is discovered on a beach during monitoring, night training over the next 5 nights will be conducted only on other beaches. If beach sand is compacted by landing craft, the beach topography will be restored within 3 days using non-mechanized methods (e.g., rakes or other hand tools). The Department of Defense will implement beach training protocols upon initiation of CJMT amphibious training activities.		
Special-status Species: Migratory Bird Treaty Act-listed Species *Alternative 1*: The removal of 1,745 acres (706 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the collared kingfisher, Mariana fruit dove, and white-throated ground-dove, would be unavoidable. *Alternative 2*: The removal of 1,883 acres (762 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the collared kingfisher, Mariana fruit dove, and white-throated ground-dove, would be unavoidable. *Alternative 3*: The removal of 1,862 acres (754 hectares) of forested and herbaceous scrub habitats (including Tinian	*SI*	• Department of Defense may implement forest enhancement in areas of tangantangan or herbaceous scrub habitat to replace the mixed introduced forest and herbaceous scrub removed during construction. Forest enhancement would include removal of non-native vegetation and establishment of native species that are characteristic of native forest habitats. • Department of Defense may establish a conservation area for the protection of the Tinian monarch and other wildlife species with one or more conservation sites within the Military Lease Area. Forest enhancement and invasive species control may also be implemented within the wildlife conservation site(s). • To avoid and minimize impacts to Migratory Bird Treaty Act-listed species that use native limestone forest on Tinian, the Department of Defense will implement training restrictions within native limestone forest. All limestone forest habitat within the Military Lease Area will be designated as “No Wildlife Disturbance Areas,”	X	

Table 4.9-11. Summary of Mitigation Measures for Tinian Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*TinianPhase*	
			Construction	*Operation*
Military Retention Land for Wildlife Conservation) used by native landbirds, including the collared kingfisher, Mariana fruit dove, and white-throated ground-dove, would be unavoidable.		with the following actions prohibited: off-road vehicle travel; vehicle parking except on existing roads or trails; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; and aircraft landings. Any maneuvers conducted in native limestone forest will be on foot (no off-road vehicle maneuvers), and units will be tactical, with no support camps. Limestone forest "No Wildlife Disturbance Area" restrictions will be implemented upon initiation of CJMT training activities on Tinian. • To improve habitat quality for native wildlife on Tinian, Department of Defense may implement monitoring and control of non-native species within forest habitat, including control of invasive plant, mammal, and insect species. • To avoid and minimize impacts to Mariana fruit bats and sea turtles, hooded lights will be used to the maximum extent practicable at all new roads and facilities within sea turtle nesting habitat and fruit bat foraging and roosting habitat. "Night-adapted" lights will be installed in the briefing and bleacher areas. Illumination of forests, coastlines, and beaches will be kept to an absolute minimum. Lighting will be designed to meet minimum safety, anti-terrorism, and force protection requirements. • To avoid impacts to Migratory Bird Treaty Act-listed species that use the Lake Hagoi and two Bateha wetland sites, the Department of Defense will designate the three wetland sites as "No Training Areas." Ground disturbance and vegetation removal of any kind will be prohibited within these "No Training Areas." In addition, the CJMT-associated aircraft overflights of these sites will be limited to a minimum altitude of 500 feet (152 meters) above ground level. Wetland "No Training Area" restrictions would be implemented upon initiation of CJMT training activities on Tinian.		

Legend: *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.
Note: Mitigation measures associated with terrestrial biology do not alter the significance of the impacts.

4.9.4 Pagan

4.9.4.1 Pagan Alternative 1

4.9.4.1.1 Construction Impacts

4.9.4.1.1.1 Vegetation Communities

Vegetation communities that would be impacted during construction activities under Pagan Alternative 1 are listed in Table 4.9-12 and shown in Figure 4.9-8. While bare ground, lava, and sand areas do not have vegetation that would be impacted, the acreage within the project footprints for these community types is included for habitat area reference.

Table 4.9-12. Potential Direct Impacts to Vegetation Communities with Implementation of Pagan Alternative 1

Project Area	*Vegetation Community (acres)**								
	NF	*MNIF*	*HS*	*Cas*	*Coco*	*Grass*	*Sand*	*Bar*	*Total*
Northern High Hazard Impact Area	7.1	0	22.2	104.1	0	0	0	186.3	319.7
Isthmus High Hazard Impact Area	7.2	22.1	4.0	0	16.1	128.3	0	0	177.7
Field Artillery Direct Fire Range	0	0	0	0	0	0	0	9.9	9.9
Field Artillery Indirect Fire Range	0	0	2.1	0.1	0	7.7	0	9.9	19.8
Airfield Clear Zone	0	22.9	51.1	27.5	0.5	106	0	181.7	389.7
Munitions Storage Area	0.8	0	3.5	1.0	0	0.9	0.2	3.5	9.9
Landing Zones	<0.1	1.9	9.4	10.5	2.9	8.3	0	3.3	36.3
Military Training Trails	4.7	0.6	5.9	23.4	4.2	16.6	0.4	14.8	69.7
Total Impacted under Alternative 1	**19.8**	**47.5**	**98.2**	**166.6**	**23.7**	**266.0**	**0.6**	**409.4**	**1,032.7**
Total on Pagan	*418*	*398*	*1,362*	*3,197*	*858*	*1,706*	*28*	*2,531*	*11,502*
% Impacted under Alternative 1 on Pagan	*4.5%*	*11.9%*	*6.9%*	*5.2%*	*2.8%*	*15.6%*	*1.4%*	*16.0%*	*8.9%*

Notes: *Impact areas are based on areas depicted and labeled in Chapter 2, *Proposed Action and Alternatives,* Figure 2.6-4. Numbers may not add precisely due to rounding

Legend: Bar = barren: lava, cinder, or bare ground; Cas = *Casuarina* forest; Coco = coconut forest; Grass = grassland; HS = herbaceous scrub; MNIF = mixed native-introduced forest; NF = native forest; Sand = sand.

Under Pagan Alternative 1, approximately 623 vegetated acres (252 hectares) would be cleared within the northern part of the island and represents approximately 7% of the island's vegetation. The majority of the removed habitat comprises approximately 47 acres (19 hectares) of mixed native-introduced forest (12% of total on island), 98 acres (40 hectares) of herbaceous scrub (7% of total on island), and 167 acres (68 hectares) of *Casuarina* forest (5% of total on island). Approximately 20 acres (8 hectares) (4% of total on island) of native forest would be removed, primarily within the High Hazard Impact Areas (see Table 4.9-11). Given the importance of native forest habitat for native species, this permanent loss of native vegetation would be a significant and unavoidable direct impact. Potential indirect impacts to vegetation associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2 and Appendix D, *Best Management Practices*).

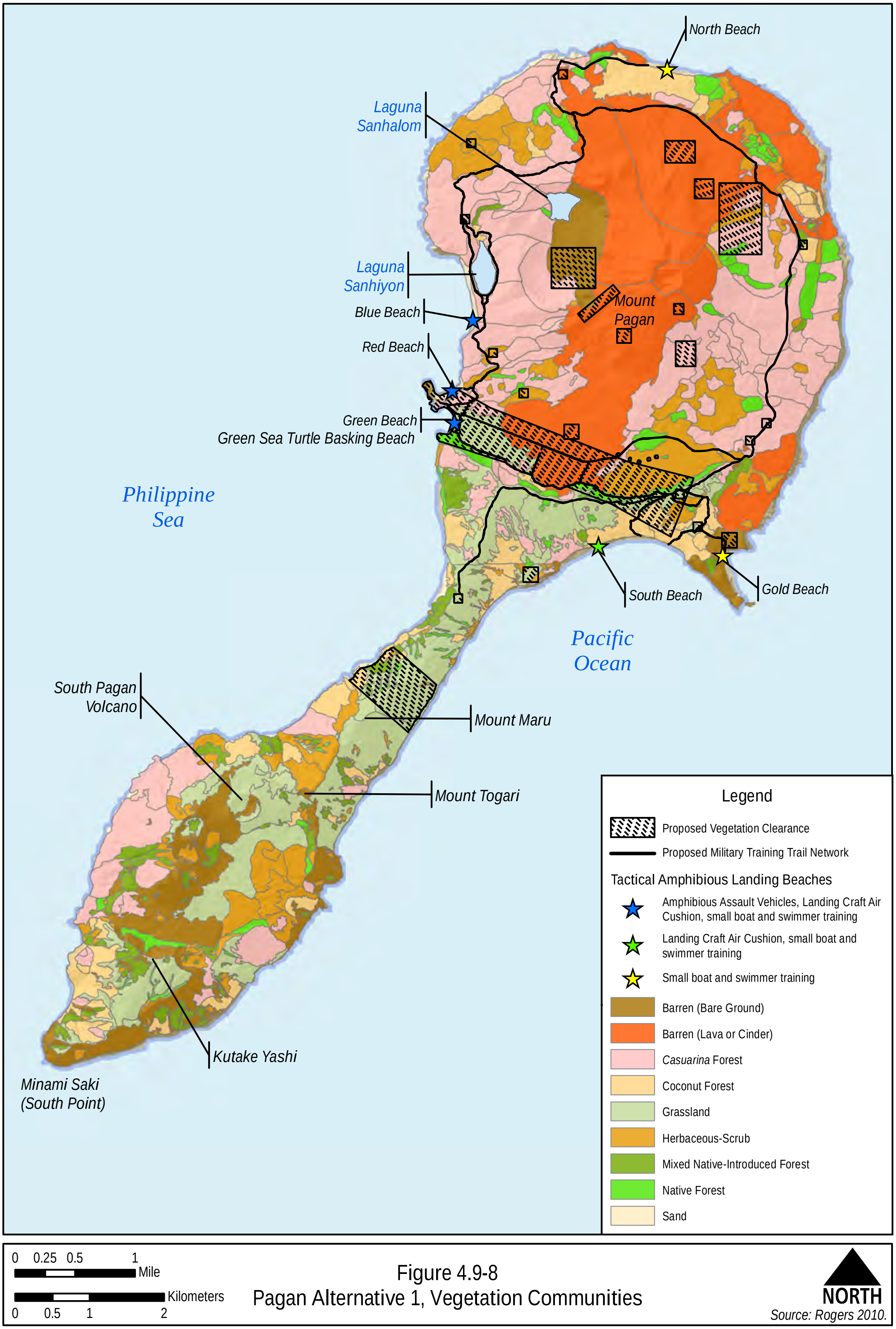


Figure 4.9-8
Pagan Alternative 1, Vegetation Communities

Source: Rogers 2010.

To mitigate for significant impacts to native forest on Pagan, the Department of Defense may facilitate native forest regeneration on southern Pagan by implementing feral ungulate removal. This would consist of active control (i.e. trapping, snaring, shooting) of animals, with the goal of eradicating all feral ungulates from southern Pagan. The Department of Defense may also implement monitoring and control of non-native invasive species within forest habitat on Pagan, including control of invasive plant, mammal, and insect species.

4.9.4.1.1.2 Native Wildlife

Potential impacts from construction activities associated with Pagan Alternative 1 to native bird species on Pagan that are not listed under the Migratory Bird Treaty Act are described in this section. Species protected under the Migratory Bird Treaty Act are addressed separately in the *Special-status Species* section. Long-term habitat loss would result from the construction of the proposed facilities. Approximately 258 acres (104 hectares) of forested habitat would be removed by construction (see Table 4.9-11). This permanent loss of habitat would affect approximately 5% of the island's forest habitat and reduce the available habitat for wildlife populations.

Therefore, implementation of Pagan Alternative 1 and the removal of approximately 258 acres (104 hectares) of forested habitats would result in less than significant direct impacts to native wildlife populations. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.4.1.1.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Based on historical data and surveys conducted in support of this EIS/OEIS, Figure 4.9-9 provides the general locations of special-status species in relation to Pagan Alternative 1. Direct impacts to special-status species from proposed construction activities include the removal of habitat, fragmentation of remaining habitat, and associated noise and human activities. With the exception of the Mariana fruit bat, none of the areas proposed for construction would occur within the vicinity of federally listed or proposed species habitat on Pagan, as most Endangered Species Act-listed species are located on southern Pagan south of the isthmus. Therefore, there would be no impacts to these species resulting from construction. Construction in the northern portion of the island would remove potential foraging habitat for the Mariana fruit bat (4% of native forest, 12% of mixed native introduced forest, and 5% of Casuarina forest). In addition, construction activities could potentially temporarily displace fruit bats from their foraging areas due to noise and human presence.

Construction noise on Pagan would occur with the extension of the expeditionary airfield, clearing of landing zones, and clearing for an unpaved perimeter road around the northern portion of the island (see Figures 2-13 and 2-14). Noise levels from equipment and other construction activities are anticipated to generate noise levels from 70-90 decibels at a distance of 50 feet (15 meters). Fruit bats on the northeastern end of Pagan may flush from and temporarily avoid the roosting site and foraging locations in this area during clearing for the perimeter road. Effects of such flushing may include temporary disruption of roosting and foraging behaviors. As there are no proposed construction activities within southern Pagan, the two fruit bat colonies in southern Pagan would not be exposed to construction noise.

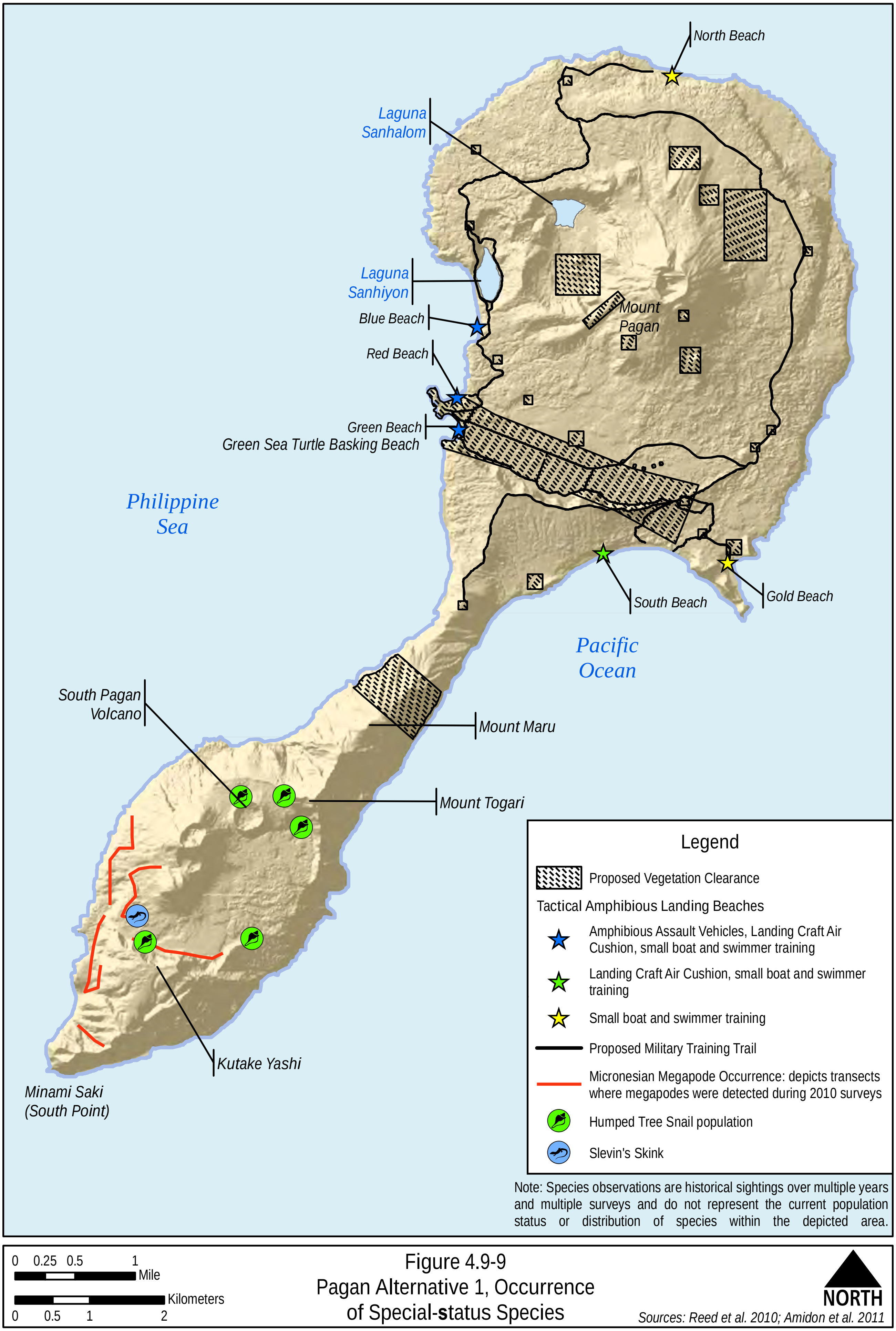


Figure 4.9-9
Pagan Alternative 1, Occurrence of Special-status Species

Sources: Reed et al. 2010; Amidon et al. 2011

Based upon the above information, direct impacts to the Mariana fruit bat population from construction activities associated with Pagan Alternative 1 would be less than significant.

4.9.4.1.1.4 Special-status Species: Migratory Bird Treaty Act-listed Species

Of the 12 bird species that have been observed on Pagan and are protected under the Migratory Bird Treaty Act (Table 3.9-7), 9 species are seabirds and 3 are landbirds. As discussed above in *Vegetation Communities*, approximately 258 acres (104 hectares) of forested habitat for native species would be removed because of Pagan Alternative 1 proposed construction activities (see Table 4.9-12). Construction impacts to landbird species protected under the Migratory Bird Treaty Act would be similar to that described above for wildlife. Therefore, implementation of Pagan Alternative 1 and the removal of approximately 258 acres (104 hectares) of forested habitats through construction activities would result in less than significant direct and indirect impacts to populations of Migratory Bird Treaty Act-listed forest birds.

4.9.4.1.1.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the federally listed Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are also listed as threatened/endangered by the CNMI. Impacts to these species are discussed previously under the *Special-status Species: Endangered Species Act-listed and Proposed Species* section. No other CNMI-listed species occur on Pagan.

4.9.4.1.2 Operation Impacts

4.9.4.1.2.1 Vegetation Communities

Potential impacts to vegetation communities from training operations associated with Pagan Alternative 1 include foot traffic, vehicle use, and fire potential. There would be no impacts to vegetation from vehicle use in the southern portion of the island as vehicle travel would be restricted to only the northern portion of the island where the topography allows. Off-road vehicle use in the Northern Live-Fire Maneuver Area would increase the potential of soil erosion and cause direct vegetation disturbance. Soil erosion could also be generated through ongoing training exercises where lands are cleared and/or disturbed for bivouac sites and digging. Large amounts of foot traffic, camping, equipment staging, and ordnance deployment would result in the crushing, breaking, removal, and reduction of overall vegetative cover; and could potentially cause erosion during the rainy season. However, the location of foot traffic would vary during training throughout the maneuver areas, thereby minimizing impacts in any one area. In addition, vegetation growth on Pagan is fairly robust and it is expected that vegetation would regrow rapidly.

Fire potential would increase due to proposed live-fire range operations. Fire can result in direct effects to vegetation by killing or damaging individual plants; or indirect effects, for example, increasing erosion, allowing non-native species to invade and altering wildlife habitat by reducing food resources, breeding habitat, and shelter. The majority of the northern High Hazard Impact Area would be located within lava/cinder and bare ground areas. Vegetation in both the northern and isthmus High Hazard Impact areas would be maintained at approximately 6 inches (15 centimeters) above ground. In addition, the isthmus High Hazard Impact Area would contain a fire break established around the perimeter, and targets would be placed in areas of sparse vegetation. The potential for the spread of wildfire would thus be minimized. A fire prevention and management plan would be developed prior to initiation of live-fire training that would outline standard procedures for safe range use and management of fire risk.

Potential impacts to vegetation communities from training operations would be avoided and minimized by implementing resource management measures summarized in Section 4.9.2 and presented in detail in Appendix D, *Best Management Practices*. In particular, establishment of a firebreak around the High Hazard Impact Area, vegetation management within the associated target areas and firebreak, and implementation of a Fire Prevention and Management Plan, which establishes management and fire suppression and emergency response procedures, would minimize fire risk. Given implementation of resource management measures, implementation of the training activities associated with Pagan Alternative 1 would result in less than significant direct and indirect impacts to vegetation communities due to foot traffic and vehicle use.

4.9.4.1.2.2 Native Wildlife

Potential direct and indirect impacts to native wildlife species may result from direct strikes during maneuver training and munitions use, fires, noise from munitions training and aircraft, and direct strikes from aircraft. Indirect impacts to wildlife species may result from potential non-native species introductions.

Direct Strikes from Maneuver Training and Munitions Use

Heavy vehicle movement both on roads and off-road as well as ordnance explosion could result in direct impacts to wildlife including wildlife injury/mortality and indirect impacts such as degradation and/or loss of habitat. The majority of the High Hazard Impact Areas would be located where there is limited wildlife habitat within lava/cinder and bare ground areas in the higher elevations of the Pagan or in areas where vegetation has been cleared. In addition, direct strike of wildlife by munitions is unlikely, as animals would flush and move away from target areas in response to munitions noise. Stray ammunition may fall within the surface danger zones; however, the likelihood of any single animal being struck is negligible. There is the potential for certain wildlife species to be crushed by vehicles, but most wildlife would be able to move away from the maneuvers to avoid this.

Disturbance from foot traffic throughout the island as well as off-road vehicle maneuvering in the northern maneuver area could cause some limited degradation and fragmentation of habitat. However, the location of foot traffic would vary during training throughout the maneuver areas minimizing impacts in any one area. In addition, vegetation growth on Pagan is fairly robust and it is expected that vegetation would regrow rather rapidly. As a result, it is expected that there would be less than significant direct and indirect impacts to wildlife due to direct strikes associated with maneuver training and munitions use under Pagan Alternative 1.

Fires

As stated in the *Vegetation Communities* section, fire potential would be increased from live-fire and vehicle maneuvering operations. Fire can result in direct effects to all wildlife through mortality from smoke inhalation or incineration. Native plants, animals, and their habitats on Pagan are adapted to a humid, tropical climate and are not adapted to a fire-driven ecosystem (U.S. Fish and Wildlife Service

2008). The alteration or removal of habitats by fire could reduce food sources, prevent or inhibit breeding, or create competition for feeding and sheltering, particularly for species that establish discrete territories. However, due to the proposed vegetation clearing during construction, vegetation management, and the preparation and implementation of a Fire Prevention and Management Plan (see previous discussion under *Vegetation Communities*), the potential for wildfire would be minimized. With implementation of these measures, direct and indirect impacts to native wildlife from fire are not anticipated under Pagan Alternative 1.

Noise

Direct impacts from noise would be limited to times of active training operations, which would occur up to 16 non-consecutive weeks per year (but not 24/7). Noise modeling studies were conducted for the proposed small arms and large caliber munitions and aircraft activities; noise levels and noise contours are provided in Section 4.5, *Noise*. Wildlife within the northern portion of Pagan would be exposed to noise of more than 85 decibels A-weighted day-night average sound level and 104 decibels Peak level from small-caliber weapons (see Figures 4.5-7 and 4.5-8), 70 decibels C-weighted day-night average sound level and 130 dB Peak level from large-caliber weapons (see Figures 4.5-9 and 4.5-10), and 65-70 decibels A-weighted day-night average sound level from aircraft operations (see Figure 4.5-12).

It is important to note that all operational noise disturbances would be temporary and would not be continuous for several reasons: (1) the type of activity (small- and large-caliber firing, and aircraft overflights) consists of non-continuous events; (2) training events would only occur up to 16 non-consecutive weeks per year; and (3) some ranges would likely not be used on any given training day.

No noise studies have been conducted specifically on wildlife species present on Pagan. However, noise studies have been conducted on the effects of military noise on wildlife species associated with other ranges that are similar to those proposed for use on Pagan. Refer to Tinian Alternative 1, *Native Wildlife* (see Section 4.9.3.1) for a summary of potential wildlife responses to noise associated with military training.

Training on Pagan would not be continuous, and some wildlife species have been shown to habituate to noise associated with training activities. However, due to the noise levels, time of day, and large geographic extent of noise that would be generated by live-fire training, there would be less than significant impacts to native wildlife species due to noise associated with Pagan Alternative 1 training operations.

Aircraft Strikes

Implementation of Pagan Alternative 1 would result in the potential for bird/animal aircraft strikes. However, in accordance with DoN requirements, a Bird/Animal Aircraft Strike Hazard Plan would be prepared to address all aircraft operations on Pagan. This plan would be prepared to minimize the occurrence of bird/animal aircraft strikes, and would provide detailed procedures to monitor and react to heightened risk of bird strikes. When risk increases, limits would be placed on low-altitude flight and some types of training. Special briefings would be provided to pilots whenever the potential exists for increased bird/animal strikes within the airspace.

With implementation of these procedures, potential direct and indirect impacts to native wildlife species from aircraft strikes resulting from implementation of Pagan Alternative 1 would be less than significant.

Introduction of Non-native Species

Training activities would result in increased transport of material and personnel by ship and aircraft between Guam, other CNMI locations, and Pagan. These activities have the potential to introduce non-native species that could degrade habitat. The brown treesnake is the most serious potential non-native species that could be brought to Pagan. In addition, several non-native plant species (e.g., refer to Space and Falanruw 1999) could be introduced due to the proposed training activities. These and other species have the potential to prey on or compete with native species and degrade native forest habitats.

Section 4.9.2 discusses in detail applicable biosecurity measures that the U.S. military would implement to ensure that risk from transporting invasive species to Pagan is controlled. Refer to Appendix D, *Best Management Practices*, and Appendix L, *Biological Resources Supporting Documentation*, for a detailed discussion of biosecurity measures.

With implementation of resource management measures, the introduction of non-native species would be avoided and potential direct and indirect impacts to native wildlife species would be less than significant.

4.9.4.1.2.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Potential direct and indirect impacts to special-status species from direct strikes during maneuver training and munitions use, fires, direct strikes from aircraft, and non-native species introduction would be similar to those previously discussed for wildlife. There would be significant direct and indirect impacts from munitions noise on the Mariana fruit bat population on Pagan.

Mariana Fruit Bat

Currently, three Mariana fruit bat roost colonies are known on Pagan: two on southern Pagan and one on northern Pagan.

For those species of fruit bats that have been tested for hearing sensitivity, the hearing curves are very similar to those of humans, with similar upper and lower frequency limits and hearing threshold levels (Calford et al. 1985; Hall and Richards 2000). Therefore, it is likely that noise from live-fire operations at the proposed ranges would be heard by fruit bats as it would be heard by humans, and the modeled A- and C-weighted noise levels are appropriate for assessing the potential impacts of noise associated with proposed CJMT activities.

Munitions Noise. A summary of the expected noise levels at the three fruit bat colonies on Pagan due to live-fire weapons operations is presented in Table 4.9-13. Fruit bats at the colony located on northern Pagan would be exposed to small-caliber weapons noise levels of 64 decibels A-weighted day-night average sound level and 124 decibels Peak (Table 4.9-13). Received noise levels from large-caliber weapons would be 74 decibels C-weighted day-night average sound level and 147 decibels and greater than 150 decibels Peak under neutral and unfavorable weather conditions, respectively (Table 4.9-13).

Table 4.9-13. Modeled Weapons and Aircraft Noise Levels at Mariana Fruit Bat Colonies on Pagan under Alternative 1

	Small-caliber Weapons		*Large-caliber Weapons*			*Aircraft Operations*	
Location	*DNL (dBA)*	*Peak (dB)*	*DNL (dBC)*	*Peak-n* (dB)*	*Peak-u* (dB)*	*DNL (dBA)*	*SEL (dBA)*
Southern 1	<50	<87	55	<110	120	45.7	86.2
Southern 2	<50	<87	62	125	136	48.7	80.7
Northern	64	104	74	147	>150	64.2	78.6

Legend: dB = decibels; dBA = A-weighted decibels; dBC = C-weighted decibels; DNL = day-night average sound level; Peak-n = Peak noise level under neutral weather conditions; Peak-u = Peak noise level under unfavorable weather conditions; < = less than; > = greater than.
Sources: Army Public Health Command 2014; DoN 2014b.

The periods of potential noise disturbance from live-fire weapons training on Pagan would occur approximately 16 non-consecutive weeks per year and would occur during both day and night. Due to the proximity of the High Hazard Impact Area to the northern colony, and the high noise levels from small- and large-caliber weapons training, Mariana fruit bats are expected to flush from and avoid the northeastern portion of the island periodically or permanently. Effects of such periodic flushing may include disruption of roosting and foraging behaviors, decreased ability to regulate their body temperature, increased stress, particularly during daytime hours, and abandonment and mortality of offspring.

The fruit bat colonies on southern Pagan would be exposed to lower noise levels from live-fire of small- and large-caliber weapons. The two southern colonies would be exposed to small-caliber weapons noise levels of less than 50 decibels A-weighted day-night average sound level, while Peak levels would be less than 87 decibels (see Table 4.9-13). Received noise levels at the Southern 1 colony from large-caliber weapons would be 55 decibels C-weighted day-night average sound level, and less than 110 decibels and 120 decibels Peak under neutral and unfavorable weather conditions, respectively (see Table 4.9-13). Large-caliber weapons training on northern Pagan at the isthmus High Hazard Impact Area would expose the Southern 2 colony to noise levels of 58 decibels C-weighted day-night average sound level and 112 decibels and 124 decibels Peak under neutral and unfavorable weather conditions, respectively (see Table 4.9-13). Received noise levels on southern Pagan from large-caliber weapons training, particularly training that uses the isthmus High Hazard Impact Area, may cause Mariana fruit bats to flush from and avoid the roosting colony location near the isthmus of Pagan periodically or permanently. Effects of such periodic flushing may include disruption of roosting and foraging behaviors, decreased ability to regulate their body temperature, increased stress, particularly during daytime hours, and abandonment and mortality of offspring.

Therefore, proposed large-caliber weapons firing would result in significant direct impacts to Mariana fruit bats at the Southern 2 and Northern colonies; noise impacts to the Southern 1 colony from proposed large-caliber weapons firing are not anticipated based on modeled sound levels.

Aircraft Noise. Aircraft operations on Pagan would expose the fruit bat colony on northern Pagan to noise levels of 64.2 decibels A-weighted day-night average sound level and 78.6 decibels A-weighted day-night average sound level. Aircraft operations would expose the two fruit bat colonies on southern Pagan to noise levels of approximately 45.7 and 48.7 decibels A-weighted day-night average sound level and 86.2 and 80.7 decibels A-weighted day-night average sound level, respectively (see Table 4.9-13). These modeled noise levels are due to aircraft, primarily jets, approaching the High Hazard Impact Area from the south over the isthmus and west of the fruit bat colonies in southern Pagan. Previous studies of Mariana fruit bat reactions to aircraft overflights at Andersen Air Force Base on Guam have shown flushing and noticeable increases in maintenance, decreased ability to regulate their body temperature, and alertness behaviors 0-10 min after aircraft overflights. However, the animals in these studies were directly beneath or immediately adjacent to the runway departure corridors where noise levels are significantly higher (J.M. Morton 1996; Joint Region Marianas, Naval Facilities Engineering Command Marianas, and Andersen Air Force Base 2012). To minimize noise impacts to the fruit bat colonies on southern Pagan, flight restrictions would be established that would limit all aircraft to greater than 500 feet (152 meters) above ground level over the fruit bat colonies on southern Pagan, and a 0.5-mile (0.8-kilometer) lateral buffer zone will be established around the southern colonies.

Aircraft Strikes. Aircraft overflights of fruit bat colonies have the potential to result in aircraft strikes of fruit bats, particularly with a species such as the Mariana fruit bat that flies in large groups when moving between foraging or roosting sites. To avoid and minimize potential aircraft-fruit bat strikes, aircraft would be restricted to 500 feet (152 meters) above ground level over the fruit bat colonies in southern Pagan. Data on aircraft strikes of fruit bats in Australia have shown that the majority of strikes occurred at or below 1,000 feet (305 meters), with the largest proportion of those occurring below 492 feet (150 meters) around sunset (5-8 p.m.) (Parsons et al. 2008, 2009). In addition to avoiding and minimizing noise disturbance to fruit bat colonies, the 0.5-mile (0.8-kilometer) buffer zone around each colony would also significantly reduce the potential for aircraft strikes of fruit bats.

As a best management practice, a Bird/Animal Aircraft Strike Hazard Plan would be prepared to address all aircraft operations on Pagan. This plan will be prepared to minimize the occurrence of aircraft strikes, and it will provide detailed procedures for aviators to monitor and react to heightened risk of strikes. These procedures will also reduce the risk of aircraft strike hazard for fruit bats on Pagan.

Overall, impacts to the Mariana fruit bat population under Pagan Alternative 1 would be significant and unavoidable and unmitigable due to noise from large-caliber munitions.

Micronesian Megapode

Megapodes have been observed only within the southern portion of Pagan within *Casuarina*, coconut, and mixed native-introduced forests. These areas are located within the Non-Live-Fire Maneuver Area. No vegetation would be removed during proposed operations, and only foot traffic (no vehicle use) would occur in southern Pagan. Noise from large-caliber weapons and aircraft overflights may cause impacts to megapodes. However, the megapode population on Farallon de Medinilla, a DoN live-fire range to the north of Tinian, is subject to large-caliber live-fire munitions training and aircraft overflights. Megapodes persist on Farallon de Medinilla and do not appear to be affected by the noise levels associated with live-fire training and aircraft overflights on that range. In addition, proposed overflight altitude restrictions of a minimum of 500 feet (152 meters) over southern Pagan would minimize aircraft noise impacts to megapodes. Megapodes may be exposed to physical disturbance by troops conducting on-foot maneuvers that may result in flushing of birds. However, this level of disturbance is anticipated to have less than significant impacts on the megapode population on Pagan. Potential impacts to individual megapodes under the preferred alternative will be addressed during Endangered Species Act section 7 consultation with the U.S. Fish and Wildlife Service.

Sea Turtles

No sea turtles have been observed nesting on the beaches of Pagan. In addition, sitings of sea turtles on the beaches of Pagan are rare, with one green sea turtle observed basking on Red Beach (Kessler 2011), one of the proposed amphibious landing sites. In addition, seven beaches on Pagan were surveyed in July of 2013. No active or past nesting activity was observed on any of these beaches (DoN 2014c). Although no turtles have been observed nesting on Pagan, the potential exists. Therefore, training restrictions would be implemented to avoid and minimize effects to sea turtles.

With implementation of resource management measures, military training activities associated with Pagan Alternative 1 would result in less than significant direct and indirect impacts to green or hawksbill turtles. Potential impacts to sea turtles in the marine environment of Pagan are discussed in Section 4.10, *Marine Biology*.

Humped Tree Snail

The humped tree snail is known to occur only in native forest and mixed coconut native forest inside or along the rim of the caldera on southern Pagan. Native forest on Pagan would be designated "No Wildlife Disturbance Areas," with the following actions prohibited: vehicle maneuvers, mechanical vegetation clearing, digging or excavation without prior approval; open fires; and flights below 500 feet (152 meters) above ground level. Any maneuvers conducted in native forest will be on foot. Therefore, military training activities under Pagan Alternative 1 would result in less than significant direct and indirect impacts to the humped tree snail population on Pagan.

Slevin's Skink

Slevin's skink may still be present on Pagan, but if so, it occurs in small numbers (Reed et al. 2010). Stressors including noise and physical disturbance may occur in potential Slevin's skink habitat on Pagan with implementation of Pagan Alternative 1. However, given the rarity of occurrence of Slevin's skinks on Pagan, exposure to these stressors would be discountable or insignificant (effects are unlikely to occur or would not be meaningfully measured or detected). Therefore, military training activities under Pagan Alternative 1 would result in less than significant direct and indirect impacts to the Slevin's skink population on Pagan.

Cycas micronesica

Cycas micronesica was recently reported on Pagan in ravines of the southern part of the island (Pratt 2010). Foot maneuvers and associated physical disturbance on southern Pagan may occur with implementation of Pagan Alternative 1. However, with implementation of the proposed conservation measures, including invasive species interdiction, invasive species monitoring and control, fire prevention and management, training restrictions associated with native forest "No Wildlife Disturbance Areas," and ungulate removal or control on southern Pagan, it is expected that military training activities associated with Pagan Alternative 1 would result in less than significant direct and indirect impacts to *C. micronesia*.

Bulbophyllum guamense

Historically *B. guamense* occurred on Pagan, but has not been observed since 1984 (U.S. Fish and Wildlife Service 2014). Therefore, military training activities associated with Pagan Alternative 1 would result in no direct or indirect impacts to *B. guamense*.

4.9.4.1.2.4 Special-status Species: Migratory Bird Treaty Act-listed Species

Direct and indirect impacts to Migratory Bird Treaty Act-listed species from operations under Pagan Alternative 1 would be similar to those discussed under the *Native Wildlife* section and are therefore expected to be less than significant.

4.9.4.1.2.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the federally listed Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are also listed as threatened/endangered by the CNMI. Impacts to these species are discussed previously under the *Special-status Species: Endangered Species Act-listed and Proposed Species* section.

4.9.4.2 Pagan Alternative 2

4.9.4.2.1 Construction Impacts

4.9.4.2.1.1 Vegetation Communities

Impacts to vegetation from proposed construction activities would be similar to those described for Pagan Alternative 1; however, under Pagan Alternative 2 there would be no isthmus High Hazard Impact Area (Figure 4.9-10). Approximately 13 acres (5 hectares) of native forest would be removed, primarily in the northern High Hazard Impact Area (see Table 4.9-12). Given the importance of native forest habitat for native species, the conversion of approximately 13 acres (5 hectares) of native forest on Pagan to developed area from the implementation of Pagan Alternative 2 would result in significant direct impacts to the island vegetation community and its function.

Proposed potential mitigation measures would be the same as those previously proposed for Pagan Alternative 1 (see Section 4.9.4.1). To mitigate for significant impacts to native forest, the Department of Defense may facilitate native forest regeneration on southern Pagan by implementing feral goat and pig removal. This would consist of active control (i.e. trapping, snaring, shooting) of animals, with the goal of eradicating all feral ungulates from southern Pagan. The Department of Defense may also implement monitoring and control of non-native invasive species within forest habitat on Pagan, including control of invasive plant, mammal, and insect species. With implementation of this potential mitigation, direct impacts to native forest under Pagan Alternative 2 would be less than significant. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

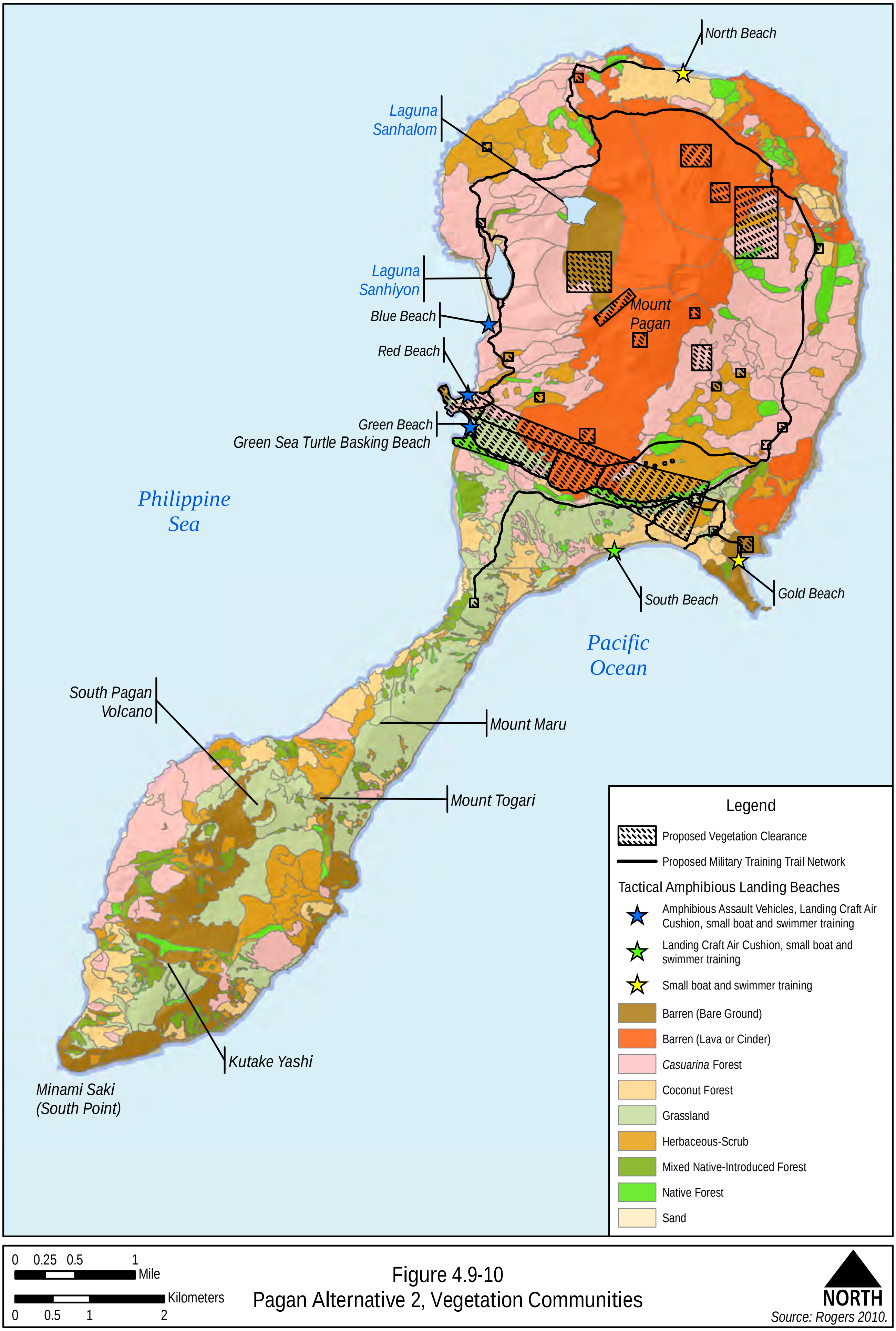


Figure 4.9-10
Pagan Alternative 2, Vegetation Communities

Source: Rogers 2010.

4.9.4.2.1.2 Native Wildlife

Direct and indirect impacts to wildlife from proposed construction activities would be the similar to that described for Pagan Alternative 1. Approximately 212 acres (86 hectares) of forested habitat would be removed during construction (Table 4.9-14). Therefore, implementation of Pagan Alternative 2 and the removal of approximately 212 acres (86 hectares) of forested wildlife habitat would result in significant impacts to native wildlife populations.

Table 4.9-14. Potential Direct Impacts to Vegetation Communities with Implementation of Pagan Alternative 2

Project Area	*Vegetation Community (acres)*								
	NF	*MNIF*	*HS*	*Cas*	*Coco*	*Grass*	*Sand*	*Bar*	*Total*
Northern High Hazard Impact Area	7.1	0	22.2	104.1	0	0	0	186.3	319.7
Field Artillery Direct Fire Range	0	0	0	0	0	0	0	9.9	9.9
Field Artillery Indirect Fire Range	0	0	2.1	0.1	0	7.7	0	9.9	19.8
Airfield Clear Zone	0	22.9	51.1	27.5	0.5	106	0.0	181.7	389.7
Munitions Storage Area	0.8	0	3.5	1.0	0	0.9	0.2	3.5	9.9
Landing Zones	<0.1	1.9	9.4	10.5	2.9	8.3	0.0	3.3	36.3
Road Development	4.7	0.6	5.9	23.4	4.2	15.7	0.4	14.8	69.7
Total Impacted under Alternative 2	**12.6**	**25.4**	**94.2**	**166.6**	**7.6**	**138.6**	**0.6**	**409.4**	**855.0**
Total on Pagan	*418*	*398*	*1,362*	*3,197*	*858*	*1,706*	*28*	*2,531*	*11,502*
% Impacted under Alternative 2 on Pagan	*2.8*	*6.4*	*6.6*	*5.2*	*0.9*	*8.1*	*1.4*	*16.0*	*7.4*

Notes: Impact areas are based on areas depicted and labeled in Chapter 2, Figure 2.6-4. Numbers may not add precisely due to rounding.

Legend: Bar = barren: lava, cinder, or bare ground; Cas = *Casuarina* forest; Coco = coconut forest; Grass = grassland; HS = herbaceous scrub; MNIF = mixed native-introduced forest; NF = native forest; Sand = sand; < = less than.

4.9.4.2.1.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Based on historical data and surveys conducted in support of this EIS/OEIS, Figure 4.9-11 provides the general locations of special-status species in relation to Pagan Alternative 2. Direct impacts to special-status species from proposed construction activities include the removal of habitat, fragmentation of remaining habitat, and associated noise and human activities.

Direct and indirect impacts to Endangered Species Act-listed species from proposed construction activities associated with Pagan Alternative 2 would similar to those described for Pagan Alternative 1. However, the amount of potential foraging habitat removed for the Mariana fruit bat would be less under Pagan Alternative 2. With the exception of the Mariana fruit bat, none of the areas proposed for construction would occur within the vicinity of Endangered Species Act-listed or proposed species habitat on Pagan. Therefore, no impacts to these species would result from construction. Potential foraging habitat for the Mariana fruit bat (1% of native forests and 2% of *Casuarina* forest) would be removed in the northern portion of Pagan; however, no fruit bat habitat in the southern portion of the island would be removed.

Therefore, direct and indirect impacts to the Mariana fruit bat population from construction activities associated with Pagan Alternative 2 would be less than significant.

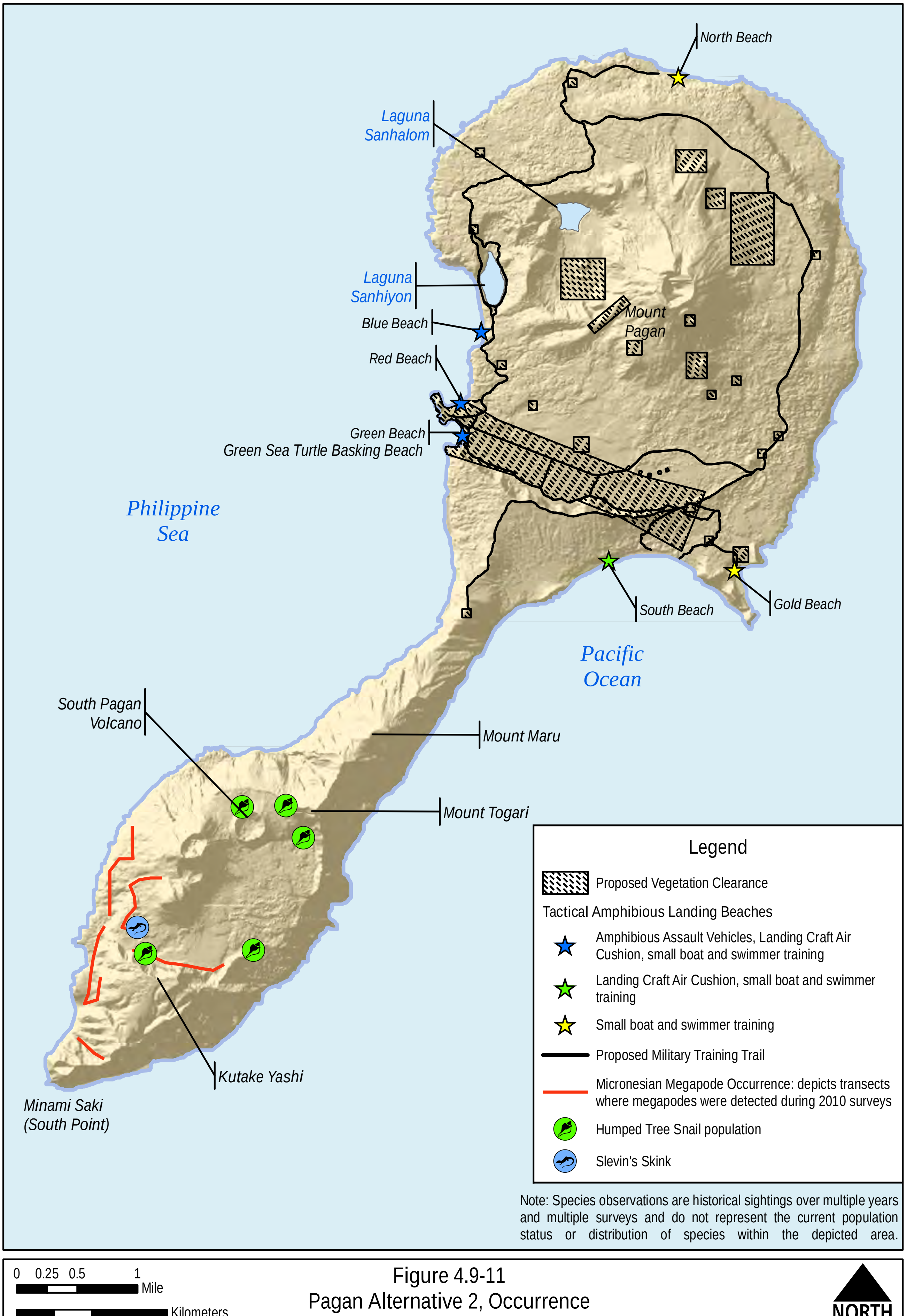


Figure 4.9-11
Pagan Alternative 2, Occurrence of Special-status Species

Sources: Reed et al. 2010; Amidon et al. 2011

4.9.4.2.1.4 Special-status Species: Migratory Bird Treaty Act-listed Species

Direct and indirect impacts to species listed under the Migratory Bird Treaty Act from proposed construction activities would be similar to those described for Pagan Alternative 1 and would be less than significant. However, the amount of habitat removed would be less under Pagan Alternative 2. As discussed above in vegetation, approximately 212 acres (86 hectares) of forested habitat for native species would be removed (see Table 4.9-14).

4.9.4.2.1.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the federally listed Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are also listed as threatened/endangered by the CNMI. Impacts to these species are discussed previously under the *Special-status Species: Endangered Species Act-listed Species* section. No other CNMI-listed species occur on Pagan.

4.9.4.2.2 Operation Impacts

4.9.4.2.2.1 Vegetation Communities

Impacts to vegetation from proposed operations would the similar to Pagan Alternative 1 (see Section 4.9.4.1); however, there would be no isthmus High Hazard Impact Area and the northern High Hazard Impact Area would be smaller, decreasing the potential for impacts to vegetation from ordnance. Therefore, implementation of the training activities associated with Pagan Alternative 2 would result in less than significant direct and indirect impacts to vegetation communities.

4.9.4.2.2.2 Native Wildlife

Impacts to native wildlife from training operations associated Pagan Alternative 2 would be the similar as those previously discussed for Pagan Alternative 1 (see Section 4.9.4.1). Therefore, implementation of Pagan Alternative 2 would result in less than significant impacts to native wildlife.

4.9.4.2.2.3 Special-status Species: Endangered Species Act-listed and Proposed Species

Impacts to Endangered Species Act-listed and proposed species from implementation of Pagan Alternative 2 would be the same as those previously discussed for Pagan Alternative 1, with the exception of the Mariana Fruit Bat which is discussed below. Therefore, there would be less than significant direct and indirect impacts to populations of the Micronesian megapode, nesting sea turtles, humped tree snail, Slevin's Skink, *Cycas micronesica,* and *Bulbophyllum guamense* from implementation of Pagan Alternative 2. Assessment of impacts to individuals of these species will be conducted during Endangered Species Act section 7 consultation with the U.S. Fish and Wildlife Service.

Mariana Fruit Bat

Potential impacts from small-caliber munitions and aircraft noise associated with Pagan Alternative 2 would be less than significant and would be similar to those previously discussed for Pagan Alternative 1 (see Section 4.9.4.1). Proposed large-caliber weapons firing would result in significant direct impacts to Mariana fruit bats at the Southern 2 and Northern colonies; noise impacts to the Southern 1 colony from proposed large-caliber weapons firing are not anticipated based on modeled sound levels. However, impacts from noise levels associated with large-caliber weapons training would be lower with Pagan Alternative 2.

Munitions Noise: A summary of the expected noise levels at the three fruit bat colonies on Pagan due to live-fire weapons operations is presented in Table 4.9-15. Under Pagan Alternative 2, impacts to fruit bats from small-caliber noise would be the same as those under Alternative 1 (Tables 4.9-13 and 4.9-15, and Figure 4.5-8). Received noise levels from large-caliber weapons under both Pagan alternatives would be the same for the northern fruit bat colony and Southern 1 fruit bat colony. However, under Pagan Alternative 2, there would be no High Hazard Impact Area on the isthmus. This would result in the Southern 2 fruit bat colony experiencing received sound levels of 58 decibels C-weighted day-night average sound level compared to 62 decibels C-weighted day-night average sound level under Alternative 1. Large-caliber Peak noise under neutral conditions at the Southern 2 colony would be 112 decibels under Alternative 2, compared to 125 decibels under Alternative 1. Large-caliber Peak noise under unfavorable conditions at the Southern 2 colony would be 124 decibels under Alternative 2, compared to 136 decibels under Alternative 1 (Tables 4.9-13 and 4.9-15).

Table 4.9-15. Modeled Weapons and Aircraft Noise Levels at Mariana Fruit Bat Colonies on Pagan under Alternative 2

	Small-caliber Weapons		***Large-caliber Weapons***			***Aircraft Operations***	
Location	***DNL (dBA)***	***Peak (dB)***	***DNL (dBC)***	***Peak-n* (dB)***	***Peak-u* (dB)***	***DNL (dBA)***	***SEL (dBA)***
Southern 1	<50	<87	55	<110	120	45.7	86.2
Southern 2	<50	<87	58	112	124	48.7	80.7
Northern	64	104	74	147	>150	64.2	78.6

Legend: dB = decibels; dBA = A-weighted decibels; dBC = C-weighted decibels; DNL = day-night average sound level; Peak-n = Peak noise level under neutral weather conditions; Peak-u = Peak noise level under unfavorable weather conditions; < = less than; > = greater than.
Sources: Army Public Health Command 2014; DoN 2014b.

To mitigate for impacts to Mariana fruit bat habitat quality on northern Pagan due to noise from operations, the Department of Defense may facilitate forest regeneration on southern Pagan by implementing feral goat and pig removal. This would consist of active control (i.e. trapping, snaring, shooting) of animals, with the goal of eradicating all feral ungulates from southern Pagan. The Department of Defense may also implement monitoring and control of non-native invasive species within forest habitat on Pagan, including control of invasive plant, mammal, and insect species. These potential mitigations would improve roosting and foraging habitat on southern Pagan for the Mariana fruit bat population. Impacts to individual fruit bats from proposed operations associated with Pagan Alternative 2 will be addressed during Endangered Species Act consultation with the U.S. Fish and Wildlife Service.

4.9.4.2.2.4 Special-status Species: Migratory Bird Treaty Act-listed Species

Impacts to Migratory Bird Treaty Act-listed species from training operations associated with Pagan Alternative 2 would be the similar to those previously discussed for Pagan Alternative 1 (see Section 4.9.4.1). Therefore, implementation of Pagan Alternative 2 would result in less than significant direct impacts to Migratory Bird Treaty Act-listed species. Potential indirect impacts associated with potential introduction of non-native species and wildfires would be avoided and minimized through the implementation of resource management measures (see Section 4.9.2).

4.9.4.2.2.5 Special-status Species: CNMI-listed Species

As described in Section 3.9, *Terrestrial Biology*, the federally listed Micronesian megapode, Mariana fruit bat, and green and hawksbill sea turtles are also listed as threatened/endangered by the CNMI. Impacts to these species are discussed previously in the *Special-status Species: Endangered Species Act-listed and Proposed Species* section. No other CNMI-listed species occur on Pagan.

4.9.4.3 Pagan No-Action Alternative

Under the no-action alternative, there would be infrequent and minor disturbance type activities on Pagan. Periodic visits for eco-tourism, scientific surveys and military training for search and rescue would be low impact and of short duration. Therefore, there would be no significant impacts associated with the no-action alternative on Pagan.

4.9.4.4 Summary of Impacts for Pagan Alternatives

Table 4.9-16 provides a comparison of the potential impacts to terrestrial biology resources for the two Pagan alternatives and the no-action alternative.

Table 4.9-16. Summary of Impacts for Pagan Alternatives

	Pagan (Alternative 1)		***Pagan (Alternative 2)***		***No Action Alternative***	
Terrestrial Biology	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Vegetation Communities	*SI*	*LSI*	*SI*	*LSI*	*NI*	*NI*
Native Wildlife	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*
Special-status Species: Endangered Species Act-listed and Proposed Species and CNMI-listed Species	*LSI*	*SI (Mariana fruit bat)* *LSI (Micronesian megapode, sea turtles, humped tree snail, Slevin's skink)* *NI (Cycas micronesica, Bulbophyllum guamenese)*	*LSI*	*SI (Mariana fruit bat)* *LSI (Micronesian megapode, sea turtles, humped tree snail, Slevin's skink)* *NI (Cycas micronesica, Bulbophyllum guamenese)*	*NI*	*NI*
Special-status Species: Migratory Bird Treaty Act-listed Species	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*

Legend: *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.9.4.5 Summary of Potential Mitigation Measures for Pagan Alternatives

Table 4.9-17 provides a summary of the potential mitigation measures for terrestrial biology resources for the two Pagan alternatives.

Table 4.9-17. Summary of Potential Mitigation Measures for Pagan Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*Phase: Construction*	*Phase: Operation*
Pagan Vegetation Communities Loss of 20 acres (8 hectares) of native forest habitat would result in an unavoidable impact.	*SI*	To minimize the effects of construction on native vegetation communities on Pagan, Department of Defense may facilitate native habitat regeneration on Pagan by implementing feral ungulate removal. This would consist of active control (i.e. trapping, snaring, shooting) of animals, with the goal of eradicating all feral ungulates from southern Pagan.	X	
Pagan Special-status Species, Endangered Species Act-listed and Proposed Species and CNMI-listed Species Large-caliber weapons firing would result in direct impacts to Mariana fruit bats associated with the northeastern colony and on the isthmus colony. Impacts would be unavoidable.	*SI*	• To minimize the effects of operations on Mariana fruit bats on Pagan, Department of Defense would facilitate native habitat regeneration on southern Pagan by implementing feral goat and pig removal. This would consist of active control (i.e. trapping, snaring, shooting) of animals, with the goal of eradicating all feral ungulates from southern Pagan. • To improve habitat quality for Mariana fruit bats on Pagan, Department of Defense may implement monitoring and control of non-native invasive species within forest habitat, including control of invasive plant, mammal, and insect species. • To avoid and minimize impacts to the Mariana fruit bat, Micronesian megapode, and tree snails, the Department of Defense will implement training restrictions within native forest on southern Pagan. All native forest habitat on southern Pagan will be designated as "No Wildlife Disturbance Areas," with the following actions prohibited: vehicle maneuvers; firing of live or inert		X

Table 4.9-17. Summary of Potential Mitigation Measures for Pagan Alternatives

Impacts	***Category***	***Potential Mitigation Measures***	***Phase***	
			Construction	***Operation***
		munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; flights below 500 feet (152 meters) above ground level, with the exception of personnel insertion/extraction via helicopter; and aircraft landings. Any maneuvers conducted in native forest will be on foot. In addition to restricting aircraft flights to a minimum of 500 feet (152 meters) above ground level in southern Pagan, a 0.5-mile (0.8-kilometer) lateral buffer zone will be established for the two fruit bat colonies in southern Pagan. In addition to avoiding and minimizing noise disturbance to fruit bat colonies, the proposed 0.5-mile (0.8-kilometer) buffer zone around each colony will significantly reduce the potential for aircraft strikes of fruit bats. Native forest "No Wildlife Disturbance Area" restrictions will be implemented upon initiation of CJMT training activities on southern Pagan.		

Legend: SI = significant impact. Shading is used to highlight the significant impacts.
Note: Mitigation measures associated with terrestrial biology do not alter the significance of the impacts.

4.10 MARINE BIOLOGY

Section 4.10 describes the direct and indirect impacts to marine biology that could result from implementation of the proposed action. Both the construction and operations elements of the proposed action have the potential to impact marine biology on Tinian and Pagan. In-water construction would occur on Tinian at Unai Chulu. Construction and operations/training activities that may affect marine water quality in the region of influence are described in Section 4.3, *Water Resources*.

4.10.1 Approach to Analysis

A variety of laws, regulations, Executive Orders, plans, and policies, including the Clean Water Act, Endangered Species Act, Marine Mammal Protection Act, Magnuson-Stevens Fishery Conservation and Management Act, and Executive Order 13089 (Coral Reef Protection), are applicable to evaluating the proposed action impacts for marine biology. A complete listing of applicable regulations is provided in Appendix E, *Applicable Federal and Local Regulations*.

The marine biology impact analysis addresses potential effects to marine habitat and Essential Fish Habitat, marine flora, marine invertebrates, fish, and special-status species including sea turtles, marine mammals, and other legally protected species. Sources of impacts to marine biology include: physical disturbance to habitats; acoustic disturbance or injury due to underwater noise; injury or mortality to individuals due to being struck by vessels or construction equipment; and indirect impacts.

Under the proposed action, impacts may be either temporary (reversible) or permanent (irreversible). Direct and indirect impacts are distinguished as follows. *Direct impacts* may include, but are not limited to, the following:

- Permanent removal of coral and marine habitat at Unai Chulu due to dredging and underwater ramp construction
- Acoustic impacts to marine species from pile driving
- Temporary disturbance of habitat due to amphibious landings
- Disturbance or mortality to individuals resulting from in-water vessel movements

Indirect impacts are may include, but are not limited to, the following:

- Indirect impacts to marine habitats and coral (from rubble, etc.) during operation
- Sedimentation/siltation of marine habitat that occurs as a result of erosion and sediment transport from facilities construction on land
- Changes in the abundance, distribution, or behavior of one species, which in turn would affect other species and their interactions.

Factors used to assess the significance of impacts to marine resources include the context and intensity of the impact (40 CFR 1508.27). Context refers to the setting in which the impact occurs; intensity refers to severity of the impact, taking into account the characteristics of the affected resource and the consequences of the impact.

Important considerations determining whether an impact to marine resources would be significant include the following:

- The extent, if any, that the action would result in the substantial loss or degradation of a marine community, ecosystem functions (natural features and processes), or Essential Fish Habitat, relative to the abundance and importance of the resource in the marine ecosystems of Tinian and Pagan.
- The extent, if any, that the action would cause injury or mortality to individuals, and could diminish the population size, distribution, habitat, or prospects for conservation and recovery, of a special-status species, relative to the abundance of that species in the marine ecosystems of Tinian and Pagan.

Impact analysis methodologies specific to each marine resource component are summarized in Sections 4.10.1.1 through 4.10.1.5.

Based on the scope of operational activities and the characteristics and small quantities of expended materials from training (fragments from munitions/target use) that would enter the marine environment, other potential stressors such as energy, entanglement, or ingestion, are considered insignificant. It is also unlikely that sea turtles would accidentally ingest expended materials while foraging on algae or seagrass. These types of impacts are not discussed further in this analysis.

Airborne noise, including construction noise from pile driving and dredging, and operational noise from aircraft, vessels, and over-water gunfire, has the potential to affect marine species. The effects of airborne noise on sea turtles on land are considered in Section 4.9, *Terrestrial Biology*. Airborne noise impacts would be limited based on (1) the transitory nature of airborne noise sources; (2) the limited exposure of animals that spend most or all of their time underwater to noise above water; and (3) the physics of sound transmission from air into the water column, in which much of the sound is reflected off the surface of the water unless the source is at a near-vertical angle (Young 1973). In addition, quantitative data or thresholds relating airborne sound levels to important physiological or behavioral responses by marine animals other than pinnipeds (which are not present in the CNMI) are generally lacking (National Oceanic and Atmospheric Administration West Coast Region 2015). As a result, airborne noise is considered to have only temporary, if any, impacts to individuals (e.g., brief startle responses), which would be unlikely to result in reduced fitness to the individual or to have population-level effects. Accordingly, airborne noise impacts to marine resources are considered less than significant and not discussed further in this analysis.

4.10.1.1 Marine Habitat and Essential Fish Habitat

A geographic information systems analysis was used to determine the areas of direct impact to habitat, focusing on the substrate, the nature and duration of the impact, and the resulting direct and indirect impacts to the organisms associated with that habitat. Acoustic impacts from pile driving, and indirect impacts to habitat (e.g., from runoff) were also considered. The analysis determined the degree to which impacts would have more than minimal and/or temporary significant effects on the quantity or quality of Essential Fish Habitat, in which case consultation with National Marine Fisheries Service is required.

4.10.1.2 Marine Flora

Impacts to marine flora were determined as described for habitats above. This included quantifying areas of direct physical disturbance to habitats that support macroalgae and seagrasses, as well as the potential for indirect effects.

4.10.1.3 Marine Invertebrates

Although a wide diversity of marine invertebrates live within the region of influence, the impact analysis focuses on corals since the integrity of the corals would be critical to the survival of other invertebrates (as well as turtles and fish). Impacts to corals are expected to affect other invertebrates because coral provides habitat for these species and measures to protect corals are expected to protect other invertebrates as well. The amount of coral impact due to construction of the Amphibious Assault Vehicle landing area at Unai Chulu was calculated based on the data from the *Coral Marine Resources Survey Report* conducted in support of this EIS/OEIS (Appendix M) (DoN 2014a).

4.10.1.4 Fish

Impacts to fish were evaluated in terms of direct and indirect impacts to habitat as described in the previous sections, as well as the spatial extent and duration of acoustic disturbance and injury to individual fish.

4.10.1.5 Special-status Species

Special-status marine species of the project action area include species that are listed under the Endangered Species Act and under the Marine Mammal Protection Act. Impacts to special-status species were evaluated on the presence of these species and the anticipated level of disturbance to the areas where they are present. The presence of species and their estimated population densities were determined based on field surveys conducted in support of this EIS/OEIS as well as reviews of applicable data and scientific literature.

4.10.1.5.1 Endangered Species Act-listed Species

In accordance with section 7 of the Endangered Species Act of 1973 (16 U.S. Code 1531 et seq.), a Biological Assessment is being prepared to analyze the potential effects of Department of Defense actions on threatened and endangered species under the jurisdiction of the National Marine Fisheries Service. Section 7(a)(2) of the Endangered Species Act requires federal agencies to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any federally threatened or endangered species or result in the destruction or significant modification of critical habitat. In accordance with Section 102 of NEPA, the Department of Defense is in section 7 consultation with the National Marine Fisheries Service on actions proposed under the preferred alternative presented in this EIS/OEIS.

Based on the information provided in Section 3.10, *Marine Biology*, listed marine species with a reasonable possibility of occurrence in the project region of influence, and thus likely to be impacted, are considered in this section. These include the coral species, *Acropora globiceps,* the green and hawksbill sea turtles, and the blue, fin, sei, humpback and sperm whale. Impacts to other listed species that are unknown or remotely possible in the project region of influence and whose exposure to direct or indirect impacts, if any, would be rare, brief, and unlikely to have any important biological consequences, are not considered further in this document. However, these impacts will be considered as required during the section 7 consultation.

Impacts of the proposed action under section 7 of the Endangered Species Act are analyzed as impacts to individuals (as defined by "take" under the Endangered Species Act). In contrast, analysis of impacts to species under NEPA, presented here, relates to the impacts to populations of these species. The potential mitigation measures proposed in this EIS/OEIS to benefit Endangered Species Act-listed and proposed species are preliminary and may be revised or augmented during Endangered Species Act section 7 consultation.

4.10.1.5.2 Marine Mammal Protection Act-listed Species

Section 3.10, *Marine Biology*, identifies the marine mammal species that could occur in the project region of influence. Due to underwater noise from pile driving, the Department of Defense will apply for an Incidental Harassment Authorization from the National Marine Fisheries Service in advance of construction. The application will fully detail potential effects to individuals of various species based on the acoustic analysis and marine mammal data provided in Appendix M, *Marine Biology Technical Memo and Survey Reports*. The NEPA analysis in this document summarizes the information from Appendix M, *Marine Biology Technical Memo and Survey Reports* and considers the effects of acoustics and other potential impacts to individuals and populations of marine mammals.

4.10.2 Resource Management Measures

Resource management measures applicable to marine biological resources are described below.

4.10.2.1 Avoidance and Minimization Measures

4.10.2.1.1 Tinian

All beaches within the Military Lease Area were considered for amphibious training operations; however, a careful selection process was employed based on analysis and environmental factors. Beaches on the windward side of the Military Lease Area, including Unai Chiget, Unai Dankulo, and Unai Masalok, were not considered for use of Amphibious Assault Vehicle landings due to wind and wave action. Unai Dankulo was eliminated for amphibious training due to the coral habitat and high tourist use. Unai Masalok was the only windward beach identified as a feasible location for amphibious training with Landing Craft Air Cushion vessels, small boats, and swimmers. On the leeward side, Unai Lam Lam, Unai Babui, and Unai Chulu were considered for amphibious training. Unai Lam Lam was considered too small for Amphibious Assault Vehicle and Landing Craft Air Cushion vessel training, but suitable for small boats and swimmers. Based on environmental criteria including analysis of bathymetry and coral cover, Unai Babui and Unai Chulu were both considered for Amphibious Assault Vehicle and Landing Craft Air Cushion vessel training. A detailed engineering analysis of construction alternatives was conducted for these two locations (see Appendix J, *Amphibious Beach Landing Site Engineering and Coastal Processes Analyses*). After careful consideration it was determined that the tactical amphibious landing training beach requirements could be met at one beach. Unai Chulu was chosen as the single beach for

Amphibious Assault Vehicle landings because of its wider configuration. Unai Babui was dismissed for Amphibious Assault Vehicle training to lessen environmental impacts; however, it would still support training for Landing Craft Air Cushion vessels, small boat, and swimmer training. The selection of one beach for Amphibious Assault Vehicles results in fewer environmental impacts to coral and other important marine resources.

Three different methods for constructing amphibious landing ramps were considered; a dredge only option, a pile-armored ramp, and a tribar-armored ramp. The dredge only option was dismissed, as the longevity of the exposed reef surface with no armoring was uncertain. The tribar alternative was also dismissed due to uncertainty of the tribar surface compatibility with Amphibious Assault Vehicle operations. The pile-armored ramp alternative was chosen for its stable design and long-term durability of the surface.

4.10.2.1.2 Pagan

All beaches on Pagan were considered for amphibious training operations. A careful selection process was employed based on training operations and environmental factors. Beaches on the windward side were not considered for use of Amphibious Assault Vehicle landings due to wind and wave action. Based on environmental criteria, including analysis of bathymetry, bottom type and coral cover, Blue, Green and Red Beach were considered for Amphibious Assault Vehicle landings. Adjustments were made in the approach zone to lessen potential effects to coral. Blue, Green, Red, and South were also considered for Landing Craft Air Cushion vessel training.

4.10.2.2 Best Management Practices and Standard Operating Procedures

Best management practices and standard operating procedures that are applicable for marine biological resources are listed below and described in Appendix D, *Best Management Practices*.

4.10.2.2.1 Construction

- All project-related materials and equipment (e.g., dredges) placed in the water should be clear of pollutants prior to use. No project-related materials (fill, revetment rock, etc.) should be stockpiled in the water (intertidal zones, reef flats, etc.).
- Construction contracts would include appropriate biosecurity measures.
- *Erosion Control Measures*. The erosion control measures such as retention ponds, swales, silt fences, fiber rolls, gravel bag berms, mulch, and erosion control blankets would be implemented during construction and operations to eliminate and/or minimize nonpoint source pollution in surface waters due to sediment.
- *Clean Water Act National Pollutant Discharge Elimination System Program*. A Stormwater Management Plan and Stormwater Pollution Prevention Plan would be prepared and implemented in compliance with the CNMI Stormwater Management Manual. Best management practices could include:
    - Soil stabilization (such as mulch and erosion control blankets).

  - Perimeter and sediment control (such as silt fences, fiber rolls, gravel bag berms, and sediment traps).
  - Management and covering of material, waste, and soil stockpiles when not in use.
  - Storage of fuels and hazardous materials with proper secondary containment, and establishment of designated vehicle and equipment maintenance and fueling areas.
- Management of spills and leaks from vehicles and equipment through inspections and use of drip pans, absorbent pads, and spill kits.
- A contingency plan to control petroleum products accidentally spilled during the project would be developed.
- *Contractor Education Program.* The DoN has developed an education program to ensure construction contractor personnel are informed of the biological resources in the project area, including special-status species, avoidance measures, and reporting requirements.
- If sea turtles or marine mammals are noticed within 150 feet (46 meters) after in-water construction work has begun, that work may continue only if the activity would not affect the animal(s). For example, divers performing surveys or underwater work would likely be permissible, whereas operation of heavy equipment is likely not.
- Personnel shall remain alert for marine mammals before and during pile driving. Pile driving will not commence if a marine mammal is observed within 300 feet (90 meters) or a sea turtle is observed within 50 feet (15 meters) of operation. Pile driving can begin 30 minutes after the last sighting of the marine mammal or sea turtle. If pile driving is already started and a marine mammal or sea turtle is sighted within 300 feet (90 meters) after drilling has commenced, drilling can continue unless the marine mammal or sea turtle comes within 210 feet (64 meters) during drilling; operations should then cease until the animal leaves the area of its own volition or after 30 minutes have passed since the last sighting.
- During pile driving and removal, the shutdown zone will be sized and established to avoid injury to marine mammals.
- Soft Start – The use of a soft-start procedure is believed to provide additional protection to marine mammals, sea turtles, and fish by providing a warning and/or giving marine species a chance to leave the area prior to the hammer operating at full capacity. Soft start shall be conducted at the beginning of each day's activity and at any time pile driving has ceased for more than 30 minutes. If vibratory pile driving has been occurring but impact has not for more than 30 minutes, soft start for the impact hammer must occur. The soft start requires contractors to initiate noise from vibratory hammers for 15 seconds at reduced energy followed by a 30-second waiting period. This procedure should be repeated two additional times. If an impact hammer is used, contractors are required to provide an initial set of three strikes from the impact hammer at 40% energy, followed by a 30-second waiting period, then two subsequent 3-strike sets.

4.10.2.2.2 Operation

- All established harbor navigation rules are observed during amphibious operations occurring within an established harbor. During amphibious operations (landings and departures) occurring outside of an established harbor, Landing Craft Air Cushion vessels stay fully on-cushion or hover when over shallow reefs to avoid corals, hard bottom, and other substrate that could potentially damage equipment.
- Flagging or marking of particular coral heads at Green Beach to avoid during training operations.
- Amphibious vehicles and small boats would avoid approaching marine mammals and sea turtles head on, to the greatest extent practical given operational need and vessel safety (necessary steerage, sea state, navigational need).
- A contingency plan to control petroleum products accidentally spilled during the project would be developed.
- *Biosecurity Outreach and Education*. A biosecurity outreach and education program would be implemented to inform contractors and Department of Defense civilian and military personnel about native versus non-native invasive species and the impacts of non-native invasive species on native ecosystems.

4.10.3 Tinian

4.10.3.1 Tinian Alternative 1

4.10.3.1.1 Construction Impacts

The majority of the land-based construction activities would take place inland and away from the nearshore environment. However, some construction activities would take place near the shore including port improvements, portions of road improvements, some observation posts, and construction of an amphibious beach landing area. An amphibious landing ramp would be constructed at Unai Chulu to create a safe landing surface for training operations. Causes of impact would include physical disturbance to the habitat, potential indirect effects, and, for some of the marine species, the underwater acoustic effects of pile driving. In-water construction activities would disturb sediment and increase turbidity and thus impact water quality. Best management practices would be utilized to capture sediment and debris caused by in-water construction activities. See Appendix J, *Amphibious Beach Landing Site Engineering and Coastal Processes Analyses* for additional details on the proposed construction methods for the amphibious landing ramp. An assessment of the potential impacts of construction of Unai Chulu to coastal processes was completed. The assessment concluded that construction of the proposed amphibious landing ramp would not significantly modify shoreline coastal processes or trigger erosion of the beach.

4.10.3.1.1.1 Marine Habitat and Essential Fish Habitat

Construction of the in-water amphibious landing ramp for Amphibious Assault Vehicles would modify the seafloor (i.e., limestone, coral reef) by contouring the approach zone (landing area) to create a flat shelf in the substrate and a pile-armored ramp at a 15-degree slope. The pile-armored ramp would consist of a gravel bed atop the coral base and a durable grooved concrete slab surface designed to be stable under severe wave conditions. Trenches with concrete anchors would secure the toe and top of the ramp and join the ramp with existing substrate surfaces.

During construction, temporary causeways would be constructed to allow an excavator access over the water. The temporary causeways would be created using pile-supported trestles through the surf zone and out to 12 feet (4 meters) depth. Steel sheet piles and steel pipe piles would be installed into the reef and penetrate approximately 40 feet (12 meters) into the substrate. The causeways would be constructed using dredged material and would be removed after amphibious landing ramp construction was complete. After the removal of the causeways, excess fill material (i.e., dredge material) would be reused or disposed of at an approved in-water or upland disposal site.

The construction would create a stable landing area for the Amphibious Assault Vehicles to safely come ashore on a repeated basis. The amphibious landing ramp at Unai Chulu would be approximately 656 feet (200 meters) long and average 160 feet (50 meters) wide with an anticipated dredge volume of 798,111 cubic feet (22,600 cubic meters). Construction is anticipated to take approximately 36 weeks.

Construction of the amphibious landing ramp and temporary construction causeways would permanently change the habitat of the nearshore areas of the beach at Unai Chulu (see Figures 4.10-1 and 4.10-2). During and subsequent to construction, coral rubble and sediments generated by the activities would be dispersed by wave action and currents, resulting in the abrasion and burial of adjacent habitats and increasing suspended sediments in the water column. Underwater noise levels would be increased during pile driving and dredging. The areas affected include soft shore habitats and reef flat and hard bottom habitat at depth. The entire water column and seafloor within the affected area is designated as Essential Fish Habitat Area for bottomfish, crustaceans, coral reef ecosystems, and pelagics. In-water construction would result in a reduction in the quality and quantity of Essential Fish Habitat within the nearshore area.

Table 4.10-1 presents the areas of potential direct and indirect impacts to marine habitats during construction of the proposed action on Tinian. The direct impacts include permanent removal of marine habitat to create the amphibious landing ramp at Unai Chulu. The analysis assumes that in addition to the area exposed to direct physical disturbance during construction, an additional area surrounding the construction footprint would be exposed to indirect physical impacts associated with mobilized rubble generated by the construction activities. When mobilized by water motion, any mobile rubble can strike or smother corals and degrade coral habitat. In this context, mobilized rubble includes living and dead coral colonies that are broken off of the substrate and reduced to a size that can be mobilized by water motion; reef substrate itself that is broken off; and preexisting unattached fragments. Smaller fragments are likely to be transported farther than larger fragments. Both upslope and downslope transport would occur but transport downslope is more likely. Transport alongshore would occur but this is likely to be less than downslope transport. Reef flats and topographic lows (grooves in the coral reef) are more likely to be affected than topographic highs. The likelihood of an unattached fragment becoming mobilized is a function of its density, shape, water depth, and intensity of the water motion.

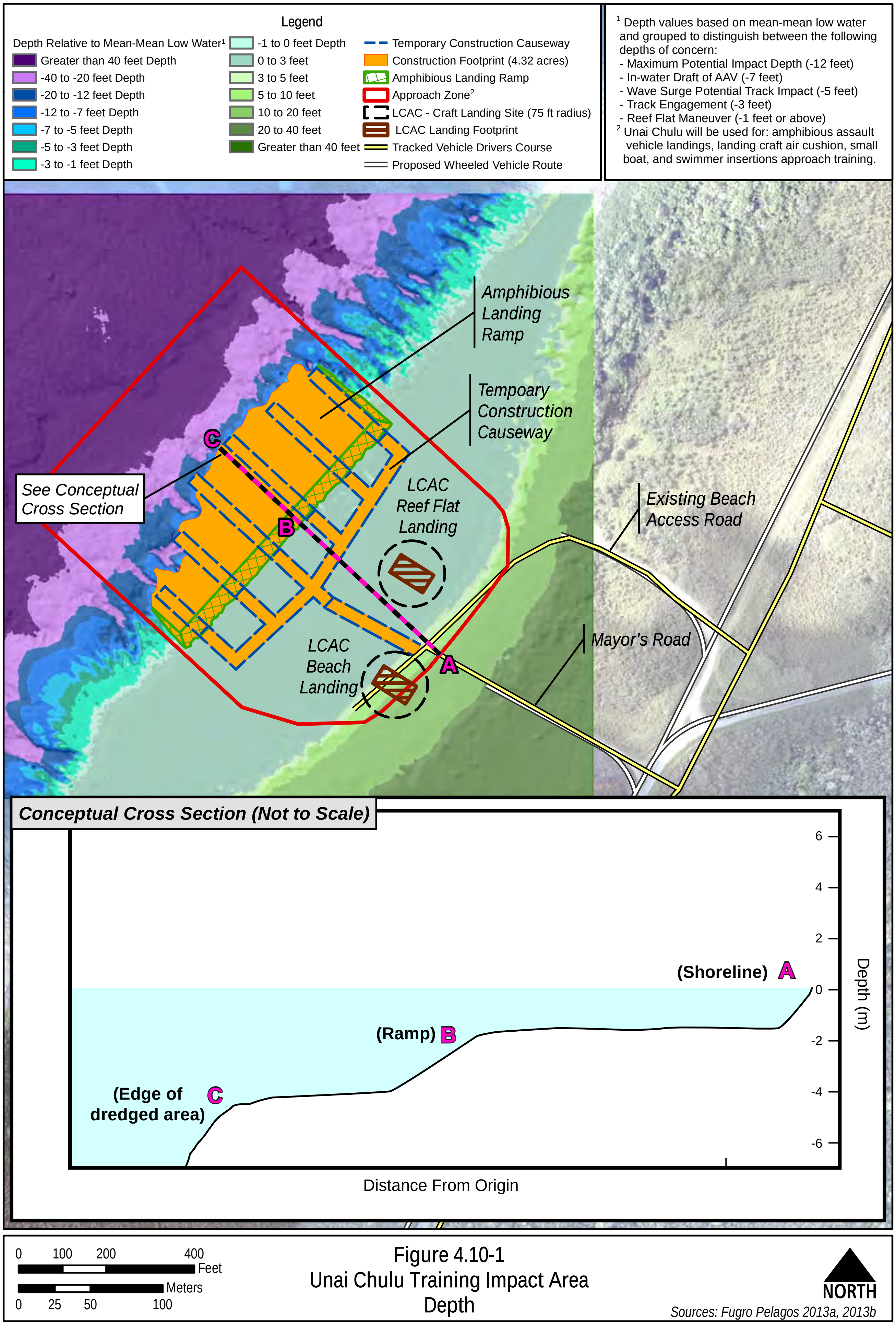


Figure 4.10-1
Unai Chulu Training Impact Area
Depth

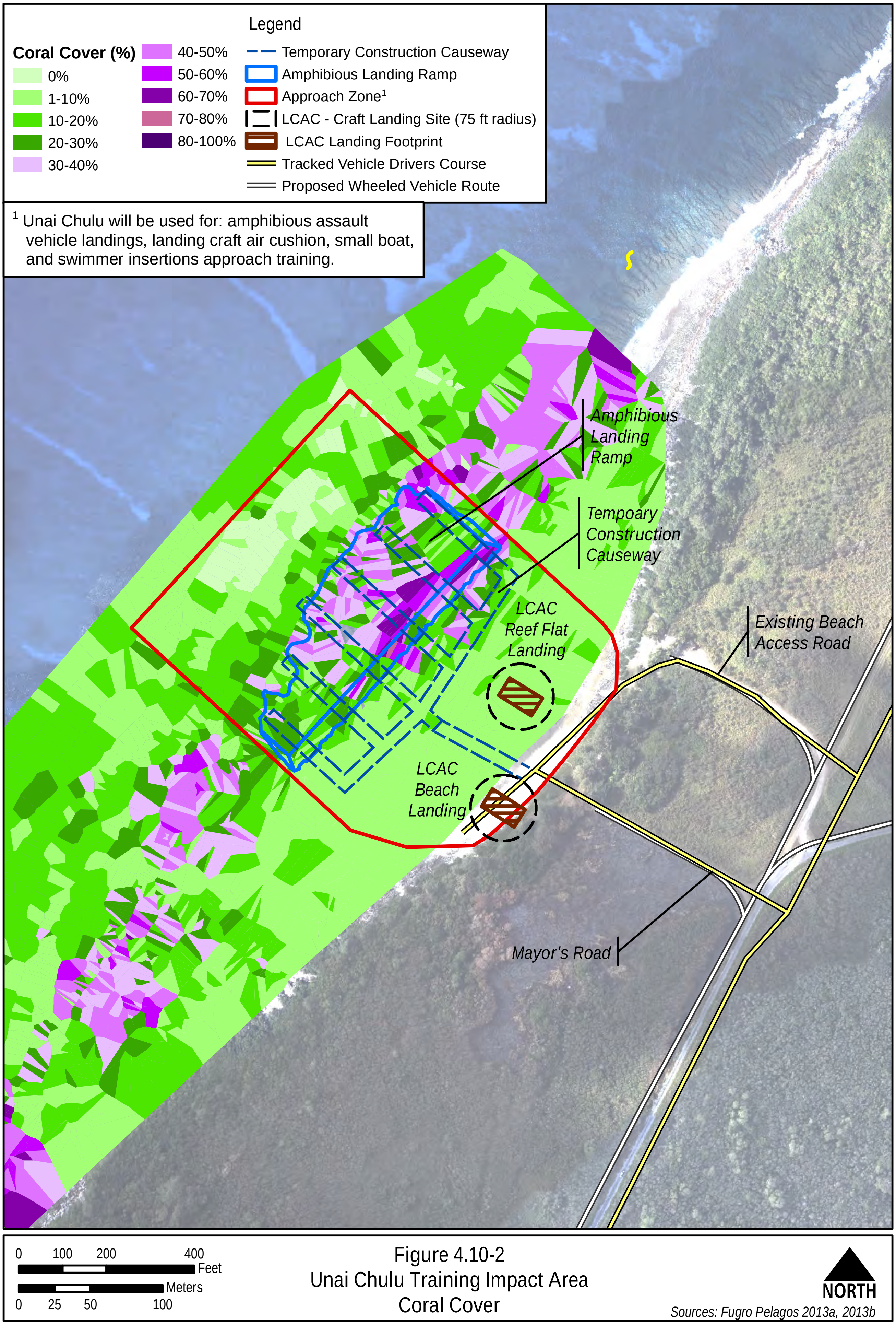


Figure 4.10-2
Unai Chulu Training Impact Area
Coral Cover

Table 4.10-1. Summary of Potential Direct and Indirect Impacts to Marine Habitat at Unai Chulu

Parcel and Activity	***Area of Direct Effects (acres)***	***Area of Indirect Effects (acres)***	***Total Area of Likely Direct and Indirect Effects (acres)***
Unai Chulu Landing	10.3	10.3	20.6

Note: This analysis estimates the size of the area exposed to indirect effects of mobile rubble would be equal to the area exposed to direct effects.

The size of the area exposed to indirect effects of mobile rubble (outside of the direct physical disturbance footprint), is conservatively estimated to be equal to the area exposed to direct effects. The shape of the indirectly affected area cannot be quantitatively estimated. There will be a gradient of disturbance within the area of indirect effect. The effects of mobilized rubble would be greater closer to the construction area and reduced at increasing distances from construction based on the assumptions for rubble movement.

A coastal processes analysis was completed to assess the potential impacts from construction of an amphibious landing ramp at Unai Chulu to coastal processes (see Appendix J, *Amphibious Beach Landing Site Engineering and Coastal Processes Analyses*). Model results comparing the existing condition with the Amphibious Assault Vehicle landing zone configuration suggest that the alteration of the nearshore bathymetry by dredging the Amphibious Assault Vehicle approach area and ramp would not significantly modify shoreline coastal processes and/or trigger erosion of the beach.

Construction impacts to the water column, as well as acoustic impacts, would be intermittent during construction, resulting in only short-term effects. Turbidity would be briefly and locally increased, but suspended sediments would either settle or be rapidly dispersed, with no long-term effects on photosynthesis. Potential impacts to water quality characteristics of the marine environment during coastal and inland construction activities would be minimized by implementing best management practices to control fugitive dust, stormwater runoff, and eutrophication (the process by which a body of water acquires a high concentration of nutrients).

The primary physical impact of in-water construction would be to permanently convert complex and variable reef habitat to an essentially flat surface bordered by disturbed areas of coral rubble, sand, and scoured rock. The diverse microhabitats associated with the topographic complexity of the reef would be eliminated. Substrate that currently supports a relatively high cover of macroalgae would be removed or buried. The mosaic-like character of the habitat, which includes patches of sand, macroalgae, and varying amounts of coral cover, would be replaced by a more homogeneous area consisting of the ramp and adjacent disturbed areas. With the loss of structural diversity, biological diversity and productivity within the impacted area would be diminished. Construction impacts would directly or indirectly affect all of the species that occur in or would otherwise utilize the habitat.

The impacted water column constitutes Essential Fish Habitat for the egg, larval, juvenile, and adult life stages for all of the species or groups of species that are managed under the Mariana Archipelago Fishery Ecosystem Plan (Western Pacific Regional Fishery Management Council 2009). Impacts to the water column would be temporary as noted previously. The substrate, which would be more severely impacted, constitutes Essential Fish Habitat for the juvenile and adult life stages of shallow water bottomfish and crustaceans, as well as the harvested and potentially harvested species of coral reef ecosystems.

The area impacted by physical disturbance at Unai Chulu during construction represents 0.34% of the total reef habitat on Tinian (see Table 3.10-1). The reef flat at Unai Chulu has high taxa richness for algae but lower taxa richness for fish and invertebrates (Minton et al. 2009). The reef flat at Unai Chulu also supports a relatively high cover of algae, which would be removed or subject to burial within the construction area. Use of this area during operations would prevent the recovery of marine algae. The loss of marine flora habitat would impact the invertebrates, fish, and sea turtles that use marine flora species as shelter or as a food source.

Essential Fish Habitat for juvenile and adult spiny lobsters includes the substrate from the shoreline to a depth of 492 feet (150 meters). Adult and juvenile spiny lobsters move onto the reef flats from rocky shelters in the surf zone at night to forage. Physical disturbance to the reef flat would permanently reduce algal cover in the impacted area, and a loss of reef flat habitat may impact both larval and adult spiny lobsters through loss of nursery and foraging habitat. This would result in permanent impacts to larval spiny lobsters, but juvenile and adult spiny lobsters in the immediate vicinity of the construction would be expected to move to more suitable foraging areas.

The estimated noise levels and areas affected by impact pile driving and vibratory pile driving and extraction are described in Appendix M, *Marine Biology Technical Memo and Survey Reports*. These noise levels would result in temporary impacts to Essential Fish Habitat, with increased noise potentially causing some fish to move out of the loudest areas closest to the source. The noise levels would also affect fish behaviors such as detection of predators and prey, schooling, mating, navigating, and in the case of coral larvae, settlement over a much larger area. Given the shallow depths and the uneven topography, any underwater noise as a result of the pile driving/extraction and coral dredging would likely dissipate quickly within the surf zone, but it may extend laterally along the coast as well as into the deeper nearshore environment, depending on environmental variables such as tide or weather patterns in the area. The distances within which various effects on fish are predicted to occur are as follows:

- Behavioral effects on fish during impact pile driving could extend to a distance of 20,695 feet (6.31 kilometers) from the pile. Corresponding effects during vibratory driving or extraction would extend a smaller distance of 243 feet (74 meters).
- Injury due to peak sound pressure levels during impact pile driving would occur to fish within 30 feet (9 meters) of the pile being driven.
- Injury due to an accumulated sound exposure level during impact pile driving would occur to fish that remain within a distance of 928 feet (283 meters) for fish weighing more than 0.07 ounces (2 grams), or 1,715 feet (523 meters) for smaller fish, throughout an entire day of pile driving activity. The corresponding distances during vibratory driving or extraction are smaller, 52 feet (16 meters) for fish weighing more than 0.07 ounces (2 grams), and 95 feet (29 meters) for smaller fish.

Pile driving activities at Tinian would occur during the daytime, and the effects would occur for a maximum of 105 days. Adherence to best management practices such as the soft-start procedure would minimize potential impacts by giving individuals a chance to leave the area to avoid injury prior to the impact hammer operating at full capacity. This would lessen the potential for fish to experience permanent injury or death and would reduce temporary or short-term and recoverable hearing loss due to acoustic impacts from pile driving. The likelihood of impacts from underwater noise are further reduced by the fact that proposed construction operations would not be in deep water but would occur in the shallow intertidal environment of Unai Chulu (approximately 5.0 to 20 feet [1.5 to 6.0 meters]).

The use of an underwater excavator to break up coral and remove sediments from the location of the proposed ramp would also generate underwater sound. Based on comparable operations that measured underwater excavation noise in an area with a limestone bottom, the loudest sounds would be associated with the bottom impact during rock fracturing and excavation (Reine et al. 2014). These sounds would be intermittent, not continuous, and would be substantially less than those predicted for impact pile driving (see Appendix M, *Marine Biology Technical Memo and Survey Reports*).

Potential impacts to water quality characteristics of the marine environment during coastal and inland construction activities would be minimized by implementing resource management measures (see Section 4.3, *Water Resources* for details) to control fugitive dust, stormwater runoff, and eutrophication (the process by which a body of water acquires a high concentration of nutrients). In-water construction would cause temporary water quality impacts, including increased turbidity. Increases in turbidity could temporarily decrease the foraging efficiency of species using Essential Fish Habitat at Unai Chulu. However, given the dynamic nature of the habitat and the grain size of the material, turbidity is expected to be minimal and localized. Impacts would be minimized to the maximum extent practicable through adherence to best management practices. Post-development stormwater management would mainly focus on a combination of natural and engineered features (i.e., Low Impact Development) that control the volume and rate of stormwater runoff and filter out pollutants.

In-water construction would cause temporary, as well as permanent, loss and degradation of coral reef habitat that comprises Essential Fish Habitat at Unai Chulu. Fish may be temporarily displaced for the duration of construction activities. Coral reef flat habitat at Unai Chulu would be permanently physically altered and removed. Due to loss of habitat, changes to local fish populations and management unit species would likely occur. Populations of reef-associated fish would be expected to decrease in rough proportion to the relative area of reef that would be impacted. While this represents a small percentage of the total, it would be more than minor and/or temporary. It would reduce the quality and quantity of Essential Fish Habitat for the coral reef ecosystem and the complex trophic (i.e., feeding and nutrition) structure of the reef ecosystem. The high levels of primary (plant) and secondary (animal) production of the reef itself would be largely eliminated.

Although the area impacted by in-water construction at Unai Chulu represents 0.34% of the total reef habitat on Tinian (see Table 3.10-1), it represents 20-30% of Tinian's reef flat habitat. Unai Chulu is one of seven well-developed reef flats on Tinian (Analytical Laboratories of Hawaii 2004; National Oceanic and Atmospheric Administration, National Centers for Coastal Ocean Science 2005; Bearden et al. 2008; Riegl and Dodge 2008; Brainard et al. 2011). Therefore, given the importance of this habitat as Essential Fish Habitat and its limited availability on Tinian, the removal of the coral reef at this beach during Tinian Alternative 1 construction activities would result in significant impacts to marine habitat and Essential Fish Habitat.

4.10.3.1.1.2 Marine Flora

Marine flora would be removed and otherwise negatively impacted by mobilized rubble within the areas of direct and indirect physical disturbance to habitat by in-water construction at Unai Chulu (see Table 4.10-1). Alteration of marine flora habitat would impact ecological function at Unai Chulu and eliminate habitat and food sources for other species. Marine flora, such as seagrasses, provide a food source for sea turtles and habitat for fishes within the region of influence (Spalding et al. 2003). Seagrasses also play a major role in fisheries production and have been shown to provide protection from coastal erosion (Spalding et al. 2003). In-water construction would also temporarily increase sedimentation within the nearshore waters, thereby increasing turbidity, reducing light availability, photosynthesis, and primary production by marine flora. However, as described in Section 3.10, *Marine Biology*, marine flora are abundant in Tinian waters, and in-water construction at Unai Chulu would eliminate approximately 0.34% of Tinian's reef habitat that could support marine flora. Therefore, Tinian Alternative 1 construction activities would result in less than significant impacts to marine flora.

4.10.3.1.1.3 Marine Invertebrates

Based on the *Marine Resource Surveys of Tinian, Volume I* (Minton et al. 2009), the reef slope at Unai Chulu is far more diverse than the reef flat. The surveys documented at least 79 coral and 89 non-coral invertebrate taxa (distinct species, genera, or families) on the reef slope, versus 15 coral and 28 non-coral taxa on the reef flat. The most abundant non-coral invertebrates on the reef slope were rock-boring urchins; on the reef flat, sea cucumbers, sea stars, and tube worms were the most abundant. Individual coral and coral colonies at Unai Chulu within the construction area would be exposed to direct physical removal and disturbance during construction. Coral located adjacent to the amphibious landing ramp would be exposed to indirect impacts associated with mobilized rubble generated by the construction activities. Non-coral marine invertebrates (starfish, sea urchins, sea cucumbers, mollusks, and tube worms) would also be subject to direct and indirect impacts associated with in-water construction. Some non-coral marine invertebrates would be directly impacted (i.e. mortality) during in-water construction. Non-coral marine invertebrates not directly impacted during in-water construction would experience temporary as well as permanent habitat loss in the construction footprint.

The in-water construction of the amphibious landing area would also result in the impacts associated effects of sedimentation. In addition, coastal construction could lead to increased runoff from supporting land-based construction activities (e.g., construction equipment staged on the beach). Sediments created and/or mobilized during dredging or other construction activities would be expected to occur within and adjacent to the construction area. When mobilized by water motion, mobile rubble can strike or smother marine invertebrates. These effects would be relatively localized and constrained to the time of construction.

In addition, underwater noise from construction equipment, vibratory and impact pile-driving, and the sounds of the substrate fragmenting and moving during the dredging process could mask the natural reef sounds that coral larvae use as settlement cues (Vermeij et al. 2010). The nature of coral larvae's use of acoustic information is related to navigation towards suitable reef habitat for settlement (Vermeij et al. 2010). Coral larvae could be anywhere in the water column to at least as deep as each species' typical depth range, and typical larval stage durations range from a few days to a few weeks (Baird et al. 2009). A possible consequence of construction noise is that coral larvae may avoid settling and remain in the water column for a slightly longer time, drifting until the sound-generating activity subsides. Based on the level of disturbance at the construction site, it is unlikely that natural reef sounds like those made by snapping shrimp and reef fish would be present, where the habitat would be degraded and inhospitable for larval settlement. Coral larvae that do not settle because of construction noise or degraded habitat conditions would drift to other nearby locations with suitable habitat within a short time (possibly minutes, depending on currents), which would be expected to have a small effect on larval survival given the duration of the planktonic phase (Baird et al. 2009). Accordingly, acoustic effects on larvae would be local, temporary, and less than significant. The proposed construction methods would permanently introduce concrete to the marine environment. Concrete sometimes inhibits settlement of coral larvae, which would be beneficial in this context, and cured concrete is not known to have effects on post-settlement corals (Jaap 2000; Southeast Florida Coral Reef Initiative 2011; Tan and Chou 2012). Apart from the physical destruction and degradation of coral reef habitat, which is already recognized as a significant impact under *Marine Habitat and Essential Fish Habitat*, the additional impact to adjacent coral reef habitat, the associated coral and non-coral invertebrates, and coral larvae would be relatively localized and temporary.

In the vicinity of Unai Chulu, coral populations would experience a population discontinuity within the construction footprint. Currently, this location is a continuous coral reef. It is expected the permanent loss of 0.34% of the Tinian reef habitat within and adjacent to the construction area at Unai Chulu would reduce non-coral marine invertebrates by a roughly equivalent amount. Therefore, Tinian Alternative 1 construction activities would result in significant impacts to coral and less than significant impacts to non-coral marine invertebrates.

4.10.3.1.1.4 Fish

In-water construction would cause temporary, as well as permanent, habitat disturbance and loss for fish species as fish may be temporarily or permanently displaced. Since reef flat coral habitat at Unai Chulu would be permanently physically altered and removed, changes to local fish populations dependent on this habitat would likely occur. Populations of reef fish would decrease, and trophic (i.e., feeding and nutrition) structure would be affected. Because many individual fish depend on specific coral habitats for survival, mortality would likely occur in these areas. Given the loss of approximately 0.34% of Tinian reef habitat during construction at Unai Chulu, a roughly equivalent reduction in populations of reef-associated fish can be anticipated.

During in-water construction, construction equipment could potentially strike any fish species found within the construction area, although some fish may be more susceptible to strike potential than others. Potential responses to physical strikes are varied, but include physiological stress, physical injury or mortality, and behavioral changes such as avoidance of the area, altered swimming speed and direction, and reduced performance of key behaviors such as eating, hiding, and predator avoidance. Construction equipment would interact with species that inhabit the seafloor, and the water column above the seafloor in the construction area. Early life stages of fish (including fish eggs, larvae, and juveniles) that inhabit the construction impact area would be the most vulnerable and could suffer mortality if they do not vacate the area during construction.

Fish are susceptible to acoustic stressors in multiple ways. Fish exposed to short-duration, high-intensity signals, such as those that emanate from pile driving, could result in injury, long-term consequences (A. N. Popper et al. 2006; Stadler and Woodbury 2009), and hearing loss, also known as a noise-induced threshold shift, or simply a threshold shift (Miller 1974). A temporary threshold shift is a temporary, recoverable loss of hearing sensitivity. Fish with hearing specializations (i.e., greater sensitivity to lower sound pressures and higher frequencies) experience some hearing loss after several days or weeks of exposure to increased background sounds, although the hearing loss seems to recover (e.g., Scholik and

Yan 2002; Smith et al. 2004, 2006). When human-generated noise interferes with natural sounds associated with behaviors such as detection of predators and prey, schooling, mating, and navigating (Myrberg 1980; A. Popper et al. 2003), such auditory masking could have impacts to fish by reducing their ability to perform these biological functions. Human-generated noise has also been documented to cause behavioral reactions such as avoidance or fleeing the area. In addition to potential effects on hearing and behavior, fish that have swim bladders are susceptible to injury by the rapid expansion/decompression of their swim bladders that is caused by pressure waves from underwater noises (Hastings and Popper 2005). At a sufficient pressure level (a measure closely related to the loudness of the sound), this exposure can be fatal.

To minimize the potential for fish to be present in the immediate vicinity of the impact or vibratory pile driving, the equipment operators would use a soft-start procedure that involves a slow increase in intensity of noise and allows individuals in the area to disperse and avoid injury before maximum noise levels are reached. It is expected that during the soft start and as the activity progresses, fish would move farther away or into sheltered locations where sound would be less intense. Hence, although there would be temporary behavioral effects, the likelihood of injury to individual fish would be low.

Currently accepted thresholds for behavioral and physiological effects to fish from underwater sound generated by activities such as pile driving are summarized below (Fisheries Hydroacoustic Working Group 2008).

- Behavioral disturbance is assumed to be likely when fish are exposed to a sound pressure level (root mean square – a mathematical process used to measure the typical magnitude of a set of numbers, regardless of whether the values are positive or negative) greater than 150 decibels (referenced to 1 micro Pascal, a measure of pressure).
- Injuries are assumed to occur when fish are: a) exposed to a peak sound pressure level (which is the greatest absolute instantaneous sound pressure during a stated time interval) of 206 decibels (referenced to 1 micro Pascal); or b) when they receive a cumulative sound exposure level (a mathematical way of summing the effects of sound over a duration of time) during a single day of 187 decibels (referenced to 1 micro Pascal squared-second). For fish that weigh less than 0.07 ounces (2 grams), the latter threshold is 183 decibels (referenced to 1 micro Pascal squared-second).

Appendix M.1, *Marine Biology Technical Memo*, provides the estimated sound levels that would be produced by impact and vibratory pile driving and vibratory pile extraction during the construction and removal of temporary causeways at Unai Chulu. Using the model described in Appendix M.1 to estimate the decrease in sound levels with distance from the pile, and estimating 10 minutes of impact pile driving (600 pile strikes) per day, the distances within which the above thresholds would be exceeded can be calculated. Output from the model showed that the potential for injury due to peak sound pressure level would exist within 30 feet (9 meters), and the sound exposure level thresholds for injury to small and large fish would only be exceeded for fish that remain exposed within distances of 1,715 feet (523 meters) and 928 feet (283 meters), respectively, for the entire 600 pile strikes. It is considered unlikely that fish would remain within these distances where injuries could occur. Small life stages that drift passively in the water column could drift through the area but would be unlikely to remain within these distances long enough to be impacted. Finally, the behavioral effects threshold would be exceeded within a distance of 120,695 feet (6,310 meters), but this would accumulate over a period that is estimated to be a total of 10 minutes distributed over the day that the pile is being hammered by the impact pile driver. This amount of behavioral disturbance is unlikely to have important biological consequences. In-water construction would cause temporary water quality impacts including increased turbidity. Increases in turbidity could temporarily decrease the foraging efficiency of fish. In sandy areas, given the dynamic nature of the habitat and the grain size of the material, turbidity is expected to be minimal and localized. Potential impacts from run-off from land-based construction could degrade water quality, particularly the construction of impervious access roads built close to the shoreline. These impacts would be minimized through adherence to best management practices (Appendix D, *Best Management Practices*).

The permanent loss of 0.34% of Tinian reef habitat within and adjacent to the construction area at Unai Chulu would reduce populations of reef-associated fish by a roughly equivalent amount. With the implementation of a soft start during pile driving, the likelihood of injuries to fish would be low, although behavioral effects would occur. Apart from the loss of coral reef and Essential Fish Habitat already discussed, the additional impact to fish populations and communities would be relatively small. Therefore, Tinian Alternative 1 construction activities would result in less than significant impacts to fish.

4.10.3.1.1.5 Special-status Species

Corals

The *Coral Marine Resource Survey* conducted in support of this EIS/OEIS recorded the presence of one coral species, *Acropora globiceps*, listed under the Endangered Species Act (National Marine Fisheries Service 2012; DoN 2014a). Other listed species are considered unlikely to occur or be affected. Table 4.10-2 presents an estimate of the number of *Acropora globiceps* that will be directly impacted and removed during in-water construction at Unai Chulu. In addition, Table 4.10-2 lists the total estimated area of coral loss. Tables for Unai Babui, Unai Masalok and Unai Lam Lam can be found in Section 4.10.3.1.2, *Operation Impacts*.

Table 4.10-2. Potential Impacts to Acropora globiceps at Unai Chulu During Construction[1]

	***Unai Chulu*[2]**
Extrapolated number of *Acropora globiceps* colonies in the Approach Zone	1,344
Density of *Acropora globiceps* colonies in the Approach Zone (colonies per square meter)	0.09
Extrapolated area (square meter) covered by *Acropora globiceps* in the Approach Zone	49.2

Notes: [1]Calculations assume that the entire susceptible area of each Approach Zone (based on depth of construction or training activity: 5 feet (1.5 meters) for small boat landings and swimmers, 12 feet (4 meters) for Amphibious Assault Vehicles) is subject to physical effects. Effects to corals/seafloor outside of these depths in each area (e.g., deep grooves) and potential effects outside of the Approach Zone are excluded from this analysis, but are considered separately as potential indirect physical effects.
[2]Includes all areas that construction will have direct physical impacts - also including temporary structures.

Due to the number of colonies that will be removed in relation to the rarity of the species, the destruction of the established colonies of *Acropora globiceps* within the construction footprint, Tinian Alternative 1 construction activities would result in significant impacts to special-status coral species.

Since there is no evidence of differential susceptibility among coral species to acoustic and indirect effects, the effects on *Acropora globiceps* are considered to be the same as were discussed previously for corals in general under *Marine Invertebrates* and would be less than significant.

Sea Turtles

The sea turtle survey conducted in support of this EIS/OEIS (DoN 2014b) confirmed the presence of sea turtles within the construction area. At the time of the survey, the density within the study area was estimated at 65 turtles per square mile (25 turtles per square kilometer), approximately one quarter the density of other areas around Tinian. Using the highest estimated density available (based on swimming transects [DoN 2014b]), this equates to an average of less than one turtle within the 10.3 acre (4.1 hectare) in-water construction footprint at any given time. However, it can reasonably be assumed that turtles move through the area and that numbers would vary from zero to several individuals. Construction impacts related to sea turtles include habitat disturbance, acoustic impacts, and physical disturbance and strike.

In-water construction of the amphibious landing area at Unai Chulu would cause temporary and permanent effects to sea turtle foraging and resting habitat within the 10.3 acre (4.1 hectare) construction footprint, and possibly a small area of degraded habitat adjacent to the construction footprint. Sea turtles could be displaced from these waters for the duration of construction activities. Coral habitat at Unai Chulu would be physically altered and permanently removed during the proposed construction activities. Sea turtles depend on this nearshore coral reef habitat for food and shelter. The loss of this coral habitat may temporarily affect sea turtles within the project footprint, as coral habitat in the surrounding areas has similar characteristics and the sea turtle population density appears low enough for relocation without overcrowding or displacement. As a result, nearshore habitat loss at Unai Chulu resulting from Tinian Alternative 1 construction activities would not be likely to impact the current population or future recovery of green and hawksbill sea turtles, and is considered a less than significant impact.

Sea turtles occurring in the shallow waters of the Unai Chulu construction area would be subject to construction noise. In most cases, during the soft start procedure, sea turtles would either surface or swim away from the noise source and therefore avoid injury before maximum noise levels are reached. Over the course of construction, sea turtles may relocate at a distance where the noise would not further affect their behavior, or individual turtles may become habituated to the noise at disturbance levels between 160-190 decibels (Moein et al. 1994). Designating a zone to where behavioral impacts can occur to 1,000 feet (309 meters) from the source noise would indicate approximately twelve turtles could be impacted from construction noise. Based on past (Kolinski et al. 2004) and recent transects (DoN 2014b), the density of sea turtles within the construction area at Unai Chulu is the lowest calculated density across the island (Kolinski et al. 2004; DoN 2014b). Sea turtles in the southern Mariana Islands, including Tinian, are locally harvested, and as a result, many have developed a conditioned response to flee or vacate an area due to the presence of people or other human disturbances. The presence of personnel, equipment and vessels in the water during construction are likely to cause a flight response in sea turtles. As such, injury and behavior impacts from pile driving or other construction noise resulting from implementation of Tinian Alternative 1 would result in less than significant impacts.

Sea turtles, especially juveniles, could be struck by construction equipment, which could cause mortality or injury. Smaller, younger turtles require refuge from predators, primarily sharks, and occupy crevices in the spur and groove coral habitat. There is a possibility that these animals could use the specific habitat within the proposed construction footprint at the time of construction. However, a direct strike would be unlikely due to the low density of turtles in the construction footprint and expected flight response from construction noise. Proper surveillance would also be implemented during construction activities to further reduce the potential for a sea turtle strike from construction equipment. Therefore, Tinian Alternative 1 construction activities would result in less than significant impacts to sea turtles.

Through the Endangered Species Act section 7 consultation process, potential effects to individual sea turtles and on the continued existence of the species would be evaluated and detailed in the Biological Assessment. Best management practices, such as implementation of a soft start during pile driving, would be implemented during construction to reduce potential impacts. Additional mitigation measures may be recommended during agency consultations.

Marine Mammals

As discussed in 3.10.4.6, *Marine Mammals,* no marine mammals were sighted in the Tinian region of influence during the *Marine Mammal Survey* conducted in support of this EIS/OEIS (DoN 2014c). However, marine mammals have been previously documented in the region of influence and may travel through the region of influence during proposed construction. Based on an analysis of the marine species surveys associated with Tinian, sightings data provided in Hill et al. (2014) shows that the marine mammal most often sighted in the nearshore environment (less than 3 nautical miles [5.6 kilometers]) was the spinner dolphin (54% of encounters). However, sightings around Tinian primarily occurred on the eastern side of the island, away from areas currently proposed for construction or operations. Ligon et al. (2011) did not sight spinner dolphins off Tinian during a survey around the island, but did report anecdotal evidence of spinner dolphins off Tinian Harbor on the southwestern coast of the island. While a lack of sightings specific to the region of influence does not preclude the species from being present, it does indicate that spinner dolphins appear to use other areas around Tinian more regularly, and would likely be transmitting through the region of influence.

Proposed construction would involve construction equipment and human activity on the beach in the shallow-water environment for approximately 36 weeks. Pile driving/extraction would occur intermittently and for relatively brief periods during daylight hours throughout this period. Since there would be considerable noise and human activity with the construction area at Unai Chulu, it is unlikely that a marine mammal would closely approach this area during construction. Best management practices, such as implementation of a soft start during pile driving, would be implemented during construction. Construction personnel would not commence pile driving if a marine mammal was observed within 300 feet (90 meters). Acoustic impacts to marine mammals would be limited to temporary physiological and behavioral effects that would be considered non-injury disturbance. For these reasons, it is assumed that construction at Unai Chulu would result in non-injurious behavioral impacts due to acoustic harassment of a relatively small numbers of cetaceans as a result of pile driving and pile removal during construction activities; however, no injury or mortality are anticipated. Any effects experienced by individual marine mammals are anticipated to be limited to short-term disturbance of normal behavior or temporary displacement of animals near the source of the noise. Appendix M, *Marine Biology Technical Memo and Survey Reports*, provides a general discussion of marine mammal hearing and communication and potential acoustic effects on marine mammal hearing, communication, and behavior. Impacts to marine mammals resulting from Tinian Alternative 1 construction activities would be limited to temporary physiological and behavioral effects and result in less than significant impacts to marine mammals.

4.10.3.1.2 Operation Impacts

As described in Chapter 2, Tactical Amphibious Beach Landings (non-live-fire) would occur on Tinian up to 20 weeks per year. Table 4.10-3 gives an overview of each operational/training activity per beach. Figures 4.10-1 to 4.10-8 show proposed amphibious training activities for the beaches on Tinian. Each pair of figures presents proposed activities for a specific beach in relation to bathymetry (Figures 4.10-3, 4.10-5, 4.10-7) and coral cover (Figures 4.10-4, 4.10-6, 4.10-8)." The number of daily landings may vary based on factors such as the training scenario and objectives, weather/sea state, and vehicle availability. In general, amphibious training on Tinian would be spread evenly throughout the 20 weeks of military training, consistent with the unit level of training emphasis, with daily variations as noted below.

Table 4.10-3. Tinian Beach Activity Overview

Beach	*Activity*
Unai Chulu	• Amphibious Assault Vehicle landings • Landing Craft Air Cushion vessel landings • Small boat landings • Swimmer insertions
Unai Babui	• Landing Craft Air Cushion vessel landings • Small boat landings • Swimmer insertions
Unai Masalok	• Landing Craft Air Cushion vessel landings • Small boat landings • Swimmer insertions
Unai Lam Lam	• Small boat landings • Swimmer insertions

Potential impacts to marine water quality as a result of land-based training activities in support of the proposed action would be limited by the best management practices described in Section 4.3, *Water Resources*, and would be less than significant.

4.10.3.1.2.1 Marine Habitat and Essential Fish Habitat

At Unai Chulu, four main activities would directly affect marine habitat as deep as 12 feet (4 meters) below mean low water: Amphibious Assault Vehicle landings, Landing Craft Air Cushion vessel landings, small boat landings, and swimmer landings. Due to the turbulent nature within this area, the mobile rubble would be distributed and transported outside of the landing zone, with the potential to cause damage to the deeper reef over time, particularly during storm events. Landings at Unai Chulu would occur within the construction footprint already accounted for (see Table 4.10-1). The additional disturbance associated with operations in the degraded footprint would be less than significant, although it would prevent the long-term recovery of the coral reef ecosystem that could eventually occur in the absence of disturbance. Indirect impacts may include future impact by mobilized rubble from training operations associated with the proposed facilities and training areas.

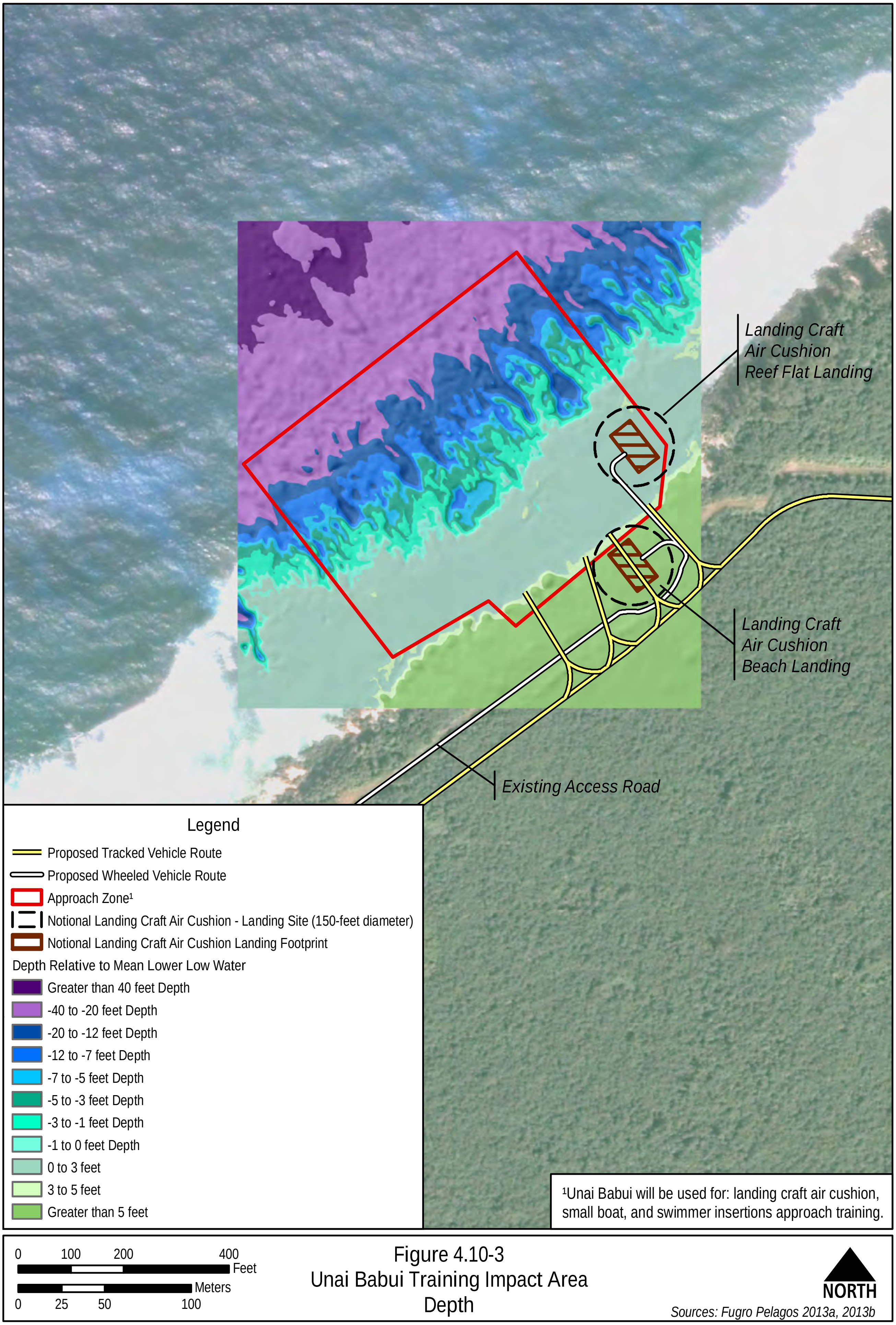


Figure 4.10-3
Unai Babui Training Impact Area
Depth

Sources: Fugro Pelagos 2013a, 2013b

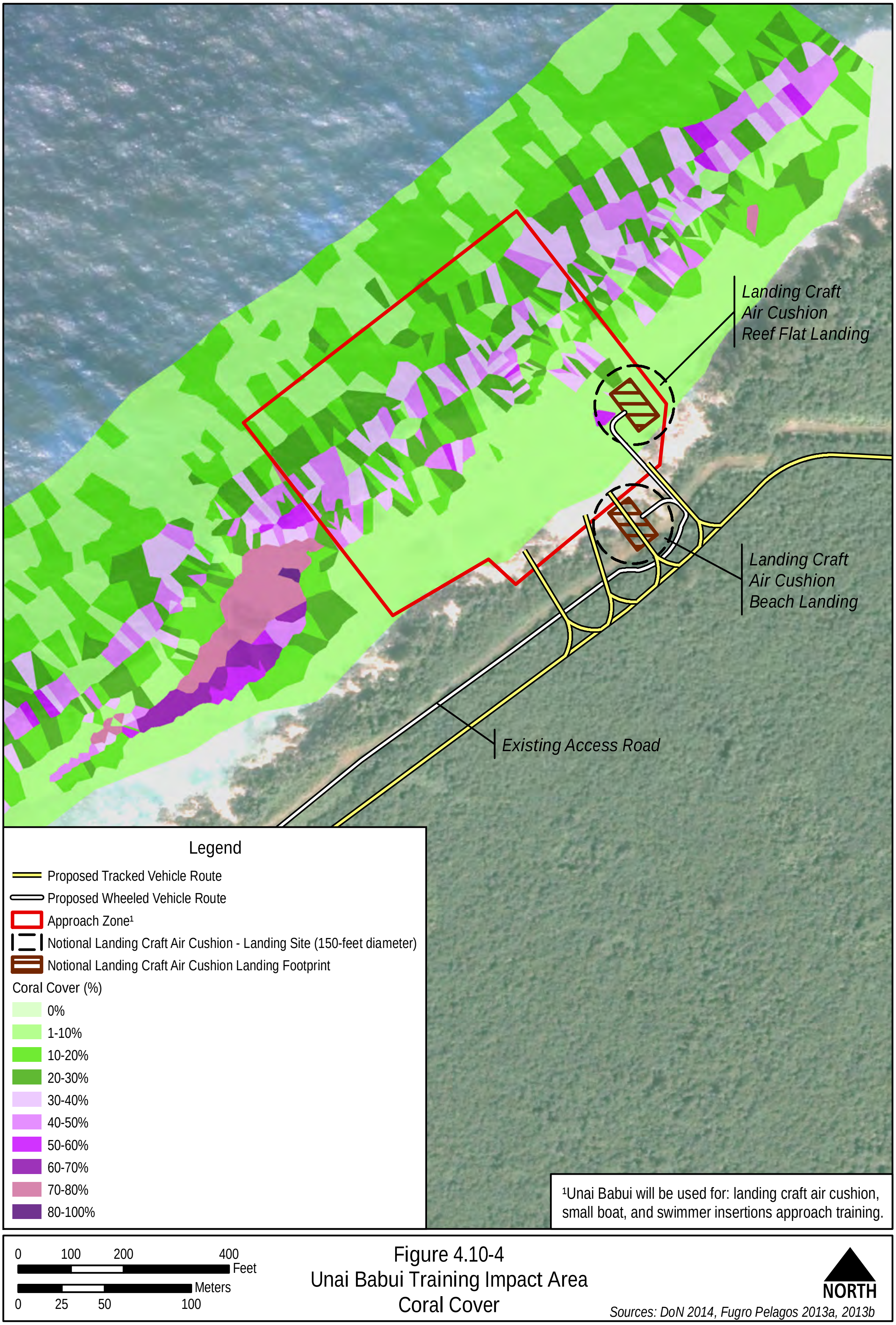


Figure 4.10-4
Unai Babui Training Impact Area
Coral Cover

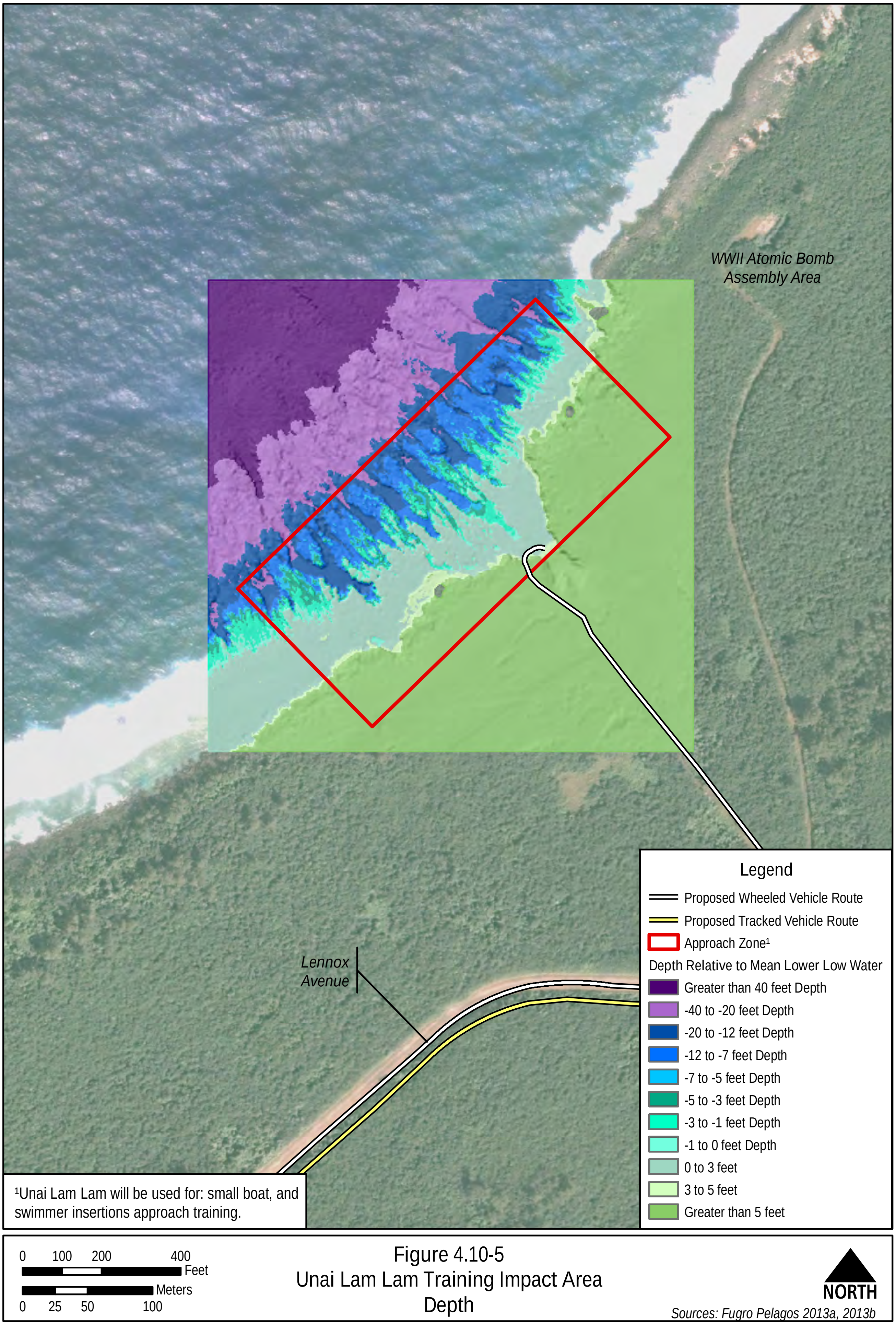


Figure 4.10-5
Unai Lam Lam Training Impact Area
Depth

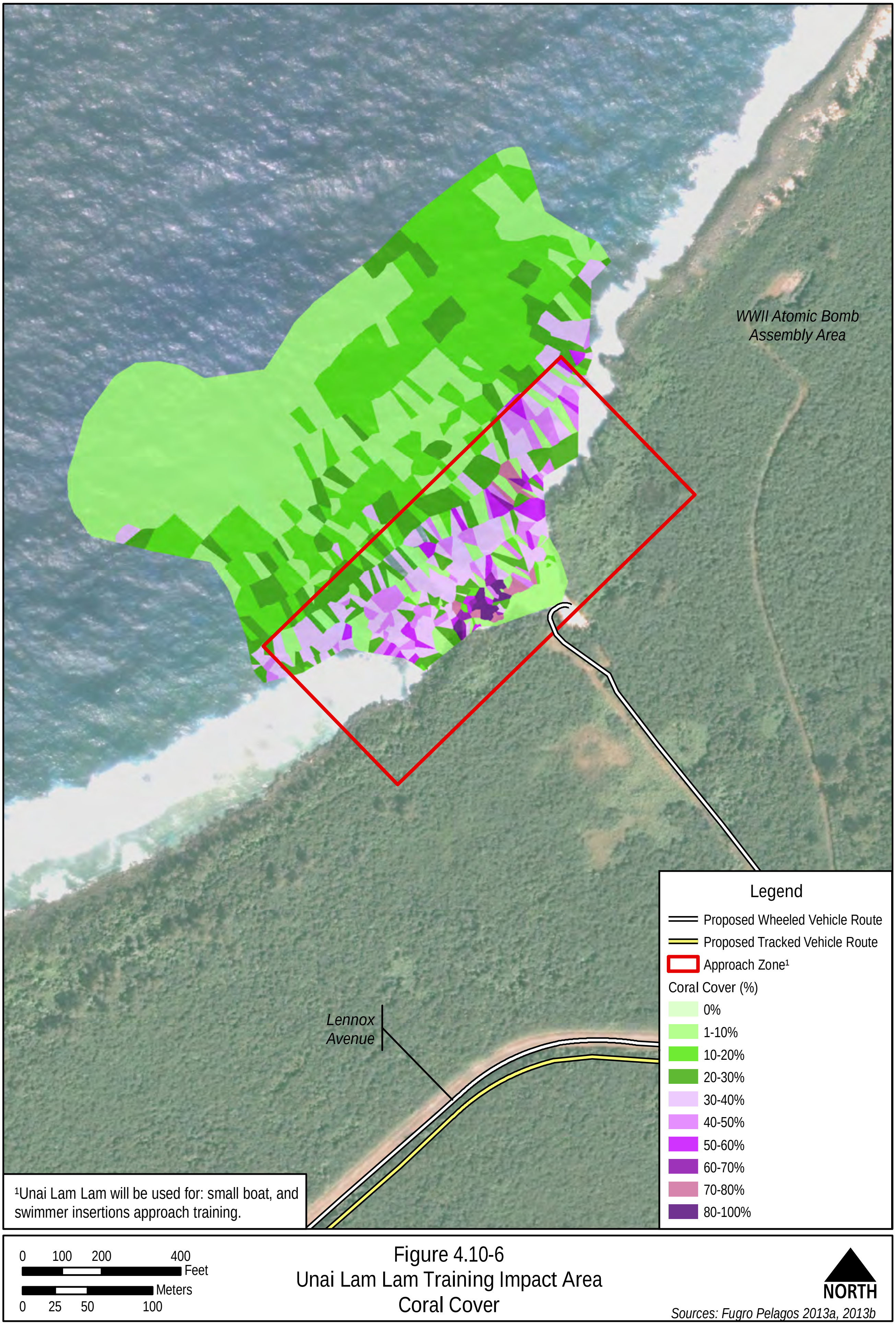


Figure 4.10-6
Unai Lam Lam Training Impact Area
Coral Cover

Sources: Fugro Pelagos 2013a, 2013b

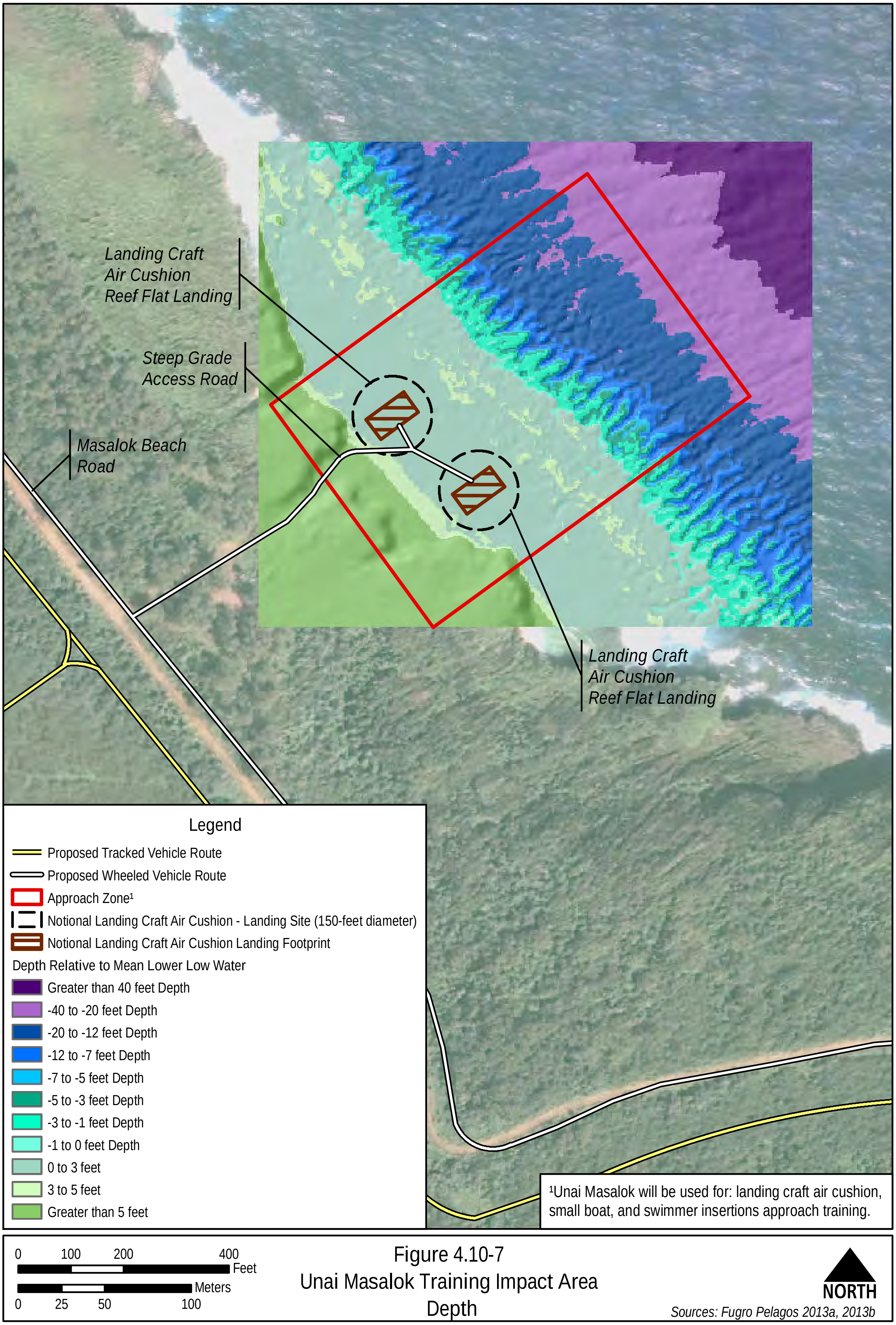


Figure 4.10-7
Unai Masalok Training Impact Area
Depth

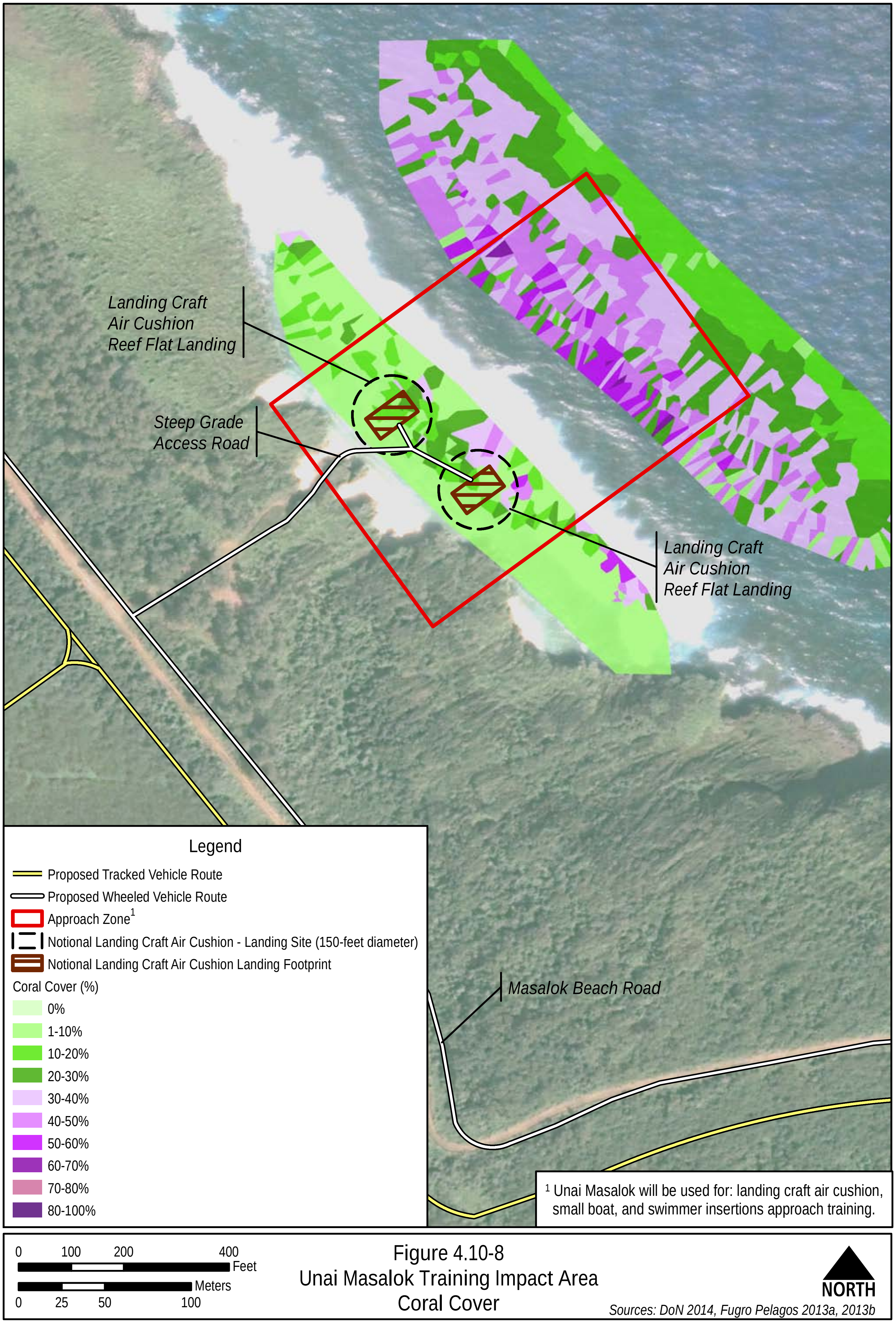


Figure 4.10-8
Unai Masalok Training Impact Area
Coral Cover

Sources: DoN 2014, Fugro Pelagos 2013a, 2013b

At Unai Babui, three training activities would directly affect marine habitat: Landing Craft Air Cushion vessels landings, small boat landings, and swimmer landings. Landing Craft Air Cushion vessels landings would affect coral colonies and coral reef habitat where habitat occurs within the set-down circle(s), which could occur anywhere along the beach at Unai Babui. Inflatable boats and swimmer landings could affect coral colonies and coral reef habitat to as deep as 5 feet (1.5 meters) below mean low water (see Figures 4.10-3 and 4.10-4). The area of reef substrate shallower than 5 feet (1.5 meters) in the landing area at Unai Babui is 3.05 acres (1.2 hectares).

At Unai Lam Lam, the two main activities with the potential to directly affect marine habitat are small boat landings and swimmer landings. Small boats and swimmer landings could affect coral colonies and coral reef habitat to as deep as 5 feet (1.5 meters) below mean low water (see Figures 4.10-5 and 4.10-6). The area of reef substrate shallower than 5 feet (1.5 meters) in the Approach Zone at Unai Lam Lam is 3.83 acres (1.54 hectares). These operational activities could affect marine habitats by disturbing or altering the seafloor, water quality, or physical environment. The primary effect would be physical strike and disturbance from equipment such as boat hulls and swimmers boots that could break or abrade corals and could create mobile rubble that is capable of being transported outside of the small boat and swimmer landing areas with the potential to cause damage to the deeper reef over time. Consequences of these potential effects would reduce the volume and complexity of Essential Fish Habitat in the affected areas. These activities would result in periodic short-term and long-term/permanent impacts to Essential Fish Habitat.

At Unai Masalok, the three main activities with the potential to directly affect marine habitat include Landing Craft Air Cushion vessels landings, small boat landings, and swimmer landings. Landing Craft Air Cushion vessels landings would affect coral colonies and marine habitat where habitat occurs within the set-down circle(s) which could occur anywhere along the beach at Unai Masalok. Inflatable boats and swimmer landings could affect coral colonies and marine habitat to as deep as 5 feet (1.5 meters) below mean low water (see Figures 4.10-7 and 4.10-8). The area of reef substrate shallower than 5 feet (1.5 meters) at Unai Masalok is 4.5 acres (1.8 hectares).

At any one time, a small fraction of the total area, corresponding to the area of disturbance by individual vehicles/vessels would be impacted. Over time, some portions would likely be used more frequently and intensively than others, but the cumulative areas disturbed would approach the acreages shown in Table 4.10-4. Operations could create sediment and mobile rubble that is capable of causing ongoing indirect effect (physical disturbance outside the amphibious landing area), both along-shore and downslope. The size of the area exposed to indirect effects of mobile rubble is conservatively estimated to be equal to the area exposed to direct effects. The shape of the indirectly affected area cannot be quantitatively estimated as there would be a gradient of disturbance within the area of indirect effect. The effects of mobilized rubble would be greater closer to the area of operation and reduced at increasing distances from operation activities based on the assumptions for rubble movement.

Consequences of these potential effects would reduce the volume and complexity of Essential Fish Habitat in the affected areas. Table 4.10-4 presents the areas of the potential direct and indirect impacts to marine habitat with implementation of the proposed action on Tinian.

Table 4.10-4. Summary of Potential Direct and Indirect Impacts to Marine Habitat on Tinian

Beach and Activity	***Area of Direct Effects (acres)***	***Area of Indirect Effects[1] (acres)***	***Total Area of Likely Direct and Indirect Effects (acres)***
Unai Chulu	10.3[2]	10.3[2]	20.6
Unai Babui	3.05	3.05	6.10
Unai Lam Lam	3.83	3.83	7.66
Unai Masalok	4.50	4.50	9.00

Note: [1]This analysis assumes the size of the area exposed to indirect effects of mobile rubble is assumed to be equal to the area exposed to direct effects.
[2]Impacts at Unai Chulu were analyzed under construction impacts; see Section 4.10.3.1.1.1, *Marine Habitat and Essential Fish Habitat*

Operational activities may impact the water quality and introduce noise in the water column within the designated Essential Fish Habitat area for pelagics, bottomfish, crustaceans, and coral reef ecosystems. Potential impacts to the water column habitat by vessel noise during the proposed operational activities would mainly include impacts to prey species, including fish and invertebrates. Vessel movements have the potential to expose fish and invertebrates to sound and general disturbance, which could result in short-term behavioral or physiological responses (e.g., avoidance, stress, increased heart rate). However, this would not be expected to compromise the general health or condition of individual fish or populations of invertebrates. Given typical underwater vessel noise of about 160 decibels at 3.3 feet (1 meter), the 150-decibel threshold for behavioral effects to fish would be exceeded within about 15 feet (4.6 meters) of the vessel. Such effects would be brief and infrequent, resulting in relatively minor, temporary effects on the quantity and quality of Essential Fish Habitat in the water column. There would be no effects on the substrate. As a result, vessel noise during operations of Tinian Alternative 1 would not have a significant impact to marine habitat or Essential Fish Habitat.

Operational activities would cause temporary water quality impacts including increased turbidity. Increases in turbidity could temporarily decrease the foraging efficiency of Essential Fish Habitat at the proposed tactical amphibious landing beaches. In sandy areas, given the dynamic nature of the habitat and the grain size of the material, turbidity is expected to be minimal and localized. Potential impacts from run-off from land-based construction could degrade water quality, particularly the construction of impervious access roads built close to the shoreline. Training activities are not expected to cause long-term erosion or to modify marine habitat outside of the footprints identified in Table 4.10-4. Impacts would be minimized to the maximum extent practicable through adherence to resources management measures.

Approximately 3.05 acres (1.2 hectares) of marine habitat, including corals and coral reef habitat would be directly impacted at Unai Babui, 3.83 acres (1.55 hectares) would be directly impacted at Unai Lam Lam, and 4.50 acres (1.82 hectares) would be directly impacted at Unai Masalok (see Table 4.10-3). As stated in Chapter 3, Table 3.10-1, 65,920 acres (26,676 hectares) of total reef habitat are present across the Mariana Islands, 5,696 acres (2,305 hectares), which is present around Tinian (Analytical Laboratories of Hawaii 2004; National Oceanic and Atmospheric Administration, National Centers for Coastal Ocean Science 2005; Bearden et al. 2008; Riegl and Dodge 2008; Brainard et al. 2011). Based on the sum of the area shallow enough to be affected by the in-water training activities at Unai Babui, Unai Lam Lam, and Unai Masalok (as deep as 5 feet [1.5 meters]), Tinian Alternative 1 operations would directly and indirectly impact approximately 0.44% of total reef habitat from Tinian during operations. It is expected the permanent loss of 0.34% of the Tinian reef habitat within and adjacent to the construction area at Unai Chulu and the additional disturbance associated with operations would prevent the long-term recovery of the coral reef ecosystem that could eventually occur in the absence of disturbance. Total reef habitat around Tinian, which may include marine flora habitat or potential habitat, totals 5,696 acres (2,305 hectares). Based on the low percentage of marine habitat loss in comparison to the total available marine habitat around Tinian, Tinian Alternative 1 operations would result in less than significant impacts to marine habitat and Essential Fish Habitat.

4.10.3.1.2.2 Marine Flora

The actions that could potentially impact marine flora during operation include in-water training, landings of Amphibious Assault Vehicles, Landing Craft Air Cushion vessels and small inflatable boats, and operation of vessels in nearshore waters. Marine flora that could be impacted from training activities would be reef substrate shallower than 12 feet (4 meters) below mean low water. Vessels conducting or supporting training could impact marine flora by disturbing the bottom and swimmers could impact marine flora through disturbance of the nearshore environment. Small boats and swimmer landings could affect marine flora to as deep as 5 feet (1.5 meters) below mean low water.

Operational impacts would be periodic. Marine flora already impacted during construction at Unai Chulu would continue to be impacted during operation. With recurring operations and disturbance of the substrate, limited regrowth of marine flora would occur following construction activities, and it would then be directly impacted from vessels or swimmers disturbing or uprooting any marine flora habitat shallower than 12 feet (4 meters).

Marine flora habitat would not be directly removed at Unai Babui, Unai Lam Lam, or Unai Masalok as a result of Tinian Alternative 1, but habitat may be disturbed during training activities. As described in Section 3.10, *Marine Biology*, marine flora is abundant in Tinian waters as Tinian has one of the highest mean macroalgal covers of all the islands in the Marianas Archipelago (Brainard 2012).

As stated in Chapter 3, total reef habitat around Tinian, which may include marine flora habitat or potential habitat, totals 5,696 acres (2,305 hectares) (Analytical Laboratories of Hawaii 2004; National Oceanic and Atmospheric Administration, National Centers for Coastal Ocean Science 2005; Bearden et al. 2008; Riegl and Dodge 2008; Brainard et al. 2011). The total area potentially disturbed at these three beaches during training activities is equal to 0.44% of the total reef habitat area. It is expected the permanent loss of 0.34% of the Tinian reef habitat within and adjacent to the construction area at Unai Chulu and the additional disturbance associated with operations would prevent the long-term recovery of the marine flora that could eventually occur in the absence of disturbance. Marine flora is plentiful at various locations and depths around the training area and across Tinian nearshore waters and there are no known special-status species. As a result, Tinian Alternative 1 operations would result in less than significant impacts to marine flora.

4.10.3.1.2.3 Marine Invertebrates

Landings at Unai Chulu would occur within the construction footprint already accounted for (see Table 4.10-1). The reefs at Unai Babui, Unai Lam Lam, and Unai Masalok show moderate to high topographic complexity and moderate (Unai Babui and Unai Lam Lam) to high (Unai Masalok) coral cover with little sand. The reef flat at Unai Lam Lam is rich with high coral cover (90%), whereas the reef flat on Unai Masalok has low coral cover (DoN 2014a). Swimmers and small boats transitioning through the reef flat at Unai Lam Lam are expected to impact corals, and it is assumed that those corals would be permanently impacted or destroyed. Landing Craft Air Cushion vessels landings, small boat landings, and swimmer landing would occur at Unai Masalok and would also result in loss of existing corals, but the limited density of corals would limit the total amount of coral loss. Non-coral invertebrate communities dominated by tube worms, sea urchins, and sea cucumbers (Minton et al. 2009), would also be impacted to the extent that the coral habitat is degraded, although sea cucumbers would be less affected because they burrow and feed on detritus in the sediments rather than living on the reef.

It is expected the permanent loss of 0.34% of the Tinian reef habitat within and adjacent to the construction area at Unai Chulu and the additional disturbance associated with operations would prevent the long-term recovery of the coral reef ecosystem that could eventually occur in the absence of disturbance. As describe in *Marine Habitat and Essential Fish Habitat*, training activities at Unai Babui, Unai Lam Lam, and Unai Masalok (as deep as 5 feet [1.5 meters]) would directly and indirectly impact an additional 0.44% of total reef habitat at these three beaches on Tinian. Based on the low percentage of marine habitat loss in comparison to the total available marine habitat available to support marine invertebrates around Tinian, Tinian Alternative 1 operations would result in less than significant to marine invertebrates.

4.10.3.1.2.4 Fish

Actions that could potentially impact fish during proposed operations include landings of Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, and small inflatable boats. Fish may be temporarily displaced for the duration of training activities at these beaches. The coral section above details the loss of coral habitat that would occur during training activities. Coral impacts would directly and indirectly impact fish, as many fish species depend on this coral habitat for shelter, feeding, and reproduction. The overall impact to reef-associated fish populations on Tinian would be roughly proportional to the area of impact by the in-water training activities at Unai Chulu, Unai Babui, Unai Lam Lam, and Unai Masalok.

In-air noise has no potential to affect fish. As described previously (Section 4.10.3.1.2.1, *Marine Habitat and Essential Fish Habitat*) the underwater noise from vessels engaged in training would be brief, infrequent, and would not exceed levels likely to cause behavioral reactions in fish more than about 15 feet (4.6 meters) from the vessel. As a result, no significant impacts would result from underwater noise during operations. In addition, the potential for direct strikes to fish as a result of the proposed training is low as the noise and presence of vessels would likely cause fish to temporarily flee the area, and the resulting impact would be less than significant.

Tinian operation activities could cause temporary water quality impacts including increased turbidity, erosion, and sediment transport. Increases in turbidity could temporarily decrease the foraging efficiency of fish. In sandy areas, given the dynamic nature of the habitat and the grain size of the material, turbidity is expected to be minimal and localized. Potential impacts from run-off from land-based operational activity, such as the landing of amphibious and small craft vehicles on beaches, could degrade water quality; however, any impacts would be localized, temporary in nature and be limited to training periods.

The use of beaches on Tinian for training operations would impact reef habitat through recurring disturbance and the resulting degradation of habitat. It is expected the permanent loss of 0.34% of the Tinian reef habitat within and adjacent to the construction area at Unai Chulu and the additional disturbance associated with operations would prevent the long-term recovery of the marine habitat that could eventually occur in the absence of disturbance. As described in *Marine Habitat and Essential Fish Habitat*, training activities at Unai Babui, Unai Lam Lam, and Unai Masalok (as deep as 5 feet [1.5 meters]) would directly and indirectly impact an additional 0.44% of total reef habitat at these three beaches on Tinian. Based on the low percentage of fish habitat loss in comparison to the total available marine habitat available to support fish around Tinian, Tinian Alternative 1 operations would result in less than significant to fish.

4.10.3.1.2.5 Special-status Species

Corals

The *Coral Marine Resource Survey* (provided in Appendix M, *Marine Biology Technical Memo and Survey Reports*) conducted in support of this EIS/OEIS recorded the presence of one Endangered Species Act-listed coral species, *Acropora globiceps*, at each beach (DoN 2014a). The three other Endangered Species Act-listed coral species discussed in Chapter 3 are not known to occur, and would be unlikely to occur, in appreciable numbers or areas within the training area footprints. Therefore, impacts to these other coral species are unlikely and considered less than significant.

Table 4.10-5 describes the impacts to *Acropora globiceps* in the Approach Zone at Unai Chulu, Unai Babui, Unai Masalok and Unai Lam Lam during operation/training activities. Vessels have the potential to impact marine species by disturbing the water column. Wash from vessel movement (water displaced by propellers/impellers used for propulsion) and water displaced from vessel hulls can potentially impact eggs and pelagic larvae of Endangered Species Act-listed corals (Bishop 2008; Bickel et al. 2011; Marshall 2012). Amphibious craft may affect the water column to a depth of approximately 12 feet (4 meters). Disturbance caused by propeller wash could extend to approximately twice this depth.

Table 4.10-5. Potential Impacts to Acropora globiceps at Unai Chulu, Unai Babui, Unai Masalok, and Unai Lam Lam During Operation/Training Activities[1]

	Unai Chulu[2]	***Unai Babui[3]***	***Unai Lam Lam[4]***	***Unai Masalok[3]***
Total extrapolated *Acropora globiceps* coral area (square feet) in the Approach Zone[5]	388	187.4	107.4	1.9
Extrapolated number of *Acropora globiceps* colonies in the Approach Zone	995	381	550	22
Density of *Acropora globiceps* colonies in the Approach Zone (per square meter)	0.09	0.06	0.04	< 0.005
Extrapolated area (square meter) covered by *Acropora globiceps* in the Approach Zone	36.1	17.4	10.0	0.2

Notes: [1]Calculations assume that the entire susceptible area of each Approach Zone (based on depth of construction or training activity: 5 feet (1.5 meters) for small boat landings and swimmers, 12 feet (4 meters) for Amphibious Assault Vehicles) is subject to physical effects. Effects to corals/seafloor outside of these depths in each area (e.g., deep grooves) and potential effects outside of the Approach Zone are excluded from this analysis, but are considered separately as potential indirect physical effects.
[2]Excludes entire Unai Chulu construction area to prevent double-counting.
[3]No Amphibious Assault Vehicles at Unai Babui or Unai Masalok. Calculation includes swimmers, small boat landings, and Landing Craft Air Cushion vessels set-down/turning circles.
[4]No Amphibious Assault Vehicles or Landing Craft Air Cushion vessels at Unai Lam Lam. Calculation includes swimmers and small boat landings.
[5]Species presence is based on recent high-intensity surveys of the Approach Zone (Minton et al. 2009; Sukhraj et al. 2010; DoN 2014d). Quantitative estimates of the numbers of Endangered Species Act-listed coral species are based on the most recent high-intensity survey (DoN 2014d). Calculations are based on in situ data that intersects with the proposed action areas to develop quantitative extrapolations for each reef zone. The values in the table are weighted sums.

Landing activities that contact the seafloor during operation include Amphibious Assault Vehicles, Landing Craft Air Cushion vessels and small boat landings. At the level of the individual coral, the consequences of physical strike by heavy equipment would be functionally equivalent to the consequences of physical strike by a swimmer's boot. However, at the level of coral reef habitat, the consequences of physical strike by an Amphibious Assault Vehicle would be greater than Landing Craft Air Cushion vessels, small boat, and swimmer landings because of the increased potential to reduce larger corals and reef substrate to smaller pieces of mobile rubble. In reef habitats, mobile fragments are transported up and down slope with greater amplitude than when they are transported laterally (Allingham and Neil 1995; Erftemeijer et al. 2012). Rubble mobilized from inside the area of direct physical impact would be transported outside the area of direct impact (Allingham and Neil 1995; Chew III 1999). The consequences of physical strike by an Amphibious Assault Vehicle would be greater in magnitude than the consequences of physical strike by rubble.

Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, and small boat landing activities all would generate underwater sound during Tinian operations. Although vessel noise could theoretically mask natural reef sounds that coral larvae use as settlement cues (Vermeij et al. 2010; Simpson et al. 2011), this would occur briefly, infrequently, and on a small scale. Therefore, noise impacts associated with Tinian Alternative 1 operations are not expected to impact *Acropora globiceps*.

However, in combination with the impact to *Acropora globiceps* from construction at Unai Chulu, the impact of physical disturbance on this species resulting from Tinian Alternative 1 operations would result in significant impacts to this species.

Sea Turtles

Training activities could cause sea turtles to avoid habitat or cause habitat to be unavailable since turtles may be temporarily displaced for the duration of training activities during operational activities. This would directly impact the local sea turtle population, as they depend on algae, sponges, and hiding locations on the reef for survival. In-water habitat disturbance during operations would be caused by Amphibious Assault Vehicles (at Unai Chulu) and Landing Craft Air Cushion vessels, which may contact the reef or otherwise alter the nearshore habitat. The regrowth of marine flora at Unai Chulu would be disrupted by periodic training activities, thus sea turtles would be disturbed or limited from foraging or resting in the low-relief habitat during training. As such, habitat disturbance from activities associated with Tinian Alternative 1 operations would have limited impacts to sea turtles. See Section 4.9, *Terrestrial Biology*, for potential impacts to nesting sea turtles.

Sea turtles cannot hear high frequency noises and have the greatest sensitivity between 200 to 400 hertz (Ridgway et al. 1969; Bartol and Ketten 2006). As sea turtles generally cannot hear well in air (Lenhardt et al. 1983), in-air noise is unlikely to cause any behavioral modification. Vessel noise could disturb sea turtles and potentially elicit an alerting, avoidance, or other behavioral reaction. Sea turtles are frequently exposed to research, ecotourism, commercial, government, and private vessel traffic. Some sea turtles may have habituated to vessel noise, and may be more likely to respond to the sight of a vessel rather than the noise of a vessel, although both may play a role in prompting reactions (Hazel et al. 2007). Any reactions are likely to be minor and short-term avoidance reactions, leading to no long-term consequences for the individual or population. Such disturbances would be brief, infrequent, and relatively isolated, affecting a small number of individuals at any one time, based on the size of the vessels (a small portion of the Approach Zone would be impacted at any one time) and turtle densities described in Section 3.10, *Marine Biology*. As such, acoustic disturbance by vessels resulting from Tinian Alternative 1 operations is considered less than significant.

Research suggests that sea turtles may not react quickly enough to move out of the way of vessels going faster than about 2.2 knots (4.0 kilometers per hour) (Hazel et al. 2007). Accordingly, there would be a risk of vessel strikes for turtles within the approach zones. The likelihood of vessel strikes to sea turtles is considered low given relatively few sea turtles in the approach zones and infrequent and localized vessel activity within these zones. While the risk would be low, some mortality due to vessel strikes cannot be ruled out and should be anticipated. Given the dynamic wave environment, increased turbidity and sedimentation would be temporary effects and unlikely to have any lasting impact to photosynthesis and food supply.

Overall, training activities may impact a small number of sea turtles due to the unavoidable risk of vessel strikes; however, this would be minimized due to the relatively few sea turtles in the approach zones and infrequent and localized vessel activity within these zones. Therefore, Tinian Alternative 1 operations would have a less than significant impact to sea turtle populations.

Marine Mammals

Vessel noise has the potential to cause minor disturbance to marine mammals and elicit an alerting, avoidance, or other behavioral reaction. Most studies have reported that marine mammals react to vessel noise and traffic with short-term interruption of behavior or social interactions (Watkins 1981; Richardson et al. 1995; Magalhaes et al. 2002; Noren et al. 2009). Some species respond negatively by retreating or responding to the vessel aggressively, while other animals ignore vessel noises altogether (Watkins 1986).

In conventional vessels, the sounds of the engine, transmission, and drive shaft(s) are conducted through the hull and into the water. When small, fast vessels are operated at high speeds, considerably less hull is exposed to the water, thus less sound is transmitted into the water. When a vessel planes above the water surface air is sucked under the hull as it travels. These bubbles of air, as well as the flow of water under the hull, produce some noise but also attenuate and scatter sounds for the engine. The bubbles of the wake also mask, scatter, and absorb sounds. When the Amphibious Assault Vehicles would be launched, they begin maneuvering in the idle mode, using jets only. Once they reach high speeds, planing above the water surface, a matter of seconds, the sound level drops off rapidly. When traveling, the sound increases as the Amphibious Assault Vehicle approaches, then falls off after it passes, like any moving sound source.

Given low densities of marine mammals in the surrounding waters (Section 3.10, *Marine Biology*), and the infrequent, localized occurrence of training activities, disturbance by vessels would be less than significant. Sightings data presented in Hill et al. (2014) shows that the spinner dolphin was the most often seen marine mammal species in the nearshore environment, with 54% of all encounters including sightings of the species. While Ligon et al. (2011) did not observe spinner dolphins during a concerted survey around Tinian; they did report anecdotal evidence of spinner dolphins off Tinian Harbor.

However, while this species was the most often sighted species by Hill et al. (2014), the locations of sightings indicated a greater presence in areas not associated with the region of influence. Based on these data, spinner dolphins that would be exposed to vessel traffic during operations would likely be transmitting through the region of influence, and their exposure would result in less than significant impacts. While other marine mammal species are present in the region of influence, their densities are lower than spinner dolphins, and impacts would be expected to be less than that for spinner dolphins. Furthermore, there are no known vessel strikes to marine mammals attributed to or by the U.S. Navy or U.S. Coast Guard vessels or amphibious vehicles in the region of influence or for Department of Defense amphibious vehicles at other training locations. Along with exposure to vessel traffic, marine mammals may detect and react to aircraft, but no more than momentary reactions would be anticipated, with negligible impacts to important behaviors.

In conclusion, Tinian Alternative 1 operations would result in less than significant impacts to marine mammals.

4.10.3.2 Tinian Alternative 2

4.10.3.2.1 Construction Impacts

The impacts to marine biological resources from construction activities associated with Tinian Alternative 2 would be the same as those described for Tinian Alternative 1. See Section 4.10.3.1, *Tinian Alternative 1*, for a discussion of impacts.

4.10.3.2.2 Operation Impacts

The impacts to marine biological resources from operational activities associated with Tinian Alternative 2 would be the same as those described for Tinian Alternative 1. See Section 4.10.3.1, *Tinian Alternative 1*, for a discussion of impacts.

4.10.3.3 Tinian Alternative 3

4.10.3.3.1 Construction Impacts

The impacts to marine biological resources from construction activities associated with Tinian Alternative 3 would be the same as those described for Tinian Alternative 1. See Section 4.10.3.1, *Tinian Alternative 1*, for a discussion of impacts.

4.10.3.3.2 Operation Impacts

The impacts to marine biological resources from operational activities associated with Tinian Alternative 2 would be the same as those described for Tinian Alternative 1. See Section 4.10.3.1, *Tinian Alternative 1*, for a discussion of impacts.

4.10.3.4 Tinian No-Action Alternative

The periodic non-live-fire military training exercises that have and would continue to occur in the Military Lease Area on Tinian would be primarily land based and not involve substantial activities in the nearshore marine environment. Vessel traffic would also carry some troops and equipment to Tinian causing minor turbidity from prop wash and other vessel actions. Additionally, activities covered in the Guam and CNMI Military Relocation EIS (DoN 2010a) and associated with constructing and operating four live-fire training ranges on Tinian would have less than significant impacts to marine biology (see Table 11.2-5, DoN 2010a). No significant impacts to marine biology would occur due to Mariana Islands Range Complex operations (see Table 3.7-21; DoN 2010b). Therefore, the no-action alternative would result in less than significant impacts to marine resources around Tinian.

4.10.3.5 Summary of Impacts for Tinian Alternatives

Table 4.10-6 provides a comparison of the potential impacts to marine biological resources for the three Tinian alternatives and the no-action alternative.

Table 4.10-6. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Marine Biology	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Marine Habitat/Essential Fish Habitat (Coral Reef)	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Marine Flora	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Invertebrates (Coral)	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Marine Invertebrates (Non-coral)	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Fish	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Special-status Corals	*SI*	*SI*	*SI*	*SI*	*SI*	*SI*	*LSI*	*LSI*
Sea Turtles	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Mammals	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*

Legend: *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.10.3.6 Summary of Potential Mitigation Measures for Tinian Alternatives

Unlike resource management measures, which are implemented as part of the proposed action, commitment to the mitigation measures would be documented through the Record of Decision, a permit/approval, programmatic agreement or other formal agreement. Department of Defense may implement the following mitigation measures specifically for marine biological resources. Table 4.10-7 summarizes these measures.

Table 4.10-7. Summary of Potential Mitigation Measures for Tinian Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*Tinian Phase*	
			Construction	*Operation*
Marine Habitat and Essential Fish Habitat • Construction of underwater landing areas for Amphibious Assault Vehicles at Unai Chulu would result in the loss of 20.6 acres (8.3 hectares) of marine habitat within these areas impacted by direct and indirect physical disturbance stressors at Unai Chulu. • Construction would cause short- and long-term impacts to ecological function, including abundance/distribution of marine organisms. • Construction would result in loss/alteration of hard-bottom habitat and bathymetry.	*SI*	• DoD may consider transplantation of coral species. • DoD may consider debris removal and disposal as a one-time effort to collect large quantities of debris from an area such as Dankulo Beach on Tinian. • DoD may consider recreational mooring Buoys and/or Fish Aggregation Devices to avoid impacts to coral by dropping anchors and to reduce the potential effects on access to fishing areas. • Implementation of Marine Species Awareness Training for all lookouts and other key personnel. • Additional measures may be recommended during agency consultations.	X	X
Marine Invertebrates • A total area of 20.6 acres (8.3 hectares) of marine habitat that includes coral reef substrate (coral colonies and coral reef habitat) and supports populations of non-coral invertebrates would be directly and indirectly impacted by the construction of the Amphibious Assault Vehicle landing area at Unai Chulu. Adjacent corals outside the Amphibious Assault Vehicles landing areas may be indirectly impacted from the construction activities due to movement of coral	*SI*	See above, *Potential Mitigation Projects to Offset Impacts to Coral.*	X	X

Table 4.10-7. Summary of Potential Mitigation Measures for Tinian Alternatives

Impacts	***Category***	***Potential Mitigation Measures***	***Tinian Phase***	
			Construction	***Operation***
rubble, and from the movement of mobile species out of the construction area. Construction would cause direct loss of coral reef substrate: 10.3 acres (4.1 hectares). • Amphibious training activities at Unai Babui would directly impact 3.05 acres (1.2 hectares), 3.83 acres (1.55 hectares) would be directly impacted at Unai Lam Lam, and 4.50 acres (1.82 hectares) of marine habitat, including corals and coral reef habitat, would be directly impacted at Unai Masalok.				
Special-status Coral Species • Construction of the Amphibious Assault Vehicle landing area would cause a loss of 1,344 *Acropora globiceps* coral colonies at Unai Chulu. • At Unai Chulu, an estimate of 995 colonies of *Acropora globiceps* would be likely to be directly affected by training activities. At Unai Babui, an estimate of 381 colonies of *Acropora globiceps* would be likely to be directly affected by amphibious landings; at Unai Lam Lam, an estimate of 550 colonies of *Acropora globiceps* would likely be directly affected by amphibious landings; and at Unai Masalok, an estimate of 22 colonies of *Acropora globiceps* would likely be directly affected by amphibious landings.	*SI*	See above, *Potential Mitigation Projects to Offset Impacts to Coral.*	X	X

Legend: *SI* = significant impact. Shading is used to highlight the significant impacts.
Note: Mitigation measures associated with marine biology do not alter the significance of the impacts.

4.10.4 Pagan

As described in Chapter 2, up to six beaches would be used to conduct amphibious landings including Green, Red, Blue, South, Gold, and North Beach. No in-water construction activities would occur at proposed amphibious landing beaches. Table 4.10-8 provides a summary of the proposed training activities on Pagan.

Table 4.10-8. Pagan Beach Activity Overview

Beach	***Activity***
Green Beach	• Amphibious Assault Vehicle landings • Landing Craft Air Cushion vessel landings • Small boat landings • Swimmer insertions
Red Beach	• Amphibious Assault Vehicle landings • Landing Craft Air Cushion vessel landings • Small boat landings • Swimmer insertions
Blue Beach	• Amphibious Assault Vehicle landings • Landing Craft Air Cushion vessel landings • Small boat landings • Swimmer insertions
South Beach	• Landing Craft Air Cushion vessel landings • Small boat landings • Swimmer insertions
Gold Beach	• Small boat landings • Swimmer insertions
North Beach	• Small boat landings • Swimmer insertions

The operational activities associated with the Pagan Alternatives may result in impacts to marine resources at Green, Red, Blue, South, Gold, and North Beach. Sources of potential impact vary in intensity, frequency, duration, and location within the region of influence and would include: physical disturbance and vessel strikes, acoustic, and indirect impacts.

The approach to analysis for Pagan follows the methodology described in Section 4.10.1, *Approach to Analysis.* Section 4.10.2, *Resource Management Measures*, also applies to Pagan.

4.10.4.1 Pagan Alternative 1

4.10.4.1.1 Construction Impacts

No in-water construction is proposed under Pagan Alternative 1. The amphibious landing areas would not include any construction improvements (i.e., grading, drainage, or permanent improvements). Potential short-term impacts related to land-based construction include erosion, sedimentation, turbidity, and decreased water clarity. Storage and maintenance of construction equipment and supplies is anticipated to occur away from nearshore waters to reduce potential for impacts. In addition, best management practices including silt fence, turbidity barriers, tracking pads, filter strips, and other forms of temporary erosion/sedimentation control would be utilized to minimize impacts to nearshore waters resulting from construction activities. Based upon the above analysis and the implementation of resource management measures, Pagan Alternative 1 construction activities would result in less than significant impacts to marine biological resources.

4.10.4.1.2 Operation Impacts

Vessel-to-shore firing would occur in Pagan waters during live-fire amphibious training. As vessels (e.g., Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, and inflatable boat landings) come ashore, personnel would fire at targets on land. These vessels would use the same Approach Zones as non-live-fire activities. There would be a small chance (a tiny fraction of a percent) that an expended projectile would fall outside of the immediate range footprint, within the surface danger zone. There would be an even smaller chance for an expended projectile to fall within the nearshore waters portion or the fringes of the surface danger zone.

The landing of amphibious and small craft vehicles on beaches, beach and amphibious training maneuvers, and the use of Amphibious Assault Vehicles could impact nearshore water quality. Potential impacts include erosion, sedimentation, turbidity, decreased water clarity, and accidental discharge of pollutants. Stormwater runoff from High Hazard Impact Areas could also transport munitions constituents to nearshore waters resulting in indirect water quality impacts. Targets in the northern High Hazard Impact Area and most of the isthmus High Hazard Impact Area would be placed away from coastal cliff lines on relatively flat terrain that is visible from the firing positions. However, proposed targets on the steep slopes along the isthmus High Hazard Impact Area are close enough to the coast that dislodged rock, soil, or target material could fall into the nearshore waters below.

Potential indirect impacts would be reduced through the implementation of a stormwater management system, which would include the use of integrated management practices (Low Impact Development/best management practices), for the proposed development. The post-development stormwater management system for Pagan Alternative 1 would be developed, and Low Impact Development features would be utilized to control stormwater runoff from the Pagan RTA. Best management practices could include filter strips, bio-retention, vegetated swales and other forms of permanent erosion/sedimentation control and management measures. Implementation of a Range Environmental Vulnerability Assessment program would reduce potential impacts to water quality. Reevaluation of the effectiveness of management techniques being used would occur at a minimum every 5 years. Munitions and explosives constituents from munitions expended on land and the impacts to surface water runoff into the ocean are discussed in Section 4.3, *Water Resources*, and Section 4.16, *Hazardous Materials and Waste*.

4.10.4.1.2.1 Marine Habitat and Essential Fish Habitat

Table 4.10-9 presents the potential impacts to marine communities with implementation of the proposed action on Pagan. In addition to direct impacts, there are also potential indirect impacts associated with the proposed facilities and training areas.

Table 4.10-9. Summary of Potential Direct and Indirect Impacts to Marine Habitat on Pagan

Beach	*Area of Direct Effects (acres)*	*Area of Indirect Effects (acres)*	*Total Area of Likely Direct and Indirect Effects (acres)*
Green Beach Landings	10.98	*	10.98
Red Beach Landings	6.56	*	6.56
Blue Beach Landings	19.10	*	19.10
South Beach Landings	36.18	36.18 (**)	72.35
Gold Beach Landings	2.11	2.11 (**)	4.22
North Beach Landings	4.03	4.03 (**)	8.06

Note: * Mobile rubble would not be generated at these beaches and indirect effects would be limited to temporary increases in suspended sediments
**This analysis assumes mobile rubble would be generated at South, Gold, and North Beach. The size of the area exposed to indirect effects of mobile rubble generated by operations is conservatively estimated to be equal to the area of reef that would be exposed to direct effects.

The marine habitat at Green, Red, and Blue Beach consists of unconsolidated sediment (sand). Mobile rubble would not be generated at these beaches and indirect effects would be limited to temporary increases in suspended sediments in the water column rather than an increase in the acreage of impact.

The marine habitat at South, Gold, and North Beach is different in character (as described in Chapter 3) and mobile rubble could be generated during operation/training activities. When mobilized by water motion, any mobile rubble can strike or smother corals and degrade coral habitat. In this context, mobilized rubble includes living and dead coral colonies that are broken off of the substrate and reduced to a size that can be mobilized by water motion; reef substrate itself that is broken off; and preexisting unattached fragments.

This analysis makes reasonable qualitative assumptions about the movement of mobile rubble including: smaller fragments would be likely transported farther than larger fragments; both upslope and downslope transport would occur but net transport downslope would be likely; transport alongshore would occur but this would likely be smaller than downslope transport; flats and topographic lows (grooves in the coral reef) would be more likely to be affected than topographic highs; the likelihood of an unattached fragment becoming mobilized would be a function of its density, shape, water depth, and intensity of the water motion. The size of the area exposed to indirect effects of mobile rubble (outside of the direct physical disturbance from training) is conservatively estimated to be equal to the area exposed to direct effects. The shape of the indirectly affected area cannot be quantitatively estimated. There would be a gradient of disturbance within the area of indirect effect. The effects of mobilized rubble would be greater closer to locations where vehicles and personnel contact the bottom and reduced at increasing distances from the location of direct impacts based on the assumptions for rubble movement.

Operation and training activities would result in minor short- and long-term impacts to Marine Habitat and Essential Fish Habitat. A small portion of the entire landing area would be subject to impact during a given exercise. The physical disturbance impact would be limited to the immediate area of the vessels, and if landings are conducted in different parts of the beach at different times, areas of previous disturbance would recover to varying degrees. Recurring disturbance in the same locations would result in more severe impacts but within smaller areas. Thus the acreages in Table 4.10-9 represent the maximum cumulative extent of physical disturbance to marine habitats over time.

Operational activities may impact the water quality and introduce noise in the water column within the designated Essential Fish Habitat area for pelagics, bottomfish, crustaceans, and coral reef ecosystems. Potential impacts to the water column habitat by vessel noise during the proposed operational activities would mainly include impacts to prey species, including fish and invertebrates. Vessel movements have the potential to expose fish and invertebrates to sound and general disturbance, which could result in short-term behavioral or physiological responses (e.g., avoidance, stress, increased heart rate) by fish that happen to be in close proximity to training. The effects would not be expected to compromise the general health or condition of individual fish or populations of invertebrates. It is expected that during training, fish would move away from the area of activity into sheltered or adjacent Essential Fish Habitat. Fish within Essential Fish Habitat may be affected by auditory masking or behavioral responses to vessel noise during operations, but these impacts to individuals would be temporary and occasional. As a result, vessel noise during operations would result in less than significant impacts to marine habitat or Essential Fish Habitat from implementation of Pagan Alternative 1.

Additional acoustic elements for combined level training on Pagan include weapons firing that would occur during amphibious training. Noise-generating activities would include live-firing, explosions within High Hazard Impact Areas, aircraft, land-based vehicles, and other ground-based acoustic sources. There would be land-based target areas inside of the High Hazard Impact Area(s) for high explosives. Small caliber weapons would fire at the Battle Sight Zero range and during live-fire amphibious beach training, less than 50-caliber munitions would be shot from amphibious craft at nearshore targets at Red, Blue, and Green Beach. Exposure of fish to noise generated from these activities would be negligible due to the distance of many of these operations from marine habitats and the limited transmission of airborne sound across the air-water boundary (Young 1973).

Increases in turbidity could occur at the proposed tactical amphibious landing beaches. However, given the dynamic nature of the habitat and the grain size of the material, turbidity would be expected to be minimal and localized. Potential impacts to water quality characteristics of the marine environment during coastal and inland operational activities would be reduced to the maximum extent practicable by implementing best management practices to control stormwater runoff and eutrophication (the process by which a body of water acquires a high concentration of nutrients). Potential impacts to water quality as a result of beach and amphibious training maneuvers, the use of Amphibious Assault Vehicles, and stormwater runoff from High Hazard Impact Areas are addressed in 4.3, *Water Resources.*

A minimal amount of total reef habitat at the beaches on Pagan would be affected by the in-water training activities. Current habitat types (hard bottom and, to a lesser degree, soft shore) would be impacted on a periodic basis over an area of currently undisturbed marine habitat whereby current habitat types and ecosystem functions could be lost or degraded, and recovery prevented. Therefore, Pagan Alternative 1 operational activities would result in less than significant impacts to marine habitats, including Essential Fish Habitat, on Pagan.

4.10.4.1.2.2 Marine Flora

The periodic training activities would temporarily disturb and alter the seafloor, water quality, and physical environment, but most of the seafloor in the training areas is sand and cobble, thus lacking in marine flora.

The actions that could potentially impact marine flora during the proposed operations include in-water training, landings of Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, and small boats, and operation of vessels in nearshore waters. Marine flora that could be impacted from the proposed training activities would be reef substrate shallower than 12 feet (4 meters) below mean low water. Vessels conducting or supporting training could impact marine flora by disturbing the bottom and uprooting marine flora. Swimmers could impact flora through disturbance of the near shore environment. Operational impacts would be periodic.

Marine flora habitat may be directly and indirectly disturbed at Green, Red, Blue, South Beach, North, and Gold Beaches respectively during training activities associated with Pagan Alternative 1 (see Table 4.10-9). Based on the sum of the area shallow enough to be affected by the in-water training activities at the identified Pagan training beaches, implementation of Pagan Alternative 1 would impact approximately 1.37% of total reef habitat where marine flora could grow around Pagan through direct and indirect effects from operational activities.

Therefore, given the limited extent of marine flora and reef habitat that would be affected, Pagan Alternative 1 operations would result in less than significant impacts to marine flora.

4.10.4.1.2.3 Marine Invertebrates

The primary actions that could impact marine invertebrates during training activities would be operation of Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, inflatable boat landings, and swimmers in nearshore waters.

Overall, Pagan has low coral densities across the proposed action beaches; therefore, the overall total coral loss would be limited. The coral communities at Green Beach, Red Beach, and Blue Beach are primarily confined to the rocky headlands adjacent to the proposed landing areas. Sand and turf covered rubble dominate much of the sea floor at Red and Blue Beach (DoN 2014a). Gold and South Beach are rich and complex reefs and proposed operation activities would impact a larger number of coral colonies and species as discussed below.

Non-coral marine invertebrates (starfish, sea urchins, sea cucumbers, mollusks, and tube worms) could also be subject to direct and indirect impacts associated with operations and training. Some non-coral marine invertebrates would be directly impacted (i.e. mortality) during training. Non-coral invertebrate communities dominated by mollusks snails, sea slugs, clams and sea urchins (Sukhraj et al. 2010), could also be impacted to the extent that the coral habitat is affected on Pagan. Sea cucumbers are a significant part of the invertebrate community on Pagan, but would be less affected because they burrow and feed on detritus in the sediments rather than living on the hard coral reef.

Green Beach

Most of the seafloor in the Approach Zone at Green Beach is sand and cobble, while reef substrate is uncommon (DoN 2014a). At Green Beach, landings of Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, small boat landings, and swimmers could directly affect coral colonies and coral reef habitat shallower than 12 feet (4 meters), but the total loss would be limited because of low coral densities in these areas (see Figures 4.10-9 and 4.10-10). The area of seafloor shallower than 12 feet (4 meters) in the Approach Zone at Green Beach is 10.9 acres (4.4 hectares).

Red Beach

Most of the seafloor in the Approach Zone at Red Beach is sand and cobble, while reef substrate shallower than 12 feet (4 meters) is absent (DoN 2014a). At Red Beach, landings of Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, small boats, and swimmers could directly affect coral colonies and coral reef habitat, but the total loss would be limited because of low coral densities in these areas (see Figures 4.10-11 and 4.10-12). No portions of the Red Beach seafloor were of high complexity or high coral cover. The majority of the coral at Red Beach was observed at the headlands to the north and south of Red Beach at depths shallower than 12 feet (4 meters), but not directly in front of the sandy beach. The area of seafloor shallower than 12 feet (4 meters) in the Approach Zone at Red Beach is 6.5 acres (2.6 hectares).

Blue Beach

Most of the seafloor in the Approach Zone at Blue Beach is sand and cobble, while substrate suitable for coral is uncommon (DoN 2014a). At Blue Beach, Amphibious Assault Vehicles landings, Landing Craft Air Cushion vessels landings, small boat landings, and swimmer landings could directly affect the seafloor and impact coral, but the total loss would be limited because of low coral densities in these areas (see Figures 4.10-13 and 4.10-14). The majority of the coral at Blue Beach was observed at the headlands to the north and south of Blue Beach, but not directly in front of the sandy beach. The area of seafloor shallower than 12 feet (4 meters) in the Approach Zone at Blue Beach is 19.0 acres (7.6 hectares).

South Beach

The area of reef habitat shallower than 5 feet (1.5 meters) in the bounds of the Approach Zone at South Beach is 36 acres (14.5 hectares). At South Beach, Landing Craft Air Cushion vessels landings, small boat landings, and swimmer landings would directly affect coral colonies and coral reef habitat shallower than 5 feet (1.5 meters), but the total loss would be limited because of low coral densities in these areas (see Figures 4.10-15 and 4.10-16).

North Beach

The coral species at North Beach are less diverse relative to other sites on Pagan (DoN 2014a) (Figure 4.10-17). At North Beach, small boat landings, and swimmer landings could directly affect coral colonies and coral reef habitat as deep as 5 feet (1.5 meters) below mean low water.

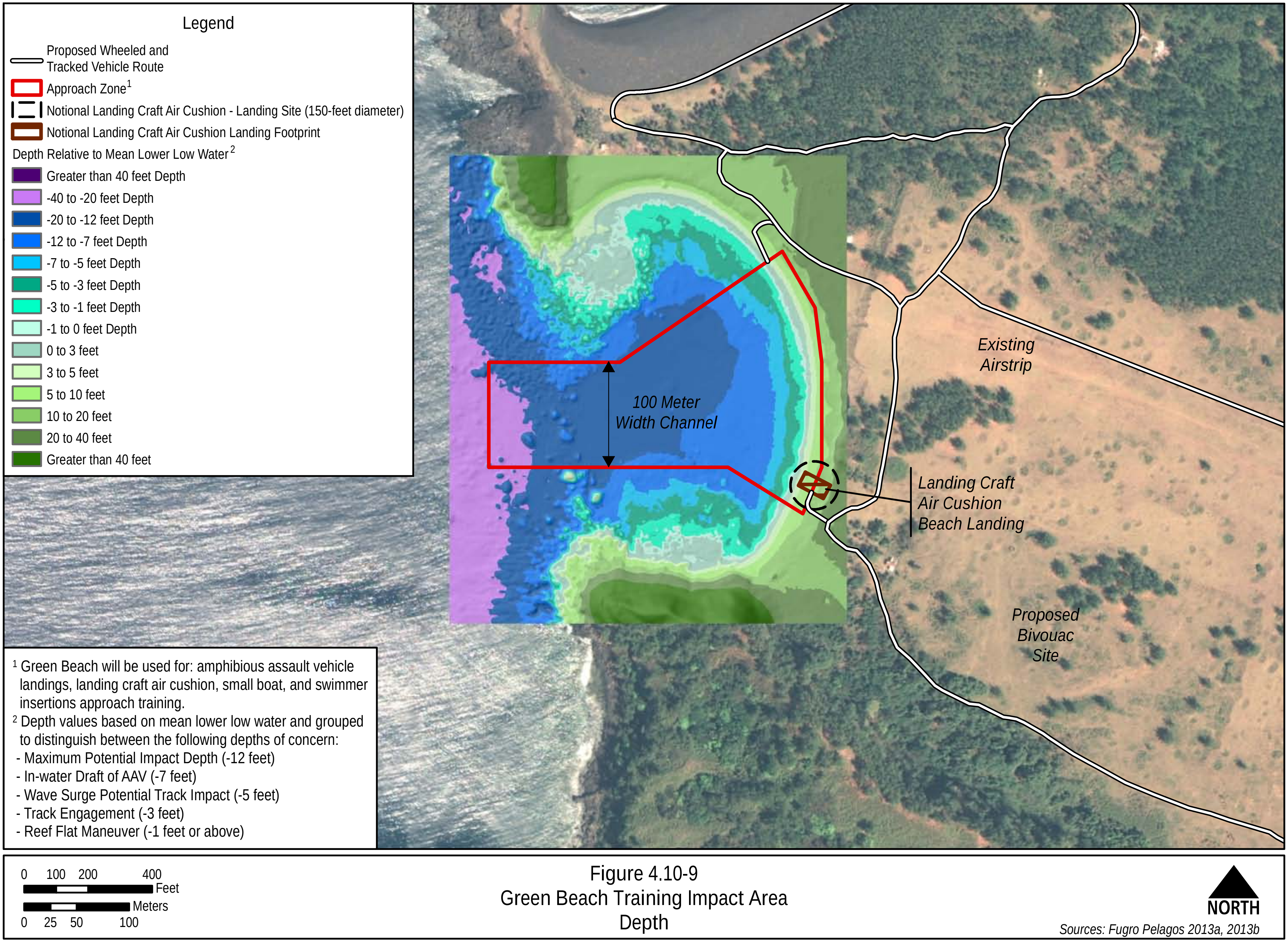


Figure 4.10-9
Green Beach Training Impact Area
Depth

Sources: Fugro Pelagos 2013a, 2013b

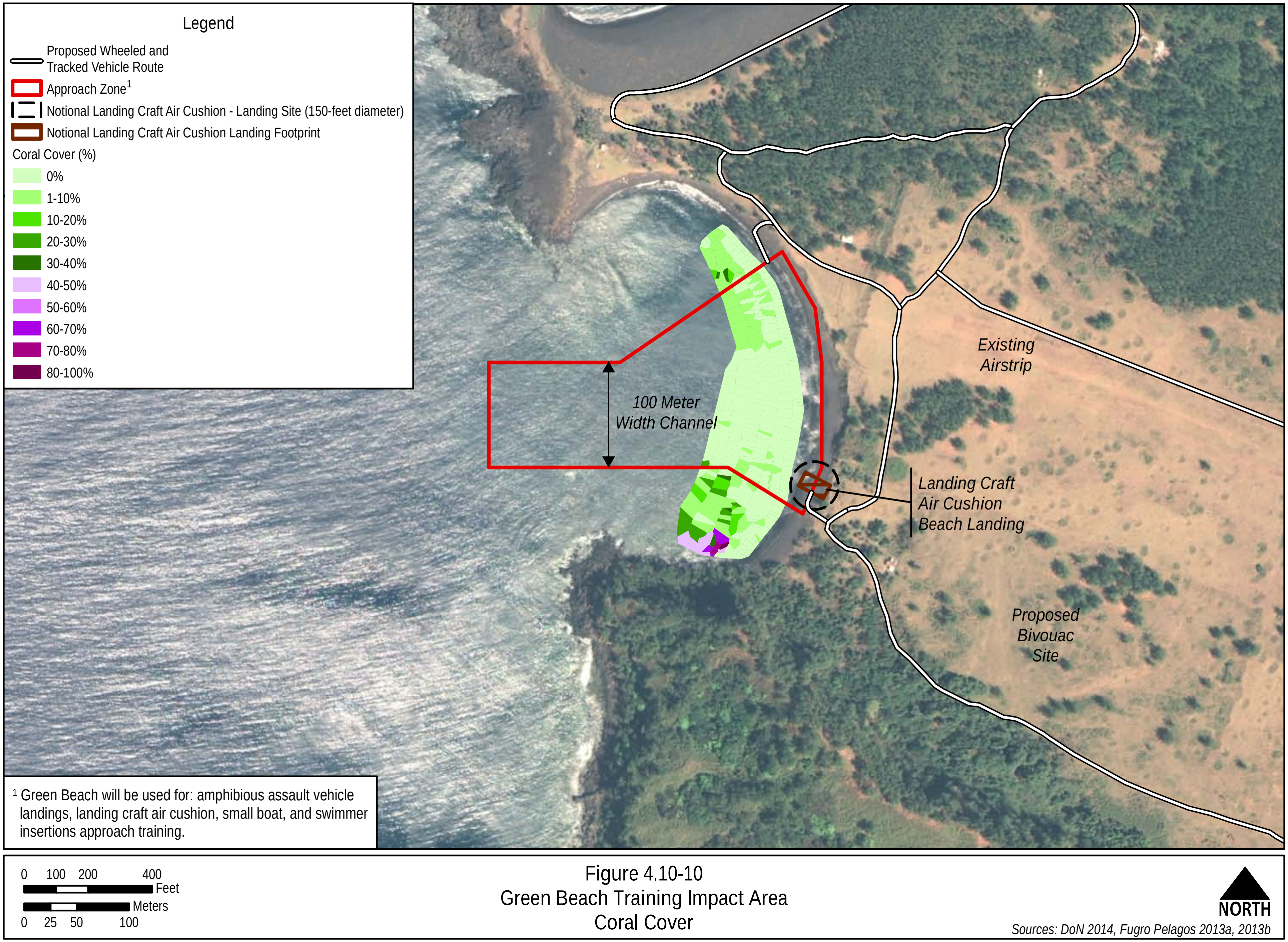
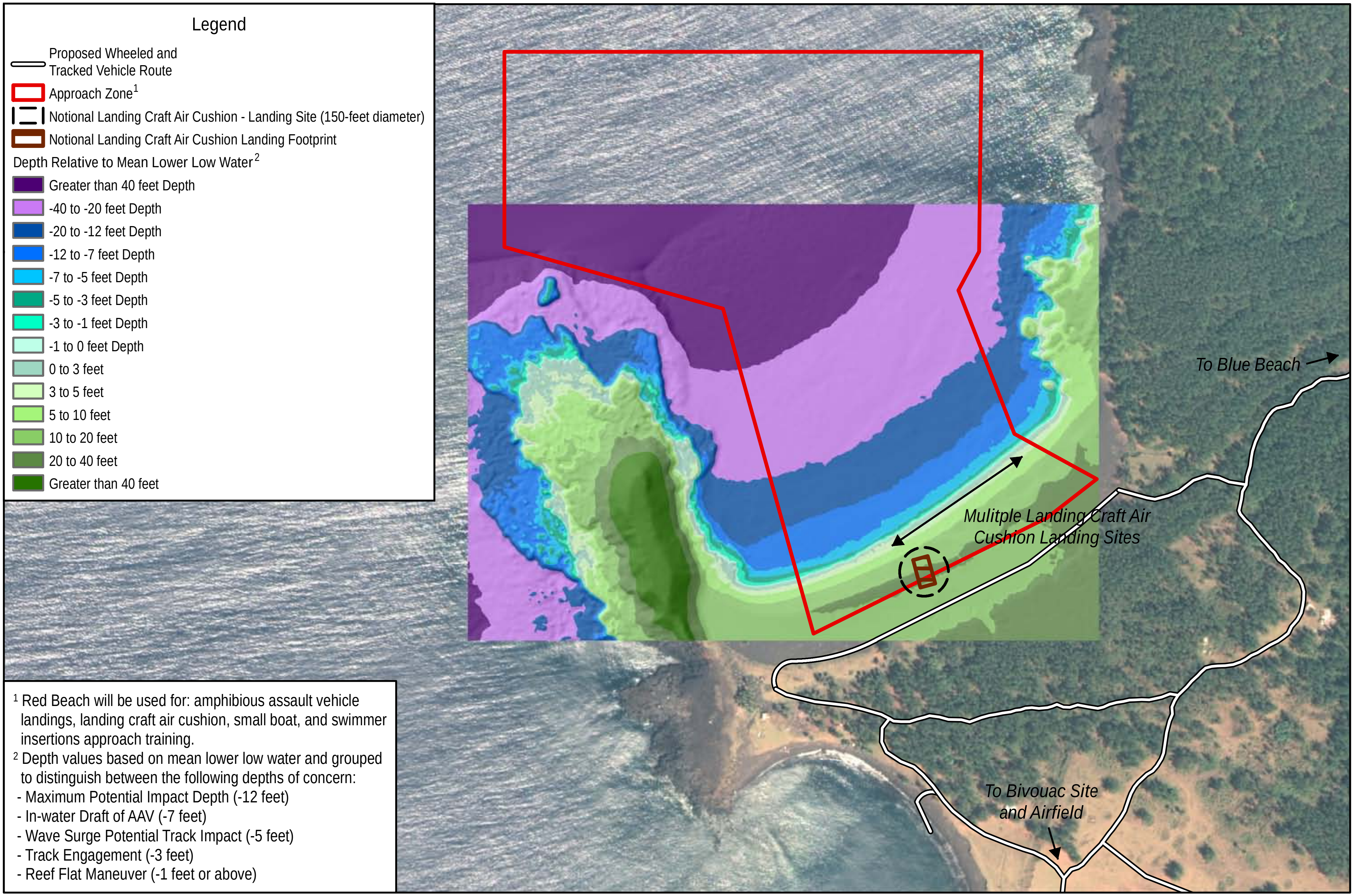


Figure 4.10-10
Green Beach Training Impact Area
Coral Cover



[1] Red Beach will be used for: amphibious assault vehicle landings, landing craft air cushion, small boat, and swimmer insertions approach training.
[2] Depth values based on mean lower low water and grouped to distinguish between the following depths of concern:
- Maximum Potential Impact Depth (-12 feet)
- In-water Draft of AAV (-7 feet)
- Wave Surge Potential Track Impact (-5 feet)
- Track Engagement (-3 feet)
- Reef Flat Maneuver (-1 feet or above)

0 100 200 400 Feet
0 25 50 100 Meters

Figure 4.10-11
Red Beach Training Impact Area
Depth

NORTH

Sources: Fugro Pelagos 2013a, 2013b

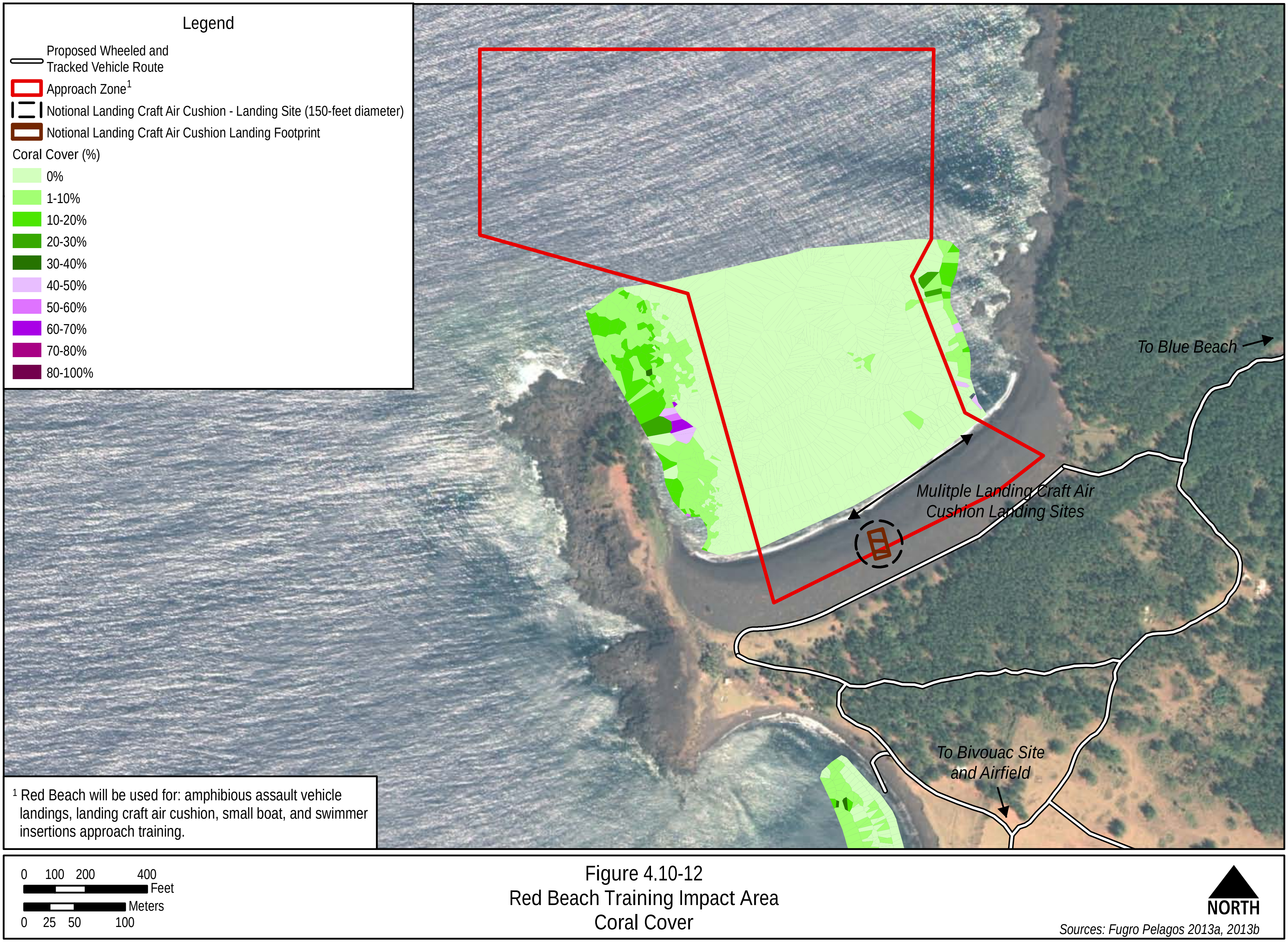


Figure 4.10-12
Red Beach Training Impact Area
Coral Cover

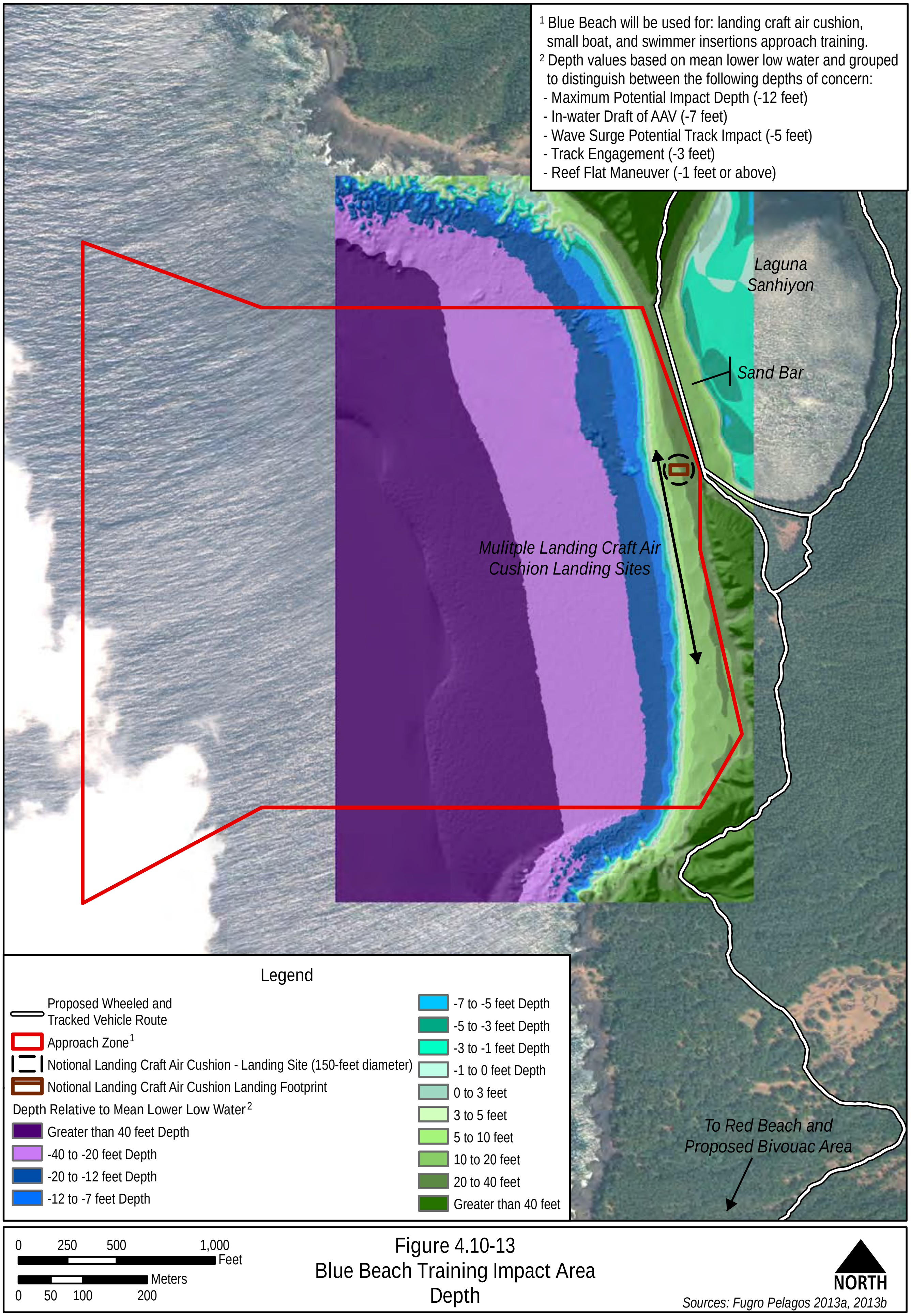


Figure 4.10-13
Blue Beach Training Impact Area
Depth

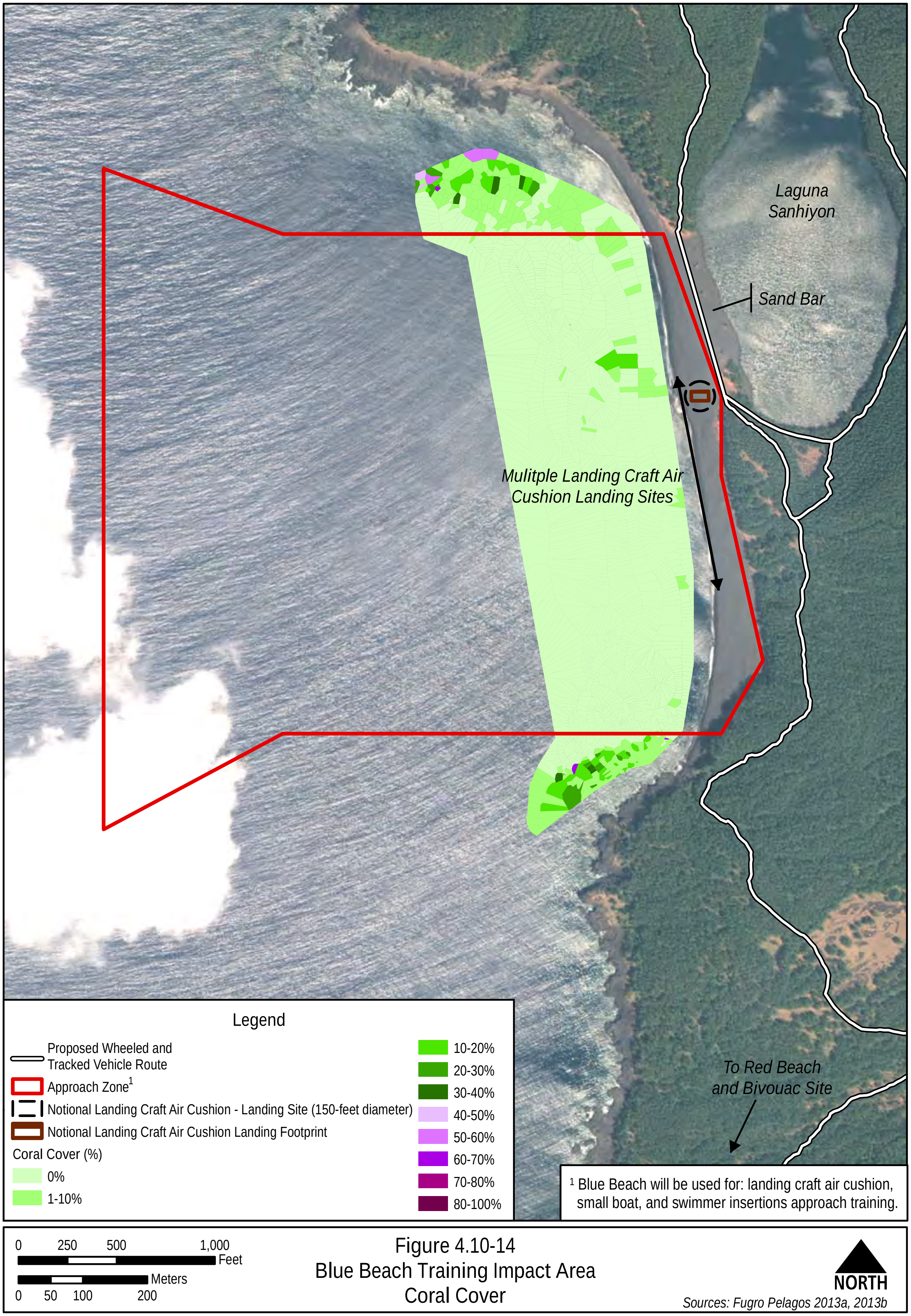


Figure 4.10-14
Blue Beach Training Impact Area
Coral Cover

Sources: Fugro Pelagos 2013a, 2013b

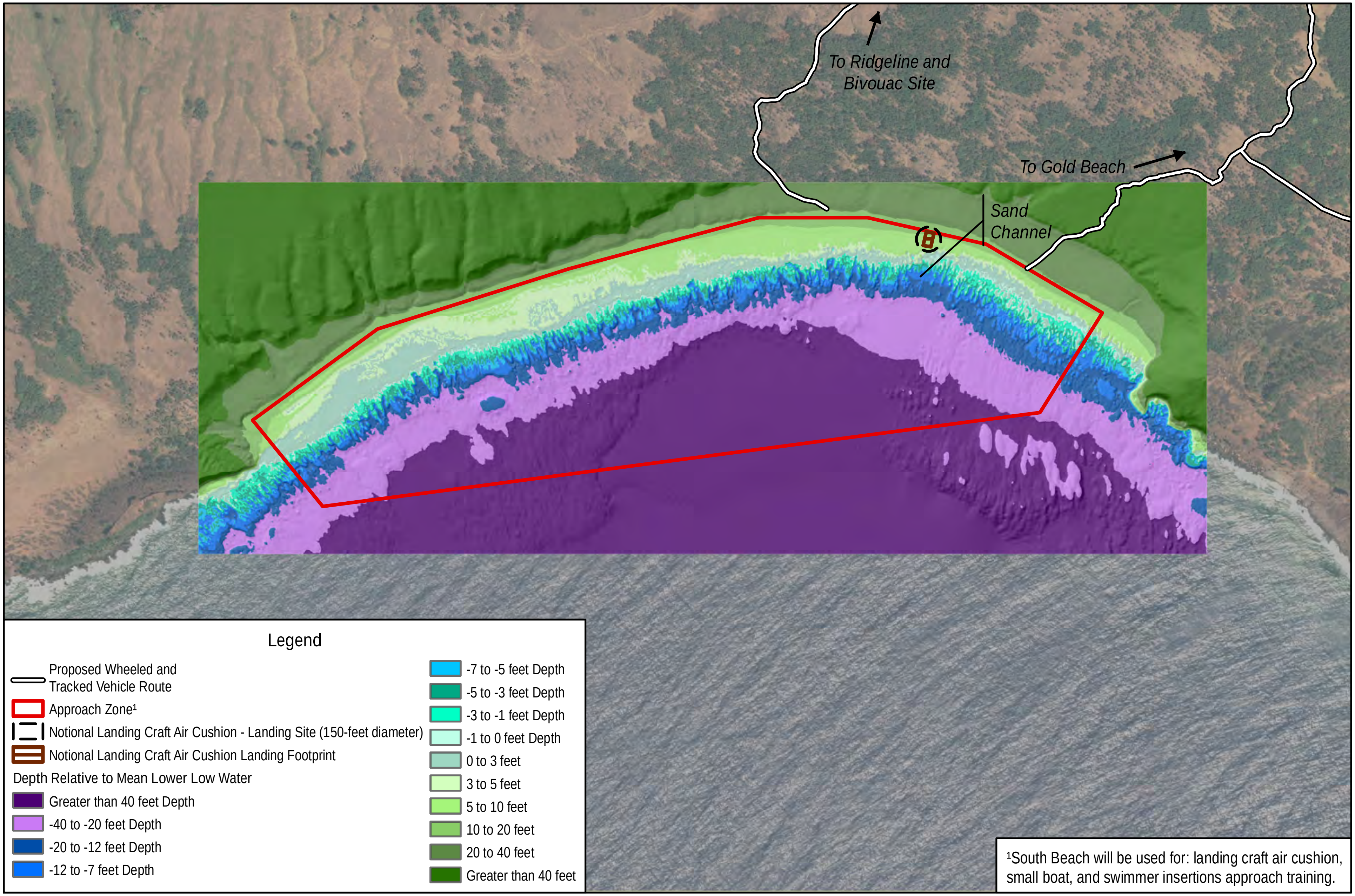


Figure 4.10-15
South Beach Training Impact Area
Depth

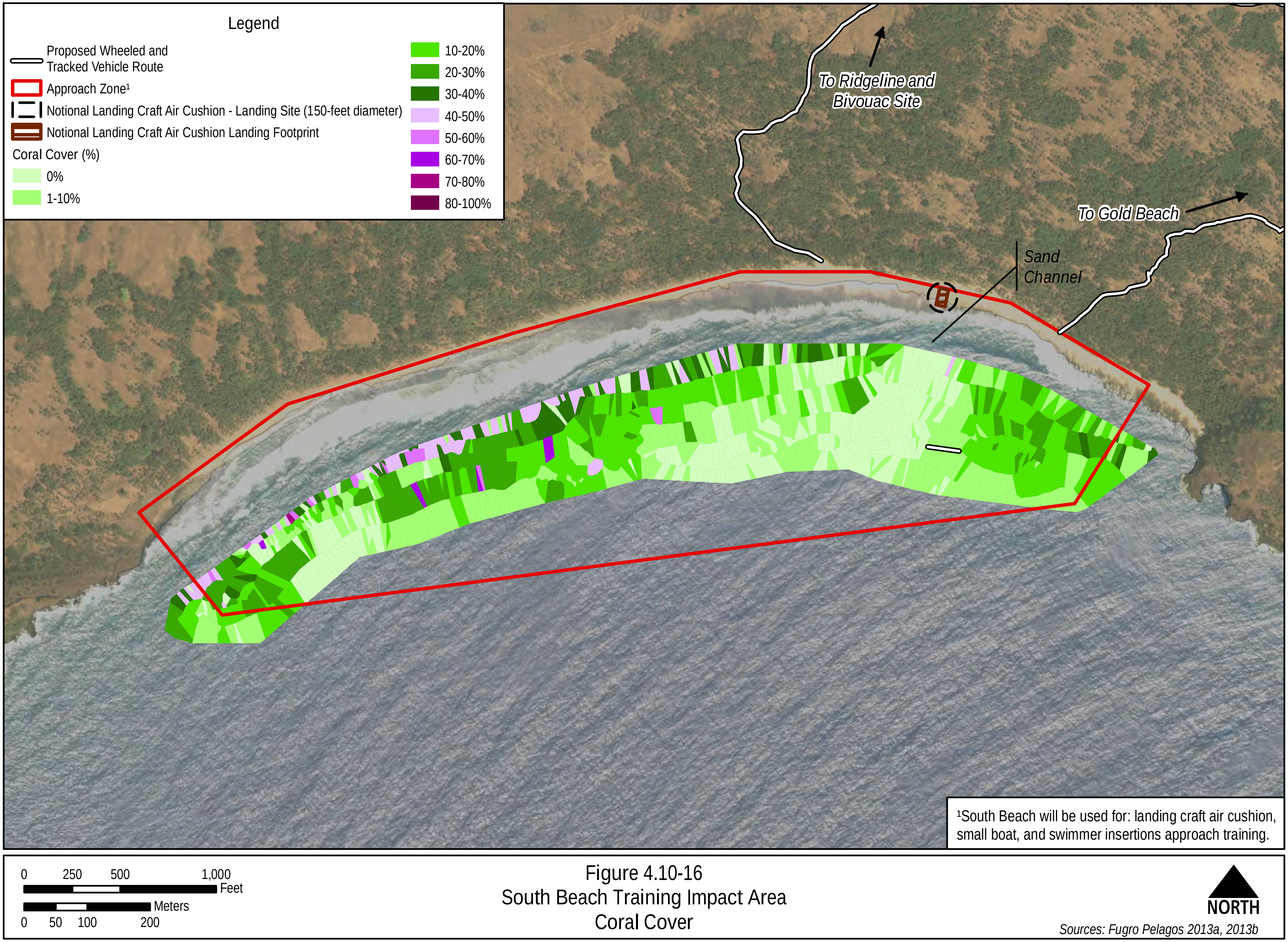


Figure 4.10-16
South Beach Training Impact Area
Coral Cover

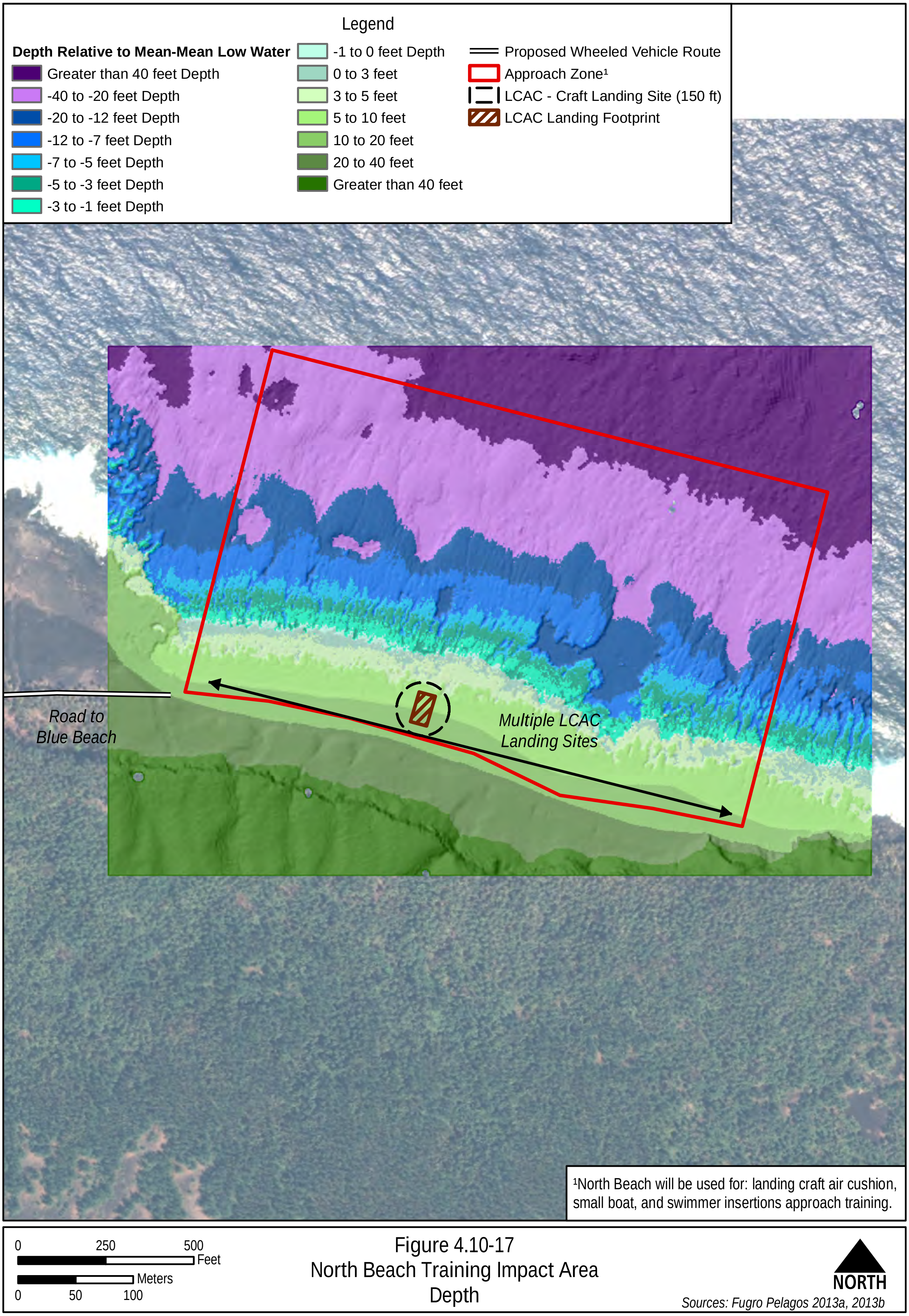


Figure 4.10-17
North Beach Training Impact Area
Depth

Gold Beach

Coral species richness was relatively high at Gold Beach (see Figures 4.10-18 and 4.10-19). At Gold Beach, small boat landings, and swimmer landings could directly affect coral colonies and coral reef habitat shallower than 5 feet (1.5 meters) below mean lower low water. The habitat is more similar to South Beach than to Green, Red, or Blue Beaches. Because of challenging sea states affecting this beach much of the time, Gold Beach is likely to accommodate draining less often than any other training beach on Pagan.

Marine habitat at Pagan beaches, including some corals and coral reef habitat, would be directly impacted by Pagan Alternative 1 operations (see Table 4.10-9). The beaches are relatively species-rich; however, the coral communities are confined to the rocky headlands adjacent to the proposed landing areas that would receive the largest training activity and would be largely unaffected. As stated in Chapter 3, Table 3.10-1, 65,920 acres (26,676 hectares) of total reef habitat are present across the Mariana Islands, 4,416 acres (1,787 hectares) of which is present around Pagan. Based on the sum of the area shallow enough to be affected by the in-water training activities at the identified Pagan training beaches, Pagan Alternative 1 operations would impact approximately 1.37% of total reef habitat around Pagan through direct and indirect effects. Therefore, based on the relatively small areas of impact to marine habitat and corals, Pagan Alternative 1 operations would result in less than significant impacts to marine invertebrates.

4.10.4.1.2.4 Fish

Actions that could potentially impact fish during proposed operations include landings of Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, and small inflatable boats; in-water training, increased vessel traffic, increased noise levels from vessels and weapons fire, and operation of vessels in nearshore waters. Fish may be temporarily displaced for the duration of training activities at these beaches. The coral section above details the loss of coral habitat that would occur during training activities. Coral impacts would directly and indirectly impact fish, as many fish species depend on this coral habitat for shelter, feeding, and reproduction. The overall impact to reef-associated fish populations on Pagan would be expected to be less than proportional to the area of impact, which is 1.37% of the reef habitat on Pagan. This impact would be less than significant.

In-air noise has no potential to affect fish. As described previously in Section 4.10.4.1.2.1, *Marine Habitat and Essential Fish Habitat* the underwater noise from vessels engaged in training would be brief, infrequent, and would not exceed levels likely to cause behavioral reactions in fish more than about 15 feet (4.6 meters) from the vessel. As a result, no significant impacts would result from underwater noise during operations. Additional acoustic elements for combined level training on Pagan include weapons firing that would occur during amphibious training. Weapons firing activities would occur as Amphibious Assault Vehicles approach the shoreline for proposed training beaches on Pagan. Firing of these weapons could have acoustic effects from sound generated by firing the gun and vibration propagating through the vessel hull. It is anticipated that the acoustic effect of weapons firing would be temporary and minimal.

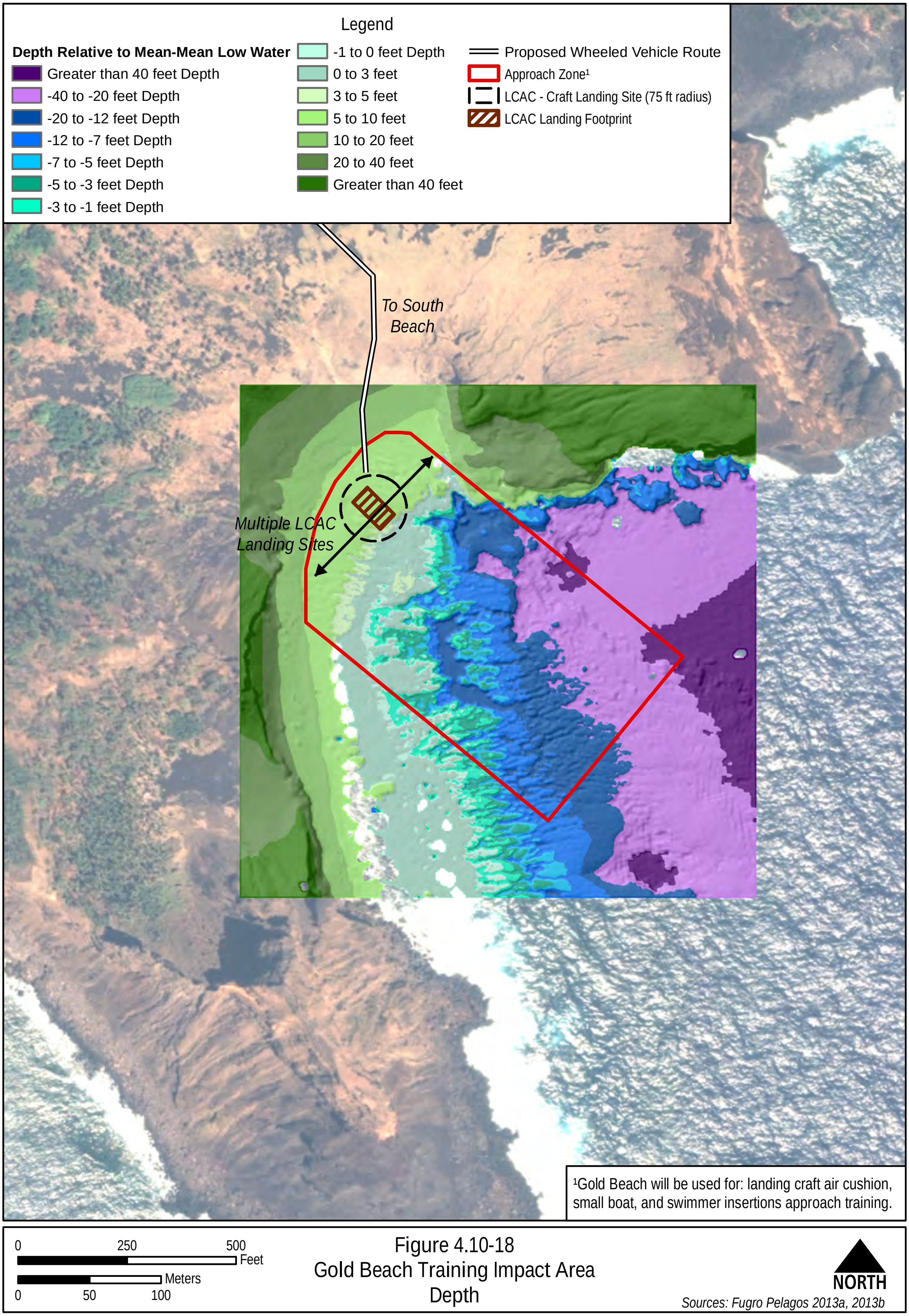


Figure 4.10-18
Gold Beach Training Impact Area
Depth

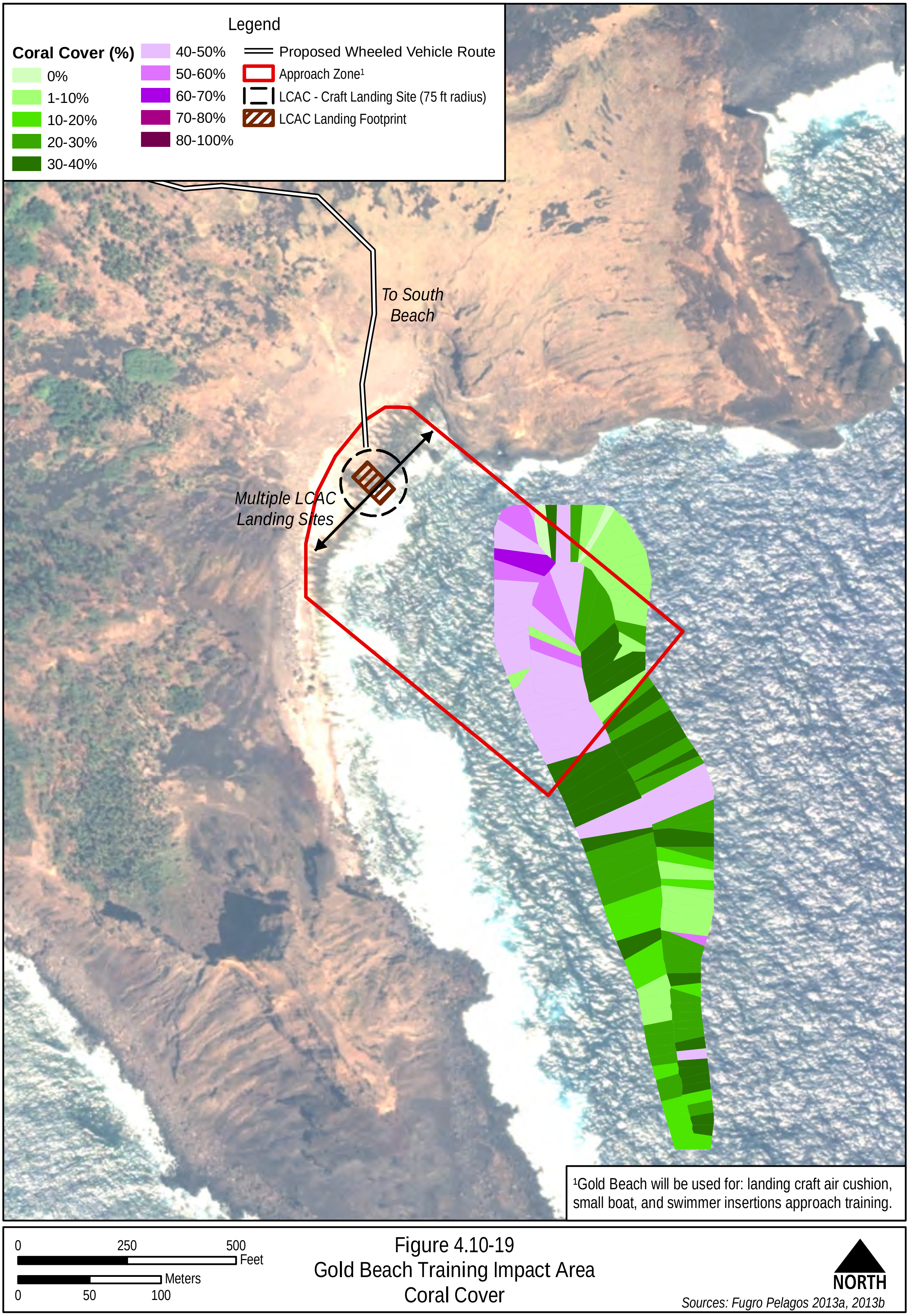


Figure 4.10-19
Gold Beach Training Impact Area
Coral Cover

The potential for direct strikes to fish as a result of the proposed training is low as the noise and presence of vessels would likely cause fish to temporarily flee the area, and the resulting impact would be less than significant. As Amphibious Assault Vehicles plane along on the surface of the water, these vessels have a low chance of striking fish at or near the surface. Landing Craft Air Cushion vehicles operates above the surface and would not be likely to strike fish. It is assumed that small inflatable boats used for combat swimmer training would be similar to other small vessel activity in nearshore waters and would not have a high likelihood of striking fish. Most adult fish can detect and avoid vessels in response to engine noise and would likely flee the area during training activities.

Operational activities at Pagan may expose fish to sounds and general disturbance that could result in short-term behavioral or physiological responses (e.g., avoidance, stress, increased heart rate), but would not be expected to compromise the general health or condition of individual fish or populations. The underwater noise from vessels engaged in training activities would be brief, infrequent, and would not exceed levels likely to cause behavioral reactions in fish more than about 15 feet (4.6 meters) from the vessel.

Potential impacts to water quality characteristics of the marine environment during coastal and inland operational activities would be reduced but not avoided by implementing resource management measures to control stormwater runoff, and eutrophication. Pagan operational activities could cause temporary water quality impacts including increased turbidity, erosion, and sediment transport. Increases in turbidity could temporarily decrease the foraging efficiency of fish. Habitat disturbance is expected to be minimal at the proposed landing beaches given the predominance of sand in the nearshore environment. Significant direct impacts to the reef at South and Gold Beaches are possible, which could adversely impact fish habitat and food sources (see Section 4.10.4.1.2.1, *Marine Habitat and Essential Fish Habitat*). The impact would be, at most, directly proportional to the total area altered. However, these impacts would be temporary in nature and limited to training activities. These impacts would be minimized through adherence to best management practices (Appendix D, *Best Management Practices*). Potential impacts to water quality as a result of beach and amphibious training maneuvers, the use of Amphibious Assault Vehicles, and stormwater runoff from High Hazard Impact Areas are addressed in 4.3, *Water Resources*.

The operational use of beaches on Pagan would impact approximately 1.37% of the reef habitat on Pagan through recurring disturbance and the resulting degradation of fish habitat. Therefore, Pagan Alternative 1 operations would result in less than significant impacts to fish.

4.10.4.1.2.5 Special-status Species

Corals

The *Coral Marine Resources Survey* conducted in support of this EIS/OEIS recorded the presence of one Endangered Species Act-listed coral species, *Acropora globiceps,* at all beaches on Pagan proposed for training (National Marine Fisheries Service 2012; DoN 2014a).

Table 4.10-10 lists the number of individual special-status coral colonies that would be directly affected at Green, Red, Blue, and South Beaches under the proposed action. In addition, the table lists the total area of coral loss.

Table 4.10-10. Potential Impacts to *Acropora globiceps* at Green, Red, Blue, South, Gold, and North Beach on Pagan[1]

	Green Beach[2]	*Red Beach[2]*	*Blue Beach[2]*	*South Beach[3]*	*Gold Beach[4]*	*North Beach[4]*
Total extrapolated *Acropora globiceps* coral area (square feet) in the Approach Zone*	0	0	0	2,242.2	‡	‡
Extrapolated number of *Acropora globiceps* colonies in the Approach Zone	1	†	†	10,609	‡	‡
Density of *Acropora globiceps* colonies in the Approach Zone (per square meter)	< 0.005	†	†	0.07	‡	‡
Extrapolated area (square meter) covered by *Acropora globiceps* in the Approach Zone	< 0.05	†	†	208	‡	‡

Notes: † Species is confirmed adjacent to the Approach Zone but not within.

‡ Species in confirmed within and adjacent to the Approach Zone, but no population data are available for effect calculations.

* Species presence is based on recent high-intensity surveys of the Action Area (Minton et al. 2009; Sukhraj et al. 2010; DoN 2014d). Quantitative estimates of the numbers of Endangered Species Act-listed coral species are based on the most recent high-intensity survey (DoN 2014d). Calculations are based on in situ data that intersects with the proposed action areas to develop quantitative extrapolations for each reef zone. The values in the table are weighted sums.

[1]Calculations assume that the entire susceptible area of each Approach Zone (based on depth of construction or training activity: 5 feet (1.5 meters) for small boat landings and swimmers, 12 feet (4 meters) for Amphibious Assault Vehicles) is subject to physical effects. Effects to corals/seafloor outside of these depths in each area (e.g., deep grooves) and potential effects outside of the Approach Zone are excluded from this analysis, but are considered separately as potential indirect physical effects.

[2]Green Beach, Red Beach, and Blue Beach are nearly 100% sand inside and adjacent to the proposed action areas. Consequently, corals in the areas are extremely uncommon.

[3]No Amphibious Assault Vehicles at South Beach. Calculation includes small boat landings and one Landing Craft Air Cushion vehicles set-down/turning circle. In a cursory survey of the shore-attached reef crest where Landing Craft Air Cushion vehicles set-down would occur, no Endangered Species Act corals were noted.

[4]No Amphibious Assault Vehicles or Landing Craft Air Cushion vehicles at North Beach, and Gold Beach.

Vessels have the potential to impact eggs and pelagic larvae of Endangered Species Act-listed corals by disturbing the water column (Bishop 2008; Marshall 2012). Wash from vessel movement (water displaced by propellers/impellers used for propulsion) and water displaced from vessel hulls can potentially impact eggs and pelagic larvae of Endangered Species Act-listed corals (Bickel et al. 2011). Amphibious craft may affect the water column to a depth of approximately 12 feet (4 meters). Disturbance caused by propeller wash could extend to approximately twice this depth.

Landing activities that contact the seafloor during operation include Amphibious Assault Vehicles, Landing Craft Air Cushion vessels and small boat landings. At the level of the individual coral, the consequences of physical strike by heavy equipment would be functionally equivalent to the consequences of physical strike by a swimmer’s boot. However, at the level of coral reef habitat, the consequences of physical strike by an Amphibious Assault Vehicle would be greater than Landing Craft Air Cushion vessels, small boat, and swimmer landings because of the increased potential to reduce larger corals and reef substrate to smaller pieces of mobile rubble. Little to no coral is expected in the landing areas where Amphibious Assault Vehicles would be operating, so damage to Endangered Species Act-list corals from Amphibious Assault Vehicles is expected to be negligible.

The marine habitat at Green, Red, and Blue Beach consists of unconsolidated sediment. Mobile rubble would not be generated at these beaches and indirect effects would be limited to temporary increases in suspended sediments in the water column rather than an increase in the acreage of impact.

The marine habitat at South, Gold, and North Beach is different in character (as described in Chapter 3), and mobile rubble could be generated. Mobile fragments are transported up and down slope with greater amplitude than when they are transported laterally (Allingham and Neil 1995; Erftemeijer et al. 2012). Rubble mobilized from inside the area of direct physical impact would be transported outside the area of direct impact (Allingham and Neil 1995; Chew III 1999).

Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, and small boat landing activities all would generate underwater sound during Pagan operations. Although vessel noise could mask natural reef sounds that coral larvae use as settlement cues (Vermeij et al. 2010; Simpson et al. 2011), this would occur briefly, infrequently, and on a small scale. As such, the impact would be less than significant.

Green Beach has a single colony of *Acropora globiceps* and South Beach has an estimated 10,609 colonies. Coral heads at Green Beach would be flagged or marked to alert vessel operators and swimmers to avoid the area during training operations. No Endangered Species Act-listed corals are present in habitats shallower than 12 feet (4 meters) at Red and Blue Beach. Therefore, given the number of colonies of *Acropora globiceps* that would be impacted, primarily at South Beach, Pagan Alternative 1 operations would have a significant impact to this Endangered Species Act-listed species.

Sea Turtles

Red, Green, and Blue Beaches provide relatively limited foraging and resting habitat for sea turtles. High quality habitat occurs adjacent to these operational areas and sea turtles are likely to migrate through these zones. In-water operation of Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, and small craft vehicles at Green, Red, and Blue Beaches could cause sea turtles to avoid habitat or cause habitat to be unavailable since turtles may be temporarily displaced for the duration of training activities. Sea turtle resting and foraging habitat disturbance from operations in the region of influence would be expected to be temporary and inconsequential. Impacts from underwater noise would likely result in a temporary fleeing response from turtles. Such impacts would be less than significant.

Sea turtles primarily hear low frequency sounds and have the greatest sensitivity between 200 to 400 hertz (Ridgway et al. 1969; Bartol and Ketten 2006). They generally cannot hear well in air (Lenhardt et al. 1983); therefore, in-air noise is unlikely to cause any behavioral modification. Vessel noise could disturb sea turtles and potentially elicit an alerting, avoidance, or other behavioral reaction. Such disturbances would be brief, infrequent, and relatively isolated, affecting a small number of individuals at any one time, based on turtle densities described in Section 3.10, *Marine Biology*. As such, acoustic disturbance by vessels resulting from Pagan Alternative 1 operations is considered less than significant.

Physical strike and disturbance of sea turtles could occur from the proposed operation actions on Pagan. Direct physical strike could cause death or injury and physical disturbance could negatively affect foraging, resting, and mating behavior as a result of the proposed action. Physical strikes from vessels would be the most significant in-water threat to sea turtles at Pagan, as it often causes serious injury or mortality. Research suggests that sea turtles may not react quickly enough to move out of the way of vessels going faster than about 2.2 knots (4.0 kilometers per hour) (Hazel et al. 2007). Accordingly, there would be a risk of vessel strikes for turtles within the approach zones. While the risk would be low, some mortality due to vessel strikes cannot be ruled out, and should be anticipated. Increased turbidity and sedimentation would be temporary effects due to the dynamic wave environment and would be unlikely to have any lasting impact to photosynthesis and food supply.

The total area of the Approach Zone at Green Beach is approximately 0.01 square mile (0.03 square kilometer), 0.08 square mile (0.21 square kilometer) at Red Beach, and 0.36 square mile (0.93 square kilometers) at Blue Beach. The area is 0.45 square mile (0.117 square kilometer) in total, which corresponds to approximately 50 sea turtles in the cumulative operations footprint. Amphibious Assault Vehicles and Landing Craft Air Cushion vessels, as well as small boats, would be operating at all locations. Therefore, it has been assumed that the entire Approach Zone presents a potential threat for vessel strikes. The turtles within this footprint, as well as any turtles migrating through the area, would be at risk of vessel strike.

Landing Craft Air Cushion vessels and small vessels would be operating at South Beach, while small inflatable boats would operate at North and Gold Beaches. There is a limited possibility of a Landing Craft Air Cushion vessel striking a sea turtle, so South Beach is discounted as a possible threat. Turtles within the footprint of North and Gold Beach would be at risk of vessel strike.

Hawksbill sea turtles contributes to approximately 33% of the total sea turtle population on Pagan (DoN 2014b). In addition, the island wide population of sea turtles is estimated at approximately 50% of Tinian's population, while total available habitat is similar between the two islands (DoN 2014b). As such, Pagan's average sea turtle density is approximately half of Tinian's average sea turtle density. As a result of the increase in total number of vehicles per landing associated with Combined Level Training over Unit Level Training, there may be an increase in the likelihood of impacts (particularly direct vessel strikes) to sea turtles due to the increase in training assets and complexity associated with this proposed training. However, this risk would be negated by the relatively few sea turtles in the approach zones and infrequent and localized vessel activity within these zones. Therefore, Pagan Alternative 1 operations would have less than significant impacts to sea turtles.

Marine Mammals

Vessel noise has the potential to cause minor disturbance to marine mammals and elicit an alerting, avoidance, or other behavioral reaction. Most studies have reported that marine mammals react to vessel noise and traffic with short-term interruption of behavior or social interactions (Watkins 1981; Richardson et al. 1995; Magalhaes et al. 2002; Noren et al. 2009).

In conventional vessels, the sounds of the engine, transmission, and drive shaft(s) are conducted through the hull and into the water. When small, fast vessels are operated at high speeds, considerably less hull is exposed to the water, thus less sound is transmitted into the water. When a vessel planes above the water surface air is sucked under the hull as it travels. These bubbles of air, as well as the flow of water under the hull, produce some noise but also attenuate and scatter sounds for the engine. The bubbles of the wake also mask, scatter, and absorb sounds. When the Amphibious Assault Vehicles would be launched, they begin maneuvering in the idle mode, using jets only. Once they reach high speeds, planing above the water surface, a matter of seconds, the sound level drops off rapidly. When traveling, the sound increases as the Amphibious Assault Vehicle approaches, then falls off after it passes, like any moving sound source.

Vessel-to-shore firing would occur in Pagan waters during live-fire amphibious training. Marine mammals in the vicinity of these activities would be expected to have an initial startle response.

Because these events are short-term, localized, and infrequent, they would not be expected to have long-term consequences for individuals or populations.

There is an increased potential for noise in the water from training vessels, but there would be no anticipated long-term consequences to the individual or populations. Short-term behavioral responses to noise associated with vessels is not likely to disrupt major behavior patterns such as migrating, breeding, feeding, and sheltering, or to result in serious injury to marine mammals. Along with exposure to vessel traffic, marine mammals may detect and react to aircraft, but no more than momentary reactions would be anticipated, with negligible impacts to important behaviors.

Given low densities of marine mammals in the surrounding waters (Section 3.10, *Marine Biology*), and the infrequent, localized occurrence of training activities, disturbance by vessels would be less than significant.

Based on data provided in the *Marine Mammal Survey* conducted in support of this EIS/OEIS (DoN 2014c) spinner dolphins were the marine mammal species most often observed (54% of encounters) around Pagan, with five of the groups seen on the eastern side of the island, and two on the western side of the island off Green Beach. All sightings were within 0.54 nautical miles (1 kilometer) of the shoreline, and the sightings were at depths of less than 686 feet (212 meters). Bottlenose dolphins and Cuvier's beaked whales were also encountered around the island. The bottlenose dolphins were sighted off the northwest coast and the Cuvier's beaked whale was encountered in over 2,000 feet (606 meters) of water. Based on their presence in the region of influence, spinner dolphins and the bottlenose dolphins would be the species most likely impacted by operations. However, short-term reactions to vessels are not likely to disrupt major behavior patterns such as migrating, breeding, feeding, and sheltering, or to result in serious injury to marine mammals. Furthermore, both spinner dolphins and bottlenose dolphins are highly mobile species that would likely leave the area in the event that operations were to occur in close proximity to individuals. Marine mammals being struck by vessels is not expected to occur in association with training around Pagan. There are no known ship strikes of marine mammals by U.S. Navy or U.S. Coast Guard vessels in the region of influence or for Department of Defense amphibious vessels at other training locations.

Military training activities could result in indirect impacts to marine mammals via habitat degradation or an effect on prey availability. Effects to prey items for marine mammals are less likely given that a large portion of their prey consist of pelagic plankton and fishes. Any effects to prey would be temporary, occurring during training activities involving direct use of landing area. No lasting impact to prey availability or the pelagic food web would be expected.

The overall impact to marine mammals from the proposed training activities during Pagan Alternative 1 operations would be less than significant.

4.10.4.2 Pagan Alternative 2

4.10.4.2.1 Construction Impacts

The impacts to marine biological resources from construction activities associated with Pagan Alternative 2 would be the same as those described for Pagan Alternative 1. See Section 4.10.4.1, *Pagan Alternative 1*, for a discussion of impacts.

4.10.4.2.2 Operation Impacts

The impacts to marine biological resources from operational activities associated with Pagan Alternative 2 would be the same as those described for Pagan Alternative 1. See Section 4.10.4.1, *Pagan Alternative 1*, for a discussion of impacts.

4.10.4.3 Pagan No-Action Alternative

Under the no-action alternative, there would be infrequent and minor DoD activities (i.e., search and rescue) around Pagan would be low impact and short duration. These activities would present less than significant impacts to Pagan's marine resources. Non-DoD activities include periodic visits for eco-tourism and scientific surveys.

4.10.4.4 Summary of Impacts for Pagan Alternatives

Table 4.10-11 provides a comparison of the potential impacts to marine biological resources for the two Pagan alternatives and the no-action alternative.

Table 4.10-11. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Marine Biology	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Marine Habitat/Essential Fish Habitat	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Flora	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Invertebrates (Coral)	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Invertebrates (Non-Coral)	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Fish	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Special-status Coral Species	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*
Sea Turtles	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Mammals	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*

Legend: *LSI* = less than significant impact; *SI* = Significant impact. Shading is used to highlight the significant impacts.

4.10.4.5 Summary of Potential Mitigation Measures for Pagan Alternatives

Table 4.10-12 provides a summary of the potential mitigation measures for marine biology resources for the two Pagan alternatives.

Table 4.10-12. Summary of Potential Mitigation Measures for Pagan Alternatives

Impacts	***Category***	***Potential Mitigation Measures***	***Pagan Phase***	
			Construction	***Operation***
Special-status Coral Species Amphibious training activities would cause a loss of one *Acropora globiceps* coral colony at Green Beach and an estimated 10,609 colonies at South Beach.	*SI*	• DoD may consider transplantation of coral species. • DoD may consider debris removal and disposal as a one-time effort to collect large quantities of debris from an area such as Gold Beach. • DoD may consider recreational mooring Buoys and/or Fish Aggregation Devices to avoid impacts to coral by dropping anchors and to reduce the potential effects on access to fishing areas. • Implementation of Marine Species Awareness Training for all lookouts and other key personnel. • Additional measures may be recommended during agency consultations.		X

Legend: *SI* = significant impact. Shading is used to highlight the significant impacts.
Note: Mitigation measures associated with marine biology do not alter the significance of the impacts.

4.11 CULTURAL RESOURCES

Section 4.11 describes the specific direct and indirect impacts on cultural resources that could result from implementation of the proposed action or other action alternatives. Both the construction and operation elements of the proposed action have the potential to impact the cultural resources of both Tinian and Pagan.

As noted in Section 3.11, Department of Defense actions within this area are covered by two Programmatic Agreements—one for military training activities relating to the Mariana Islands Range Complex EIS/OEIS (DoN 2010a), and one for the Guam and CNMI Military Relocation EIS (DoN 2010b) to establish four ranges on Tinian. If an action alternative is selected, then a new Section 106 of the National Historic Preservation Act programmatic agreement would be signed and implemented to resolve adverse effects to historic properties. The programmatic agreement for this proposed action would reference the Mariana Islands Range Complex EIS/OEIS programmatic agreement and supersede the Tinian-specific portions of the Guam and CNMI Military Relocation EIS programmatic agreement. If the no-action alternative were selected, then Tinian-specific stipulations in the Guam and CNMI Military Relocation programmatic agreement (Department of Defense 2011) would be implemented. Section 106 consultation for the current proposed action was initiated on April 20, 2013 and will be completed prior to publication of this Final EIS/OEIS.

4.11.1 Approach to Analysis

The cultural resources impact analysis addresses potential effects to historic properties (districts, sites, buildings, structures, or objects that are listed in or considered eligible for listing in the National Register of Historic Places). The analysis also considers potential impacts to other kinds of resources that may not be eligible for the National Register of Historic Places, including cultural practices, cemeteries, memorials, sacred sites, or medicinal plants. The Tinian and Pagan RTAs and their associated support facilities/infrastructure construction footprints (described in Chapter 2, *Proposed Action and Alternatives*) were examined in relation to locations of historic properties and resources of cultural importance using Geographic Information System to identify potential impacts due to construction and operations. Training area disturbance footprints were also accounted for to ensure that the full range of potential impacts was identified. Under the proposed action, impacts may be either direct or indirect and are distinguished as follows.

Direct impacts occur at the same place and/or time as actions generated by proposed construction (e.g., ground-disturbing activities) and operations (e.g., range use). These impacts may include, but are not limited to, the following:

- Physical destruction, damage, or alteration
- Ground disturbances such as excavating, filling, grubbing (i.e., use of heavy equipment to remove vegetation), and vegetation maintenance (i.e., trimming vegetation, mowing grass, limbing trees)
- Demolition

Direct impacts from construction ground disturbance and operational vegetation clearing were assumed within all areas labeled as facility footprints in Chapter 2, *Proposed Action and Alternatives,* and as

"Vegetation Maintenance" in Appendix F, *Geology and Soils Technical Memo*. Vegetation clearance, including grubbing, would occur in areas such as along roads, Convoy Course engagement areas, Tracked Vehicle Driver's Course, objective areas, and target areas (Range Complex A).

Indirect impacts are caused by or result from project- or operation-related activities, occur usually later in time or space, and are reasonably foreseeable. Potential causes of indirect impacts include, but are not limited to, the following:

- Reducing public access to historic properties and resources of cultural importance
- Changes in setting through visual or audible intrusions when these characteristics are important to the significance of the resource
- Potential increase in erosion and ground disturbance related to project-related activities
- Deferred monitoring or stabilization of sites, if needed, while ranges are in operation

The process for identifying and evaluating the significance of the impact is determined by the magnitude and nature of the action; the nature and extent of potential effects on historic properties and resources of cultural importance; and the likely nature and location of historic properties and resources of cultural importance within areas that may be impacted. Under the National Historic Preservation Act, adverse effects result from the direct loss of character-defining features and/or aspects of integrity of a historic property. Under NEPA, significant impacts to resources of cultural importance could occur if the characteristics that make the resource important to the culture are altered. If significant impacts were determined, then mitigation may be proposed to minimize or mitigate the adverse effects or impacts. A discussion of impacts to historic properties at the Tinian International Airport in accordance with Section 4(f) of the Department of Transportation Act of 1966 is included in Section 4.19.

4.11.2 Resource Management Measures

Resource management measures applicable to cultural resources include the following:

4.11.2.1 Avoidance and Minimization Measures

- To the degree possible, historic properties and resources of cultural importance were avoided when planning initial construction and operations areas for the proposed action. This included moving target locations, firing positions, engagement zones, and surface radar sites, as well as moving the High Hazard Impact Area boundaries to avoid the North Field National Historic Landmark. Department of Defense also minimized construction associated with the use of Amphibious Assault Vehicles to certain beaches and sited roads and construction laydown areas to avoid impacting historic properties where feasible. Construction was avoided on the historic runways in the North Field National Historic Landmark and use of tracked vehicles was avoided on historic roads associated with the landmark. Department of Defense would further avoid impacts to historic properties and resources of cultural importance during construction and operations through troop education, marking of sensitive areas, repairing roads, and policing areas at the completion of exercises.
- On Tinian and Pagan, if beach sand is compacted or displaced by landing craft so that the natural appearance of the beach has been altered, the beach topography will be restored within 3 days of the exercise using non-mechanized methods (e.g., rakes or other hand tools).

- Specific measures for avoiding and minimizing impacts to historic properties would be stipulated in a Programmatic Agreement regarding the current undertaking. These measures include implementation of the Secretary of the Interior's Standards for Rehabilitation for all maintenance and repair of runways for the North Field Historic Landmark and the evaluation of archaeological resources found during construction or operations. Department of Defense would follow standard operating procedures as outlined in the agreement document for inventorying areas or properties that have not been inventoried.

4.11.2.2 Best Management Practices and Standard Operating Procedures

Best management practices and standard operating procedures that are applicable to cultural resources are listed below and a complete listing is provided in Appendix D, *Best Management Practices*.

- Best management practices for erosion control, Spill Prevention, Control and Countermeasures Plans and Facility Response Plans, and Hazardous Materials Management Plans would be implemented to prevent indirect impacts to historic properties during construction and operations from potential contaminants and sediments. A Fire Prevention and Management plan would be implemented to minimize fire risk from training activities that could have an indirect impact to historic properties and resources of cultural importance.
- The Department of Defense would implement a Range Training Area Management Plan that would include stipulations to adhere to protection measures established in cultural resource management plans and implement a monitoring program for minimizing groundwater contamination. Through the Range Environmental Vulnerability Assessment program, the Marine Corps would identify potential release of munitions constituents and develop additional best management practices at the ranges to minimize off-site contamination.

4.11.3 Tinian

4.11.3.1 Tinian Alternative 1

4.11.3.1.1 Construction Impacts

As described in Section 2.4, *Tinian Alternatives*, Tinian Alternative 1 RTA development and construction would include construction and improvements for support facilities and infrastructure (e.g., base camp, airport, port, Munitions Storage Area, roadways, utilities) and training facilities (e.g., Range Complexes A, B, C, D, and Military Lease Area-wide training assets). These activities would result in ground disturbance (e.g., vegetation clearing, grubbing, grading, excavation, and filling), and potentially impact historic properties and resources of cultural importance.

In total, 1,902 acres (771 hectares) of ground disturbance would occur under Tinian Alternative 1 (see Table 2.4-8). Specific vegetation clearance areas within Range Complexes A, B, C, and D; the Landing Zone within Range Complex D; and the Military Lease Area-wide training assets are discussed in Section 4.2, *Geology and Soils* and Appendix F, *Geology and Soils Technical Memo*. Table 4.11-1 summarizes the historic properties impacted by construction activities associated with Tinian Alternative 1. Specific impacts to historic properties and resources of cultural importance are described in more detail by RTA or construction project and in Appendix N, *Cultural Resources Technical Memo*.

Table 4.11-1. Tinian Alternative 1: Summary of Significant Direct Impacts on Historic Properties from Construction

Complex	*Range*	*Number of Historic Properties*
Range Complex A	High Hazard Impact Area	20
Range Complex B	Multi-purpose Training Range, Combat Pistol Range, Anti-armor Tracking Range, Battle Site Zero Range	9
Range Complex C	Infantry Platoon Battle Course, Field Fire Range, Multi-Purpose Automated Unknown Distance Range	14
Range Complex D	Northern Battle Area Complex, Urban Assault Course	3
Military Lease Area-wide Training Assets and Support Facilities Outside of the Range Complexes	Convoy Course Engagement Areas	8
	Munitions Storage Area	3
	Roads, Fences, and Utilities, Tracked Vehicle Driver's Course	86
	Base Camp	1
	Tactical Amphibious Training Areas	3
	Landing Zones, Artillery Firing Points, Observation Posts, Surface Radar Sites	19
Outside Military Lease Area	Tinian International Airport	2
	Port of Tinian	0
	Tracked Vehicle Transit Lanes/Supply Route	4
	Total	**172**

Range Complex A: As described in Section 2.4.1, *Tinian Alternatives*, ground disturbance within Range Complex A would occur within the footprint of the ground ranges as well as within the target areas. Construction-related activities, such as grubbing, grading, excavation, and soil removal associated with construction of a perimeter road, an access road, and target areas, would significantly impact 20 historic properties. These 20 historic properties include 3 Pre-Contact sites (1 ceramic scatter and 2 cave sites), 7 pre-World War II Japanese Administration sites, 4 World War II-era Japanese defensive sites, and 6 World War II American military sites. Two of these sites are memorials, the Hinode American Memorial Shrine and the Nan'yo Kohatsu Kaisha Shrine. Significant direct impacts would occur to eight historic properties because of the construction of fences and roads around the perimeter of the High Hazard Impact Area. Since sites in this area tend to be large and dispersed, complete avoidance is not possible. However, in most cases only a portion of the site would be impacted by construction activities associated with Alternative 1.

Construction could also significantly impact 3 acres (1 hectare) of native limestone forest, which could contain resources of cultural importance, such as medicinal plants. Significant direct impacts to other cultural resources of cultural importance would include the disturbance of the two memorials described above.

Indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary. The roundabout, a portion of Broadway

Avenue, which is an entrance to the North Field National Historic Landmark and a contributing feature to the cultural landscape, would be closed during construction of Range Complex A target objectives. This closure would be temporary and the impact would be less than significant.

***Range Complex B*:** As described in Section 2.4.1, *Tinian Alternatives*, ground ranges, objective areas, roadways, and pathways would be constructed as part of Range Complex B. Construction-related activities such as grubbing, excavation, and soil removal, as well as grubbing for vegetation clearance of interior roadways and target firing points would significantly impact 9 historic properties. These historic properties include 4 pre-World War II Japanese Administration sites, 2 World War II-era Japanese defensive sites, and 3 World War II American military sites. As stated above, indirect impacts to historic properties due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary. Broadway Avenue would be closed during construction of Range Complex B target objectives. This closure would be temporary and the impact would be less than significant.

No resources of cultural importance were identified within Range Complex B.

***Range Complex C*:** As described in Section 2.4.1, *Tinian Alternatives*, ground ranges, roadways, and 20 temporary roofless structures would be constructed in Range Complex C. Construction-related activities such as grubbing, excavation, and soil removal would significantly impact 14 historic properties. These historic properties include 5 pre-World War II Japanese Administration sites, 2 World War II-era Japanese defensive sites, and 7 World War II American military sites. No impacts would occur to resources of cultural importance at Range Complex C due to construction. As stated above, indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary.

***Range Complex D*:** As described in Section 2.4.1, *Tinian Alternatives*, ground ranges would be constructed and 20 temporary roofless structures would be installed at the Urban Assault Complex in Range Complex D. A Landing Zone, an Unmanned Aircraft Systems Ground Station, and the Forward Arming and Refueling Point would be located on existing cleared runways associated with North Field and would not require vegetation clearing or ground disturbance. The Drop Zone would be cleared of vegetation. Historic assets, such as runways and remnant structures, would be avoided during construction. However, ground disturbance from grading, grubbing, and soil removal would occur in between these assets along interior roadways and at proposed target areas. These construction-related activities would have a significant direct impact to three historic properties, all World War II American military archaeological sites. One of the properties, the North Field runways and associated surrounding areas, is a contributing feature to the North Field National Historic Landmark. Although the runways themselves would be avoided, the surrounding area would be disturbed by construction and vegetation clearing. Therefore, the Landmark would be significantly impacted by ground disturbance associated with the construction of the target areas and a portion of the Convoy Course. The vegetation clearance at the existing runways, however, is considered to be a beneficial impact as it prevents deterioration of the pavement and restores the area to its historic appearance.

No resources of cultural importance were identified within Range Complex D. As stated above, indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary.

***Military Lease Area-wide Training Assets and Support Facilities Outside of the Range Complexes*:** As described in Section 2.4.1, *Tinian Alternatives,* construction associated with Tinian Alternative 1 would include support facilities (e.g., base camp, Munitions Storage Area), road improvements, utility improvements, and Military Lease Area-wide training assets (e.g., Convoy Course, Tracked Vehicle Driver's Course, Tactical Amphibious Training Areas). Construction-related activities would have a significant direct impact to the following 120 historic properties:

- Eight historic properties would be significantly impacted by grading, excavation, and soil removal associated with road construction and grubbing associated with vegetation clearance of the proposed Convoy Course Engagement Areas. These historic properties include three pre-World War II Japanese Administration sites, two World War II-era Japanese defensive sites, and three World War II American military sites.
- Three historic properties would be significantly impacted by grading, excavation and soil removal within the proposed Munitions Storage Area. These historic properties are pre-World War II Japanese Administration sites.
- Eighty-six historic properties would be significantly impacted by grading, excavation, and soil removal through widening of roads, trenching for utility lines, erection of fences, and improvements for the Tracked Vehicle Driver's Course. These historic properties include 4 Pre-Contact *latte* sites, 5 Pre-Contact ceramic scatters, 2 Pre-Contact cave sites, 29 pre-World War II Japanese Administration sites, 17 World War II-era Japanese defensive sites, and 29 World War II American military sites.
- One historic property, West Field, would be significantly impacted by grading, excavation, and soil removal within the proposed base camp.
- Three historic properties at the tactical amphibious training areas would be significantly impacted by grading, excavation, and soil removal associated with road construction and heavy machinery use during construction activities, including the World War II landing beach at Unai Chulu, a traditional cultural property, and a *latte* site.
- Nineteen historic properties would be significantly impacted by grading, excavation, and soil removal associated with construction at artillery firing points, surface radar locations, and Observation Posts, and grubbing and clearing at the landing zones. These historic properties would include 1 Pre-Contact *latte* site, 8 pre-World War II Japanese Administration sites, 4 World War II-era Japanese defensive sites, and 6 World War II American military sites.

Most of the significant impacts associated with these properties occur because of the construction of fences and roads or the grubbing associated with the clearance of landing areas and Observation Posts. As these are large, dispersed sites occurring throughout the Military Lease Area, complete avoidance is not possible. However, in most cases, only a portion of the site would be impacted by the proposed action. Existing roads surrounding the North Field National Historic Landmark, which are recommended as contributing features to the cultural landscape, would be improved for public access and for use by the Convoy Course and the Tracked Vehicle Driver's Course. Improvement of poorly maintained roads would be a beneficial impact to the Landmark; however, grubbing and clearing associated with the construction of the roads would have a significant direct impact to other historic properties.

Additionally, as described in Section 2.4.1, *Tinian Alternatives*, under Tinian Alternative 1, an amphibious landing area would be constructed at Unai Chulu. Construction would occur at the access roads leading to the beach and on an area off shore, where an amphibious landing ramp would be constructed to assist in Amphibious Assault Vehicle training operations. Heavy machinery would be used on the beach and a construction laydown area would be placed behind the beach in an area of low archaeological sensitivity as defined through archaeological testing (Athens 2009). Ground disturbance associated with the use of heavy machinery on the beach and on the existing access roads would have a significant direct impact on three historic properties. Unai Chulu, in addition to being a contributing feature of the North Field National Historic Landmark, also includes a Pre-Contact *latte* site and is considered a potential traditional cultural property. A permanent change in the setting of the beach would be a significant impact to these historic properties. An additional staging area would be located at North Field on an existing cleared runway, which would not impact the runways or the Landmark since it would be temporary and not involve ground disturbance.

An underwater study (Burns 2010) identified a series of magnetic anomalies that potentially represent a submerged cultural resource (e.g., an Amphibious Assault Vehicle, portions of a shipwreck, or historic debris) within the area of proposed dredging around the ramp at Unai Chulu. Marine biological surveys in the area have identified anchors and remnants of World War II-era amphibious assault vehicles. Depending upon the type of submerged cultural resource, it could be managed under the Sunken Military Craft Act, as well as the National Historic Preservation Act.

The purpose of the Sunken Military Craft Act is to protect sunken military vessels and aircraft and the remains of their crews from unauthorized disturbance. This statute confirms that these vessels are sovereign property and provides for archaeological research permits and civil enforcement measures, including substantial penalties, to prevent unauthorized disturbance. Under the Sunken Military Craft Act, a permit is required before any disturbance or investigations can occur to a sunken military craft. Wreck sites that are not entire aircraft or ships, but are parts strewn in a debris field are considered archaeological sites and are managed in accordance with the National Historic Preservation Act. Further investigation would be required to identify the nature of the anomalies. To the degree possible, these anomalies would be avoided during construction. If they cannot be avoided, identification efforts would be conducted to determine whether the anomalies represent a historic property. Therefore, construction of an amphibious landing ramp may impact submerged historic properties.

No resources of cultural importance were identified within the construction areas for these training assets. As stated above, indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary.

Construction of the amphibious landing ramp would likely cause a change in the local fish populations; some populations could decrease, while others may increase (see *Marine Biology*, Section 4.10.3.1). As this change would be temporary during the construction process, the impact would be less than significant.

Outside the Military Lease Area: As described in Section 2.4.1, *Tinian Alternatives,* construction-related activities outside of the Military Lease Area would occur in an area immediately north of the Tinian International Airport runways and at the Port of Tinian, as well as along roads modified to accommodate Tracked Vehicle Transit Lanes and a Supply Route. All of the areas proposed for development at the Port of Tinian and along the Tracked Vehicle Transit Lanes and Supply Route have been surveyed. Construction-related activities such as clearing, excavation, and soil removal as well as grubbing and vegetation clearance of roadways and port and aircraft support structures would have a significant direct impact to 6 historic properties, which include 2 Pre-Contact sites (ceramic/artifact scatters), 3 pre-World War II Japanese Administration sites, and 1 World War II American military site.

No resources of cultural importance were identified within the proposed construction areas for these training assets. As stated above, indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary.

Significant direct impacts to historic properties and resources of cultural importance would result from construction associated with Tinian Alternative 1. This alternative would have a significant direct impact to 172 historic properties in the Military Lease Area, immediately north of the Tinian International Airport runways, and at the Port of Tinian. Historic properties include the North Field National Historic Landmark; Pre-Contact *latte* sites, pottery scatters, and rock shelters; pre-World War II Japanese farms (primarily concrete foundations, cisterns) and shrines; and World War II-era Japanese and American military sites. However, as RTA design is finalized, the Department of Defense will seek to further avoid or minimize impacts on historic properties and resources of cultural importance.

Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.

4.11.3.1.2 Operation Impacts

As described in Section 2.4.1, *Tinian Alternatives,* under Tinian Alternative 1, training facility operations and maintenance would occur within the Military Lease Area, immediately north of the Tinian International Airport runways, and at the Port of Tinian. Live-fire and aviation training would occur at Range Complex A; vehicle-mounted and dismounted (i.e., foot) training involving firing at stationary and moving targets by rifles, machine guns and rocket launchers would occur at Range Complex B; platoon level training involving firing at targets with rifles and inert grenades, rockets, and mortars at Range Complex C; and aviation training and ground training would occur at Range Complex D. The ground training at Range Complex D would involve mostly foot traffic and use of rifles and inert ammunition for grenade launchers, mortars, and rockets.

Other operations within the Military Lease Area would include use of firing points into the High Hazard Impact Area, Convoy Course engagement areas, landing zones, Observation Posts and radar sites, and foot and vehicle traffic on roads and the Tracked Vehicle Driver's Course. In general, the footprint for operations is very similar to construction footprints and most ground disturbance and impacts to historic properties and resources of cultural importance would occur during construction of the RTA. Therefore, since disturbance to historic properties has been accounted for in the ranges under construction impacts, impacts to historic properties from training operations at the Range Complexes B, C, and D will focus on training maneuvers. Training maneuvers concern vehicle and foot traffic within areas; no digging would occur within maneuver areas. However, potential ground disturbance to historic properties in Range Complex A is larger than the footprint for construction and could occur throughout the High Hazard Impact Area.

Table 4.11-2 summarizes the historic properties impacted by operations for Tinian Alternative 1; impacts associated with construction are summarized in Table 4.11-1. In Range Complex A, 12 sites, also impacted by construction activities under Tinian Alternative 1, would be significantly impacted by operations.

During training events, foot and vehicle maneuvering would occur within range complexes, Tracked Vehicle Driver's Course, Convoy Course, maneuver areas, and roads. Vehicle traffic would be confined to established roads and trails that are designed to avoid historic properties and, therefore, would not impact historic properties. Use of historic roads associated with the North Field National Historic Landmark by convoys and other vehicles would be in keeping with existing use and would not impact this historic property. Tracked vehicles would use newly constructed gravel roads adjacent to the historic roads to prevent damage. Impacts to historic properties from foot traffic would be minimal, as it would occur primarily on roads and designated pathways or sporadically throughout the maneuver areas.

Table 4.11-2. Tinian Alternative 1 Summary of Significant Direct Impacts on Historic Properties from Operations

Complex	***Range***	***Number of Historic Properties***
Range Complex A	High Hazard Impact Area	12*
Range Complex B	Multi-purpose Training Range, Combat Pistol Range, Anti-armor Tracking Range, Battle Site Zero Range	0
Range Complex C	Infantry Platoon Battle Course, Field Fire Range, Multi-purpose Automated Unknown Distance Range	0
Range Complex D	Northern Battle Area Complex, Urban Assault Course	0
Military Lease Area-wide Training Assets and Support Facilities Outside of the Range Complexes	Convoy Course Engagement Areas	0
	Munitions Storage Area	0
	Roads, Fences, and Utilities, Tracked Vehicle Driver's Course	0
	Base Camp	0
	Tactical Amphibious Training Areas	3
	Landing Zones, Artillery Firing Points, Observation Posts, Surface Radar Sites	0
Outside Military Lease Area	Tinian International Airport	0
	Port of Tinian	0
	Tracked Vehicle Transit Lanes/Supply Route	0
	Total	**15**

Note: *All of these sites are also impacted under construction, but are located outside of the area of proposed ground disturbance for construction. Sites solely in the construction area are not included in this total.

Various types of tactical amphibious training would occur at four beaches—Unai Chulu, Unai Babui, Unai Masalok, and Unai Lam Lam. Training at Unai Chulu would involve Amphibious Assault Vehicles, Landing Craft Air Cushion vessels, inflatable boats, and combat swimmers. Training at Unai Babui and Unai Masalok would involve the use of Landing Craft Air Cushion vessels, combat swimmers, and inflatable boats. Amphibious training at Unai Lam Lam would involve inflatable boats and combat swimmers. No impacts would occur to historic properties associated with these beaches due to training operations. Training and range management activities associated with Tinian Alternative 1 would have a significant direct impact to three historic properties, the landing beach at Unai Chulu, which is part of the North Field National Historic Landmark, a traditional cultural property, and a *latte* site due to ground disturbance caused by Amphibious Assault Vehicle traffic. However, the beach would be restored to its original appearance by contouring and cleaning up expended materials at the end of the exercises (see Section 4.11.2, *Resource Management Measures*). As much as possible impacts to the *latte* site would be avoided by using existing and newly constructed roads.

Within the surface danger zones, which are safety buffers that surround target areas and live-fire maneuver areas and would contain projectiles, fragments, debris and components resulting from the firing of weapons, the potential for direct impacts from strikes from stray rounds is extremely low. The ranges would be designed to contain live-fire inside the boundaries to minimize the potential for rounds landing outside the surface danger zones. Additionally, if a stray round were to escape the ranges, the chance of it hitting a historic property is remote, given the large size of the surface danger zones and dispersal of historic properties.

Resources of cultural importance, such as cemeteries, memorials, or potential areas with medicinal plants, would not be directly impacted at these training assets by training operations.

In general, public access would be allowed to all locations except for the High Hazard Impact Area, the Munitions Storage Area, the base camp, and the Observation Posts and Surface Radar sites, when training is not occurring. It is envisioned that public access to some or all areas of the RTA, with the exceptions mentioned above, would occur during a couple of daylight hours on a nearly daily basis during the 20 weeks of live-fire training. A range control facility and dedicated range scheduler would be in place to assess public access in real-time and to provide advance notice of public access dates, time frames, and areas. Range control and the scheduler would coordinate public access directly with the Tinian Mayor's Office and other interested parties, such as ranchers and entities within the tourism industry. Access procedures would be implemented to ensure safety and provide guidance and direction. Therefore, intermittent and temporary loss of public access is not considered a significant indirect impact to cultural resources. Historic properties within the High Hazard Impact Area, base camp, Munitions Storage Area, and the Observation Posts and Surface Radar sites would already have been significantly impacted by construction activities and loss of access to these areas would be a less than significant impact.

The roundabout, a portion of Broadway Avenue, which is an entrance to the North Field National Historic Landmark and a contributing feature to the cultural landscape, would be closed permanently by the use of the High Hazard Impact Area of Range Complex A. This closure would be permanent and would be a significant indirect impact to the Landmark.

The permanent presence of Observation Posts and surface radar sites would not be visible to most historic properties. However, towers associated with Surface Radar sites would be constructed at Unai Babui and near Unai Dankulo. As discussed in Section 4.12.3.1, *Visual Resources*, a Surface Radar site would be constructed adjacent and south of Unai Dankulo and would be visible from the beach, which is a traditional cultural property. Another Surface Radar Site would be constructed within a *latte* site at Unai Babui. The permanent location of these towers would have a significant indirect impact to these historic properties.

Construction of the amphibious landing ramp would likely cause a change in the local fish populations through a permanent loss in coral reef habitat. Some populations could decrease, while others may increase (see, Section 4.10.3.1, *Marine Biology*). As this shoreline is part of a traditional cultural property associated with fishing, this change would be a significant indirect impact to the historic property.

Significant direct impacts would result from operational activities under Tinian Alternative 1. Twelve historic properties, also impacted by construction, would be significantly impacted by operations in Range Complex A. Three historic properties at Unai Chulu may be significantly impacted by training operations. However, as RTA design is finalized, the Department of Defense would seek to further avoid or minimize impacts to historic properties and other resources of cultural importance.

Significant indirect impacts to historic properties would occur to the North Field National Historic Landmark due to closure of the roundabout on Broadway Avenue, to historic properties at Unai Babui and Unai Dankulo due to the permanent presence of surface radar towers, and to the traditional cultural property at Unai Chulu from changes in the fish populations from the landing ramp construction for amphibious training.

Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.

4.11.3.2 Tinian Alternative 2

4.11.3.2.1 Construction Impacts

As described in Section 2.4.3, Tinian Alternative 2 construction activities would occur within the Military Lease Area, immediately north of Tinian International Airport runways, and at the Port of Tinian. Tinian Alternative 2 construction activities would occur within the same areas as Tinian Alternative 1, but would accommodate an additional Battle Area Complex (Range Complex C) and five additional Convoy Course Engagement Areas. This development and construction would result in 2,025 acres (820 hectares) (see Table 2.4-8) of ground disturbance (e.g., vegetation clearing, grubbing, grading, excavation, and filling), and impact historic properties and resources of cultural importance. Table 4.11-3 summarizes the 182 historic properties that would be impacted by construction-related activities for Tinian Alternative 2, which is slightly more than the 172 impacted under Tinian Alternative 1. Specific impacts to historic properties and resources of cultural importance are described in more detail by RTA or construction project below and in Appendix N, *Cultural Resources Technical Memo*.

Table 4.11-3. Tinian Alternative 2 Summary of Significant Direct Impacts on Historic Properties from Construction

Complex	*Range*	*Number of Historic Properties*
Range Complex A	High Hazard Impact Area	20
Range Complex B	Multi-purpose Training Range, Combat Pistol Range, Anti-armor Tracking Range, Battle Site Zero Range	9
Range Complex C	Southern Battle Area Complex: Infantry Platoon Battle Course, Field Fire Range, Multi-purpose Automated Unknown Distance Range, Urban Assault Course	25
Range Complex D	Northern Battle Area Complex, Urban Assault Course	3
Military Lease Area-wide Training Assets and Support Facilities Outside of the Range Complexes	Convoy Course Engagement Areas	7
	Munitions Storage Area	3
	Roads, Fences, and Utilities, Tracked Vehicle Driver's Course	86
	Base Camp	1
	Tactical Amphibious Training Areas	3
	Landing Zones, Artillery Firing Points, Observation Posts, Surface Radar Sites	19
Outside Military Lease Area	Tinian International Airport	2
	Port of Tinian	0
	Tracked Vehicle Transit Lanes/Supply Route	4
	Total	**182**

Range Complex A: Construction-related activities such as grubbing, grading, excavation, and soil removal at Range Complex A under Tinian Alternative 2 would be the same as under Tinian Alternative 1 and would have a significant direct impact to the same 20 historic properties and the same resources of cultural importance (native limestone forest and two memorials) discussed in Section 4.11.3.1, *Tinian Alternative 1.* Indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary. The roundabout, a portion of Broadway Avenue, which is an entrance way to the North Field National Historic Landmark and a contributing feature to the cultural landscape, would be closed during construction of Range Complex A target objectives. This closure would be temporary and the impact would be less than significant.

Range Complex B: Construction-related activities at Range Complex B under Tinian Alternative 2 would be the same as under Tinian Alternative 1 and would have a significant direct impact to the same 9 historic properties as described in Section 4.11.3.1, *Tinian Alternative 1*. No resources of cultural importance were identified within Range Complex B.

Range Complex C: Construction-related activities at Range Complex C under Tinian Alternative 2 would be similar to those described under Tinian Alternative 1 except for the addition of a southern area Battle Complex and the associated Urban Assault Course. As described in Section 2.4.1, *Tinian Alternatives*, ground ranges, roadways, and 20 temporary roofless structures would be constructed in Range Complex C. Construction-related activities such as vegetation clearing, excavation, and soil removal would have a significant direct impact to 25 historic properties, compared to the 14 impacted under Tinian Alternative

1. These historic properties would include 1 Pre-Contact site, 14 pre-World War II Japanese Administration sites, 1 World War II-era Japanese defensive site, and 9 World War II American military sites. Most of these significant impacts occur because of the construction of roads to the target areas. Since sites in this area tend to be large and dispersed, complete avoidance is not possible. However, in most cases only a portion of the site would be impacted by the proposed action. No resources of cultural importance were identified within Range Complex C. Indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary.

Range Complex D: Construction-related activities under Tinian Alternative 2 would be the same as under Tinian Alternative 1 and would have a significant direct impact to three historic properties, all World War II American military archaeological sites. One of the properties, the North Field runways and associated surrounding areas, is a contributing feature to the North Field National Historic Landmark. Although the runways themselves would be avoided, the surrounding area would be disturbed by construction and vegetation clearing. Therefore, the Landmark would be significantly impacted by ground disturbance associated with the construction of the target areas and a portion of the Convoy Course. Vegetation clearance at the existing runways within the proposed Drop Zone, however, is considered to be a beneficial impact as it prevents deterioration of the pavement and restores the area to its historic appearance.

No resources of cultural importance were identified within Range Complex D. Indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increases during construction would be less than significant as they would be intermittent and temporary.

Military Lease Area-wide Training Assets and Support Facilities Outside of the Range Complexes: Construction associated with Military Lease Area-wide assets under Tinian Alternative 2 would be similar to Tinian Alternative 1 (Section 4.11.3.1), but would also include five additional Convoy Engagement Areas. It would have a significant direct impact to 119 historic properties, one less than under Tinian Alternative 1. The historic properties would include 13 Pre-Contact sites (6 *latte* sites, 5 ceramic scatters, and 2 rock overhangs/caves), 43 pre-World War II Japanese Administration sites, 23 World War II-era Japanese defensive sites, 39 World War II American military sites, and 1 traditional cultural property. Most of these significant impacts occur because of the construction of roads. Since sites in this area tend to be large and dispersed, complete avoidance is not possible. However, in most cases only a portion of the site would be impacted by the proposed action. Existing roads surrounding the North Field National Historic Landmark, which are recommended as contributing features to the cultural landscape, would be improved for public access and for use by the Convoy Course and the Tracked Vehicle Driver's Course. Improvement of poorly maintained roads would be a beneficial impact to the Landmark; however, grubbing and clearing associated with the construction of the roads would have a significant direct impact to other historic properties.

Additionally under Tinian Alternative 2, construction activities at the amphibious landing beach at Unai Chulu, would be the same as under Tinian Alternative 1 (Section 4.11.3.1) and would have a significant direct impact to the same three historic properties (the landing beach, which is part of the North Field National Historic Landmark and would constitute a significant impact to the Landmark, a potential traditional cultural property, and a *latte* site) as described in Section 4.11.3.1, *Tinian Alternative 1*. A permanent change in the setting of the beach would be a significant impact to the potential traditional cultural property. An additional staging area would be located at North Field on an existing cleared runway, which would not impact the runways or the Landmark since it would be temporary and not involve ground disturbance. Construction of an amphibious landing ramp may impact submerged historic properties.

No resources of cultural importance were identified within these training asset areas. As stated above, indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary. Construction of the amphibious landing ramp would likely cause a change in the local fish populations; some populations could decrease, while others may increase (see Section 4.10.3.1, *Marine Biology*). As this change would be temporary during the construction process, the impact would be less than significant.

***Outside the Military Lease Area*:** Construction-related activities outside of the Military Lease Area would occur in an area immediately north of the Tinian International Airport runways and at the Port of Tinian, as well as along roads modified to accommodate the Tracked Vehicle Transit Lanes and a Supply Route. These activities would be the same as under Tinian Alternative 1. Construction-related activities such as clearing, excavation, and soil removal as well as vegetation clearance of roadways and port and aircraft support structures would significantly impact the same six historic properties as described in Section 4.11.3.1, *Tinian Alternative 1*.

No resources of cultural importance were identified within these training asset areas. Indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary.

Tinian Alternative 2 construction activities would result in significant direct impacts to historic properties and resources of cultural importance. Construction would significantly impact 182 historic properties in the Military Lease Area, immediately north of the Tinian International Airport runways, and the Port of Tinian. Historic properties include the North Field National Historic Landmark; Pre-Contact *latte* sites, pottery scatters, and rock shelters; pre-World War II Japanese farms and shrines; and World War II-era Japanese and American military sites. However, as RTA design is finalized, the Department of Defense will seek to further avoid or minimize impacts to historic properties and resources of cultural importance.

Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.

4.11.3.2.2 Operation Impacts

As described in Section 2.4.3, Tinian Alternative 2 operations and maintenance would occur within the Military Lease Area, immediately north of the Tinian International Airport runways, and at the Port of

Tinian. In general, the footprint for operations is very similar to construction footprints and most ground disturbance and impacts to historic properties and resources of cultural importance would occur during construction of the RTA. Therefore, since disturbance to historic properties has been accounted for in the ranges under construction impacts, impacts to historic properties from training operations at the Range Complexes B, C, and D will focus on training maneuvers. Training maneuvers concern vehicle and foot traffic within areas; no digging would occur within maneuver areas. However, potential ground disturbance to historic properties in Range Complex A is larger than the footprint for construction and could occur throughout the High Hazard Impact Area. Table 4.11-4 summarizes the historic properties impacted by operations for Tinian Alternative 1; impacts associated with construction are summarized in Table 4.11-3. In Range Complex A, 12 sites, also impacted by construction, would be significantly impacted by operations.

Use of historic roads associated with the North Field National Historic Landmark by convoys and other vehicles would be in keeping with existing use and would not impact this historic property. Tracked vehicles would use newly constructed gravel roads adjacent to the historic roads to prevent damage. Impacts to historic properties from foot traffic would be minimal, as it would occur primarily on roads and designated pathways or sporadically throughout the maneuver areas.

Table 4.11-4. Tinian Alternative 2 Summary of Significant Direct Impacts on Historic Properties from Operations

Complex	*Range*	*Number of Historic Properties*
Range Complex A	High Hazard Impact Area	12*
Range Complex B	Multi-purpose Training Range, Combat Pistol Range, Anti-armor Tracking Range, Battle Site Zero Range	0
Range Complex C	Southern Battle Area Complex: Infantry Platoon Battle Course, Field Fire Range, Multi-purpose Automated Unknown Distance Range, Urban Assault Course	0
Range Complex D	Northern Battle Area Complex, Urban Assault Course	0
Military Lease Area-wide Training Assets and Support Facilities Outside of the Range Complexes	Convoy Course Engagement Areas	0
	Munitions Storage Area	0
	Roads, Fences, and Utilities, Tracked Vehicle Driver's Course	0
	Base Camp	0
	Tactical Amphibious Training Areas	3
	Landing Zones, Artillery Firing Points, Observation Posts, Surface Radar Sites	0
Outside Military Lease Area	Tinian International Airport	0
	Port of Tinian	0
	Tracked Vehicle Transit Lanes/Supply Route	0
	Total	**15**

Note: *All of these sites are also impacted under construction, but are located outside of the area of proposed ground disturbance for construction. Sites solely in the construction area are not included in this total.

Training and range management activities associated with Tinian Alternative 2 would have a significant direct impact to three historic properties, the landing beach at Unai Chulu, which is part of the North Field National Historic Landmark a traditional cultural property, and a *latte* site due to ground disturbance caused by Amphibious Assault Vehicle traffic. However, the beach would be restored to its original appearance by contouring and cleaning up expended materials at the end of the exercises (see Section 4.11.2, *Resource Management Measures*). As much as possible impacts to the *latte* site would be avoided by using existing and newly constructed roads.

Within the surface danger zones, which are safety buffers that surround target areas and live-fire maneuver areas and would contain projectiles, fragments, debris and components resulting from the firing of weapons, the potential for direct impacts from strikes from stray rounds is extremely low. The ranges would be designed to contain live-fire inside the boundaries to minimize the potential for rounds landing outside the surface danger zones. Additionally, if a stray round were to escape the ranges, the chance of it hitting a historic property is remote, given the size of the surface danger zones and dispersal of historic properties.

In general, public access would be allowed to all locations except for the High Hazard Impact Area, the Munitions Storage Area, the base camp, and the Observation Posts and Surface Radar sites, when training is not occurring. It is envisioned that public access to some or all areas of the RTA, with the exceptions mentioned above, would occur during a couple of daylight hours on a nearly daily basis during the 20 weeks of live-fire training. A range control facility and dedicated range scheduler would be in place to assess public access in real-time and to provide advance notice of public access dates, time frames, and areas. Range control and the scheduler would coordinate public access directly with the Tinian Mayor's Office and other interested parties, such as ranchers and entities within the tourism industry. Access procedures would be implemented to ensure safety and provide guidance and direction. Therefore, intermittent and temporary loss of public access is not considered a significant indirect impact to cultural resources. Historic properties with the High Hazard Impact Area, base camp, Munitions Storage Area, and the Observation Posts and Surface Radar sites would already have been significantly impacted by construction activities and loss of access to these areas would be less than significant.

No resources of cultural importance were identified within these training asset areas.

The roundabout, a portion of Broadway Avenue, which is an entrance to the North Field National Historic Landmark and a contributing feature to the cultural landscape, would be closed permanently by the use of the High Hazard Impact Area of Range Complex A. This closure would be a significant indirect impact to the Landmark.

The permanent presence of Observation Posts and Surface Radar sites would not be visible to most historic properties. However, towers associated with Surface Radar sites would be constructed at Unai Babui and near Unai Dankulo. As discussed in Section 4.12.3.1, *Visual Resources*, a Surface Radar site would be constructed adjacent and south of Unai Dankulo and would be visible from the beach, which is a traditional cultural property. Another Surface Radar site would be constructed within a *latte* site at Unai Babui. The permanent location of these towers would have a significant indirect impact to these historic properties.

Construction of the ramp at Unai Chulu would likely cause a change in the local fish populations through a permanent loss in coral reef habitat. Some populations could decrease, while others may increase (see Section 4.10, *Marine Biology*). As this shoreline is part of a potential traditional cultural property associated with fishing, this change would be a significant indirect impact to the historic property.

Significant direct impacts would result from operational activities under Tinian Alternative 2. As discussed under Tinian Alternative 1, 12 historic properties within Range Complex A and three historic properties at Unai Chulu (the landing beach associated with the North Field National Historic Landmark, a potential traditional cultural property, and a *latte* site) would be significantly impacted in the area of potential effects. Significant indirect impacts would occur to the North Field National Historic Landmark from the permanent closure of the roundabout on Broadway Avenue, to a *latte* site and a potential traditional cultural property (Unai Dankulo) from visual impacts due to Surface Radar sites, and to a potential traditional cultural property (Unai Chulu) from changes in fish populations due to ramp construction. However, as RTA design is finalized, the Department of Defense would seek to further avoid or minimize impacts to historic properties and other resources of cultural importance.

Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.

4.11.3.3 Tinian Alternative 3

4.11.3.3.1 Construction Impacts

As described in Section 2.4.4, Tinian Alternative 3 RTA development and construction would result in 2,003 acres (811 hectares) (see Table 2.4-8) of ground disturbance (e.g., vegetation clearing, grubbing, grading, excavation, and filling), and impact historic properties and resources of cultural importance. Tinian Alternative 3 construction activities would occur within the same areas as Tinian Alternative 1, but would accommodate an additional Battle Area Complex (Range Complex C) and five additional Convoy Course Engagement Areas. Only a Drop Zone would be established in Range Complex D. Table 4.11-5 summarizes the 179 historic properties that would be directly impacted by construction-related activities for Tinian Alternative 3; 7 more than under Tinian Alternative 1. Specific impacts to historic properties and resources of cultural importance are described in more detail by RTA or construction project below and in Appendix N, *Cultural Resources Technical Memo*.

Table 4.11-5. Tinian Alternative 3 Summary of Significant Direct Impacts on Historic Properties from Construction

Complex	*Range*	*Number of Historic Properties*
Range Complex A	High Hazard Impact Area	20
Range Complex B	Multi-purpose Training Range, Combat Pistol Range, Anti-armor Tracking Range, Battle Site Zero Range	9
Range Complex C	Southern Battle Area Complex: Infantry Platoon Battle Course, Field Fire Range, Multi-purpose Automated Unknown Distance Range, Urban Assault Course	25
Range Complex D	Drop Zone	0
Military Lease Area-wide Training Assets and Support Facilities Outside of the Range Complexes	Convoy Course Engagement Areas	7
	Munitions Storage Area	3
	Roads, Fences, and Utilities, Tracked Vehicle Driver's Course	86
	Base Camp	1
	Tactical Amphibious Training Areas	3
	Landing Zones, Artillery Firing Points, Observation Posts, Surface Radar Sites	19
Outside Military Lease Area	Tinian International Airport	2
	Port of Tinian	0
	Tracked Vehicle Transit Lanes/Supply Route	4
	Total	**179**

Range Complex A. Construction-related activities such as grubbing, grading, excavation, and filling at Range Complex A under Tinian Alternative 3 would be the same as under Tinian Alternative 1 and would have a significant direct impact to the same 20 historic properties and the same resources of cultural importance (native limestone forest and two memorials) as described in Section 4.11.3.1. Indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary. The roundabout, a portion of Broadway Avenue, which is an entrance to the North Field National Historic Landmark and a contributing feature to the cultural landscape, would be closed during construction of Range Complex A target objectives. This closure would be temporary and the impact would be less than significant.

Range Complex B. Construction-related activities at Range Complex B under Tinian Alternative 3 would be the same as under Tinian Alternative 1 and would have a significant impact to the same nine historic properties as described in Section 4.11.3.1. No resources of cultural importance were identified within Range Complex B.

Range Complex C. Construction-related activities under Tinian Alternative 3 would be similar to that under Tinian Alternative 1 except that there would be the construction of a southern Battle Area Complex and associated Urban Assault Course. Construction-related activities such as clearing, excavation, and soil removal would have a significant impact to 25 historic properties (see Table 4.11-5), compared to the 14 impacted under Tinian Alternative 1. Most of these impacts occur because of the construction of roads to the target areas. Since sites in this area tend to be large and dispersed, complete avoidance is not possible. However, in most cases only a portion of the site would be impacted by the proposed action. No resources of cultural importance were identified within Range Complex C. Indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary.

***Range Complex D*:** No construction would be conducted at Range Complex D under Tinian Alternative 3, although vegetation would be cleared around the runways similar to Tinian Alternative 1. This vegetation clearance is considered to be a beneficial impact as it prevents deterioration of the historic runways, which are a contributing feature to the North Field National Historic Landmark and restores the area to its historic appearance. Therefore, no significant impacts due to construction would occur at Range Complex D.

***Military Lease Area-wide Training Assets and Support Facilities Outside of the Range Complexes*:** Construction associated with Military Lease Area-wide assets under Tinian Alternative 3 would be similar to Tinian Alternative 1 (Section 4.11.3.1), but would include additional road improvements. It would significantly impact 119 historic properties; one less than under Tinian Alternative 1 (see Table 4.11-5). The historic properties would include 13 Pre-Contact sites (6 *latte* sites, 5 ceramic scatters, and 2 rock overhangs/caves), 43 pre-World War II Japanese Administration sites, 23 World War II-era Japanese defensive sites, 39 World War II American military sites, and 1 potential traditional cultural property. Most of these significant impacts occur because of the construction of roads. Since sites in this area tend to be large and dispersed, complete avoidance is not possible. However, in most cases only a portion of the site would be impacted by the proposed action. Existing roads surrounding the North Field National Historic Landmark, which are recommended as contributing features to the cultural landscape, would be improved for public access and for use by the Convoy Course and the Tracked Vehicle Driver's Course. Improvement of poorly maintained roads would be a beneficial impact to the Landmark; however, grubbing and clearing associated with the construction of the roads would have a significant direct impact to other historic properties.

Under Tinian Alternative 3, construction activities at the amphibious training area at Unai Chulu would be the same as under Tinian Alternative 1 and would have a significant direct impact to the same three historic properties (the landing beach, which is part of the North Field National Historic Landmark and would constitute a significant impact to the Landmark, a traditional cultural property, and a *latte* site) as described in Section 4.11.3.1. An additional staging area would be located at North Field on an existing cleared runway, which would not impact the runways or the Landmark since it would be temporary and not involve ground disturbance. Construction of an amphibious landing ramp may impact submerged historic properties.

No resources of cultural importance were identified within these training asset areas. As stated above, indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary. Construction of the amphibious landing ramp would likely cause a change in the local fish populations; some populations could decrease, while others may increase (see Section 4.10, *Marine Biology*). As this change would be temporary during the construction process, the impact would be less than significant.

Outside the Military Lease Area: Construction-related activities outside of the Military Lease Area would occur in an area immediately north of the Tinian International Airport runways and at the Port of Tinian, as well as along roads modified to accommodate the Tracked Vehicle Transit Lanes and a Supply Route These activities would be the same as under Tinian Alternative 1. Construction-related activities such as clearing, excavation, and soil removal as well as vegetation clearance of roadways and port and aircraft support structures would significantly impact the same six historic properties as described in Section 4.11.3.1, *Tinian Alternative 1.*

No resources of cultural importance were identified within these training assets. Indirect impacts to historic properties and resources of cultural importance due to visual intrusions, access restrictions during construction, and noise increase during construction would be less than significant as they would be intermittent and temporary.

Significant direct impacts from construction would occur under Tinian Alternative 3 to historic properties and resources of cultural importance. Tinian Alternative 3 would significantly impact 179 historic properties in the Military Lease Area, immediately north of the Tinian International Airport runways, and at the Port of Tinian. Historic properties include the North Field National Historic Landmark; Pre-Contact *latte* sites, pottery scatters, and rock shelters; pre-World War II Japanese farms and shrines; and World War II-era Japanese and American military sites. However, as RTA design is finalized, the Department of Defense will seek to further avoid or minimize impacts to historic properties and resources of cultural importance.

Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.

4.11.3.3.2 Operation Impacts

As described in Section 2.4.4, Tinian Alternative 3 operations and maintenance would occur within the Military Lease Area, immediately north of the Tinian International Airport runways, and at the Port of Tinian. In general, the footprint for operations is very similar to construction footprints and most ground disturbance and impacts to historic properties and resources of cultural importance would occur during construction of the RTA. Therefore, since disturbance to historic properties has been accounted for in the ranges under construction impacts, impacts to historic properties from training operations at the Range Complexes B, C, and D will focus on training maneuvers. Training maneuvers concern vehicle and foot traffic within areas; no digging would occur within maneuver areas. However, potential ground disturbance to historic properties in Range Complex A is larger than the footprint for construction and could occur throughout the High Hazard Impact Area. Table 4.11-6 summarizes the historic properties impacted by operations for Tinian Alternative 3; impacts associated with construction are summarized in Table 4.11-5. In Range Complex A, 12 sites, also impacted by construction, would be significantly impacted by operations.

Use of historic roads associated with the North Field National Historic Landmark by convoys and other vehicles would be in keeping with existing use and would not impact this historic property. Tracked vehicles would use newly constructed gravel roads adjacent to the historic roads to prevent damage. Impacts to historic properties from foot traffic would be minimal, as it would occur primarily on roads and designated pathways or sporadically throughout the maneuver areas.

Table 4.11-6. Tinian Alternative 3 Summary of Significant Direct Impacts on Historic Properties from Operations

Complex	***Range***	***Number of Historic Properties***
Range Complex A	High Hazard Impact Area	12*
Range Complex B	Multi-purpose Training Range, Combat Pistol Range, Anti-armor Tracking Range, Battle Site Zero Range	0
Range Complex C	Southern Battle Area Complex: Infantry Platoon Battle Course, Field Fire Range, Multi-purpose Automated Unknown Distance Range, Urban Assault Course	0
Range Complex D	Drop Zone	0
Military Lease Area-wide Training Assets and Support Facilities Outside of the Range Complexes	Convoy Course Engagement Areas	0
	Munitions Storage Area	0
	Roads, Fences, and Utilities, Tracked Vehicle Driver's Course	0
	Base Camp	0
	Tactical Amphibious Training Areas	3
	Landing Zones, Artillery Firing Points, Observation Posts, Surface Radar Sites	0
Outside Military Lease Area	Tinian International Airport	0
	Port of Tinian	0
	Tracked Vehicle Transit Lanes/Supply Route	0
	Total	**15**

Note: *All of these sites are also impacted under construction, but are also located outside of the area of proposed ground disturbance for construction. Sites solely in the construction area are not included in this total.

Training and range management activities associated with Tinian Alternative 3 would have a significant direct impact to three historic properties, the landing beach at Unai Chulu, which is part of the North Field National Historic Landmark and a traditional cultural property, and a *latte* site due to ground disturbance caused by Amphibious Assault Vehicle traffic. However, the beach would be restored to its original appearance by contouring and cleaning up expended materials at the end of the exercises (see Section 4.11.2, *Resource Management Measures*). As much as possible impacts to the *latte* site would be avoided by using existing and newly constructed roads.

Within the surface danger zones, which are safety buffers that surround target areas and live-fire maneuver areas and would contain projectiles, fragments, debris and components resulting from the firing of weapons, the potential for direct impacts from strikes from stray rounds is extremely low. The ranges would be designed to contain live-fire inside the boundaries to minimize the potential for rounds landing outside the surface danger zones. Additionally, if a stray round were to escape the ranges, the chance of it hitting a historic property is remote, given the size of the surface danger zones and dispersal of historic properties.

In general, public access would be allowed to all locations except for the High Hazard Impact Area, the Munitions Storage Area, the base camp, and the Observation Posts and Surface Radar sites, when training is not occurring. It is envisioned that public access to some or all areas of the RTA, with the exceptions mentioned above, would occur during a couple of daylight hours on a nearly daily basis during the 20 weeks of live-fire training. A range control facility and dedicated range scheduler would be in place to assess public access in real-time and to provide advance notice of public access dates, time frames, and areas. Range control and the scheduler would coordinate public access directly with the Tinian Mayor's Office and other interested parties, such as ranchers and entities within the tourism industry. Access procedures would be implemented to ensure safety and provide guidance and direction. Therefore, intermittent and temporary loss of public access is not considered a significant indirect impact to cultural resources. Historic properties with the High Hazard Impact Area, base camp, Munitions Storage Area, and the Observation Posts and Surface Radar sites would already have been significantly impacted by construction activities and loss of access to these areas would be less than significant.

No resources of cultural importance were identified within these training asset areas.

The roundabout, a portion of Broadway Avenue, which is an entrance to the North Field National Historic Landmark and a contributing feature to the cultural landscape, would be closed permanently by the use of the High Hazard Impact Area of Range Complex A. This closure would be a significant indirect impact to the Landmark.

The permanent presence of Observation Posts and Surface Radar sites would not be visible to most historic properties. However, towers associated with Surface Radar sites would be constructed at Unai Babui and near Unai Dankulo. As discussed in *Visual Resources*, Section 4.12.3.1, a Surface Radar Site would be constructed adjacent and south of Unai Dankulo and would be visible from the beach, which is a traditional cultural property. Another Surface Radar Site would be constructed within a *latte* site at Unai Babui. The permanent location of these towers would have a significant indirect impact to these historic properties.

Construction of the amphibious landing ramp at Unai Chulu would likely cause a change in the local fish populations through a permanent loss in coral reef habitat. Some populations could decrease, while others may increase (see Marine Biology, Section 4.10.3.1). As this shoreline is part of a potential traditional cultural property associated with fishing, this change would be a significant indirect impact to the property.

Significant direct impacts would result from operational activities under Tinian Alternative 3. As discussed under Tinian Alternative 1, 12 historic properties within Range Complex A and 3 historic properties at Unai Chulu would be significantly impacted in the area of potential effects. Significant indirect impacts would occur to the North Field National Historic Landmark from the permanent closure of the roundabout on Broadway Avenue, to a *latte* site, and a potential traditional cultural property (Unai Dankulo) from visual impacts due to Surface Radar sites, and to a potential traditional cultural property (Unai Chulu) from changes in fish populations due to ramp construction. However, as RTA design is finalized, the Department of Defense would seek to further avoid or minimized impacts to historic properties and other resources of cultural importance.

Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.

4.11.3.4 Tinian No-Action Alternative

Activities during the periodic military non-live-fire training exercises on Tinian in the Military Lease Area would not impact historic properties and resources of cultural importance as these have been designed to avoid impacts by restricting ground disturbance and to improve historic runways and structures within the North Field National Historic Landmark. Establishing the four ranges on Tinian would result in significant impacts to cultural resources. These impacts were analyzed in the Guam and CNMI Military Relocation EIS and resolved through a Programmatic Agreement (Department of Defense 2011) that identified measures to mitigate significant impacts. Significant impacts to historic properties from the Mariana Islands Range Complex training were analyzed in the Mariana Islands Range Complex EIS and resolved through a Programmatic Agreement (Department of Defense 2009). Through the measures prescribed in these Programmatic Agreements, significant impacts to cultural resources would be resolved.

4.11.3.5 Summary of Impacts for Tinian Alternatives

Table 4.11-7 provides a comparison of the potential impacts to cultural resources for the three Tinian alternatives and the no-action alternative.

Table 4.11-7. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Cultural Resources	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Range Complex A	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*Not applicable*	*Not applicable*
Range Complex B	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*Not applicable*	*Not applicable*
Range Complex C	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*Not applicable*	*Not applicable*
Range Complex D	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*NI*	*LSI*	*Not applicable*	*Not applicable*
Military Lease Area-wide Training Assets and Support Facilities Outside of the Range Complexes	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*Not applicable*	*Not applicable*
Tinian International Airport	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*Not applicable*	*Not applicable*
Outside Military Lease Area	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*Not applicable*	*Not applicable*
Military Lease Area	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*SI mitigated to LSI*	*SI mitigated to LSI*

Legend: *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.11.3.6 Summary of Potential Mitigation Measures for Tinian Alternatives

Table 4.11-8 provides a summary of the potential mitigation measures for cultural resources for the three Tinian alternatives.

Table 4.11-8. Summary of Potential Mitigation Measures for Tinian Alternatives

Impacts	***Category***	***Potential Mitigation Measures***	***Tinian Phase***	
			Construction	***Operation***
CULTURAL RESOURCES				
All Tinian alternatives would have a significant direct impact on historic properties in the Military Lease Area, immediately north of Tinian International Airport runways, and at the Port of Tinian. • Tinian Alternative 1 would have a significant direct impact to 172 historic properties from construction and to 15 historic properties from operations, as well as significant indirect impacts to 4 historic properties. These historic properties include the North Field National Historic Landmark; Pre-Contact *latte* sites, pottery scatters, and rock shelters; pre-World War II Japanese farms and shrines; World War II-era Japanese and American military sites; and potential traditional cultural properties. • Tinian Alternative 2 would have a significant direct impact to 182 historic properties from construction and to 15 historic properties from operations, as well as significant indirect impacts to 4 historic properties. These historic properties include. North Field National Historic Landmark; Pre-Contact *latte* sites, pottery scatters, and rock shelters; pre-World War II Japanese farms and shrines; World War II-era Japanese and American military sites; and potential traditional cultural properties.	*SI mitigated to LSI*	Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.	X	X

Table 4.11-8. Summary of Potential Mitigation Measures for Tinian Alternatives

Impacts	***Category***	***Potential Mitigation Measures***	***Tinian Phase***	
			Construction	***Operation***
• Tinian Alternative 3 would have a significant direct impact to 179 historic properties from construction and to 15 historic properties from operation, as well as significant indirect impacts to 4 historic properties. These historic properties include the North Field National Historic Landmark; Pre-Contact *latte* sites, pottery scatters, and rock shelters; pre-World War II Japanese farms and shrines; World War II-era Japanese and American military sites; and potential traditional cultural properties.				

Legend: *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.11.4 Pagan

4.11.4.1 Pagan Alternative 1

4.11.4.1.1 Construction Impacts

As described in Section 2.5, *Pagan Alternatives*, two High Hazard Impact Areas would be established in the North Range Complex under Pagan Alternative 1. The expeditionary airfield, munitions storage area, and base camp would be developed north of the isthmus. This development and construction would result in 764 acres (310 hectares) (see Table 2.5-6) of ground disturbance (primarily due to vegetation clearance), and potentially impact historic properties and resources of cultural importance. Table 4.11-9 summarizes the historic properties impacted by construction-related activities for Pagan Alternative 1. Specific impacts to historic properties and resources of cultural importance are described in more detail below and in Appendix N, *Cultural Resources Technical Memo.*

Table 4.11-9. Pagan Alternative 1 Summary of Significant Direct Impacts on Historic Properties from Construction

Complex	*Range*	*Number of Historic Properties*
North Range Complex	North High Hazard Impact Area	2
	Landing Zones	2
	Field Artillery Direct and Indirect Fire Ranges/Mortar Firing Positions	4
	Amphibious Training Areas	0
	Live-Fire Maneuver Area	0
	Isthmus High Hazard Impact Area	2*
	Military Training Trails	7
	Airfield/Base Camp/Bivouac Area/Munitions Storage Area	10
South Range Complex	Non-Live-Fire Maneuver Area	0
	Total	**27**

Note: *Although this area has not been surveyed, former residents indicate that two potential historic properties are located in the area of potential effects.

North Range Complex: As described in Section 2.5.2, *Pagan Alternative 1*, construction associated with the High Hazard Impact Area in the north would be minimal; however, 600 acres (243 hectares) would need to be cleared through grubbing for target placement, landing zones, and firing positions. Of this total, about 7 acres (3 hectares) is composed of native forest that would be removed (see Section 4.9, *Terrestrial Biology*). A firebreak would be established along the perimeter of the northern High Hazard Impact Area and eight targets put within the impact area. Although most of this area has not been surveyed, in general, the area is covered by lava to depths of over 30 feet (9.1 meters) from recent volcanic eruptions. Historic properties would not be found on the surface in this area. Outside of the lava area, historic properties tend to be found nearer to the coastal areas. Most of the area of potential effects for the firebreak has been surveyed. Construction-related activities associated with the firebreak under Pagan Alternative 1 would have a significant direct impact to two historic properties including one Pre-Contact artifact scatter and one World War II–era Japanese defensive site. Construction would also impact 7 acres (3 hectares) of native forest which could contain resources of cultural importance, such as medicinal plants. No other resources of cultural importance, such as cemeteries or memorials, would be directly impacted by construction in this area.

Construction associated with High Hazard Impact Area located on the isthmus would likewise be minimal; however, 167 acres (68 hectares) would need to be cleared for target placement. Of this total, about 7 acres (3 hectares) is composed of native forest that would be removed (see Section 4.9, *Terrestrial Biology*). A firebreak would be established along the perimeter and one target would be cleared during construction within the isthmus High Hazard Impact Area. Because of thick vegetation and steep topography, the isthmus area has not been surveyed for archaeological resources, but it does contain two areas identified by former residents as the location of Kannathomhum, a *latte* village located close to the coast, and one unnamed location, which probably contained World War II-era Japanese military features. Other archaeological sites in the area are unlikely based on the steep topography and lack of accessibility to coastal resources. Construction of a firebreak would not significantly impact these resources, but grubbing during vegetation clearance associated with a target would have a significant direct impact to these resources. Construction would also significantly impact 7 acres (3 hectares) of native forest which could contain resources of cultural importance. A resource of cultural importance, a potential area for collecting betel nuts, also could be impacted by construction.

No construction would occur at the amphibious landing beaches or within the Live-Fire Maneuver Area. Eleven landing zones, 1 Field Artillery Direct Firing Range Position, 10 Field Artillery Indirect Firing Positions (8 co-occur with landing zones), and 6 firing points associated with the Mortar Range would be constructed throughout the northern portion of the island. Most of the landing zones and artillery firing points have either been surveyed or are located on lava. Of the 2 unsurveyed landing zones and the 2 unsurveyed firing points associated with the Mortar Range, 3 are located in steep interior areas surrounding Mount Pagan, and 1 is located in the High Hazard Impact Area on the isthmus in an area surrounded by steep topography. Both of these areas have a low potential for containing historic properties. Construction-related activities associated with the clearing and grubbing of landing zones and firing points under Pagan Alternative 1 would have a significant direct impact to six historic properties including one Pre-Contact *latte* site, one pre-World War II Japanese Administration site, and four World War II–era Japanese defensive sites.

A military training trail network would be constructed around the perimeter of the northern portion of Pagan to provide access to the base camp/bivouac area, Landing Zones, and the northern High Hazard Impact Area. A portion of the access road construction would involve the improvement of existing trails, while new trails would be constructed as well. A total of 39 acres (16 hectares) would be cleared and graded in the construction of these trails. Construction-related activities under Pagan Alternative 1 would have a significant direct impact to 7 historic properties including 2 Pre-Contact sites (*latte* sites), 2 pre-World War II Japanese Administration sites, and 3 World War II-era Japanese defensive sites. Given the steep topography of the area which restrict locations of trails (both existing and proposed), it is difficult to avoid known historic properties. Construction would also significantly impact 5 acres (2 hectares) of native forest which could contain resources of cultural importance. No other resources of cultural importance have been identified in this area.

The area adjacent to an existing airfield would contain the expeditionary base camp/bivouac area, interior roads, temporary munitions storage area, and airfield improvements. A grass airfield would be improved, and a temporary munitions storage area would be constructed. These areas would be cleared of vegetation. Construction-related activities such as grading, grubbing, and soil removal would have a significant direct impact to 10 historic properties including 1 Pre-Contact site (*latte* site), 4 pre-World War II Japanese Administration sites, and 5 World War II-era Japanese defensive sites. Resources of cultural importance would not be impacted by construction.

Although public access would not be allowed in the construction area, the public may be allowed in nearby areas depending upon the type of construction. An increase in noise and changes in visual setting may occur during construction in the vicinity of historic properties, including potential traditional cultural properties, when members of the public are present. This change in the noise and visual setting would be intermittent and temporary and result in a less than significant impact.

***South Range Complex*:** The South Range Complex would be used as a non-live-fire maneuver area. There would be no construction-related ground clearance undertaken; therefore, there would be no direct or indirect impacts to historic properties or resources of cultural importance from construction activities associated with the establishment of the South Range Complex.

Although public access would not be allowed to the construction area, the public may be allowed in nearby areas in south Pagan when construction is ongoing. An increase in noise and changes in visual setting may occur during construction in the vicinity of historic properties, including potential traditional cultural properties, when members of the public are present. This change in noise and visual setting would be intermittent and temporary and result in a less than significant impact.

Pagan Alternative 1 would result in significant direct impacts to historic properties and resources of cultural importance from construction activities. It would significantly impact up to 27 historic properties in the range complexes and expeditionary area. Historic properties include Pre-Contact *latte* complexes, pre-World War II Japanese Administration sites, and World War II-era Japanese defensive sites. However, as range design is finalized, the Department of Defense will seek to further avoid or minimize impacts on historic properties and resources of cultural importance.

Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.

4.11.4.1.2 Operation Impacts

As described in Section 2.5, *Pagan Alternatives*, under Pagan Alternative 1, operations and maintenance would occur within the North and South Range Complexes.

Target areas in the High Hazard Impact Areas would be used for live-fire and inert munitions training. In general, the footprint for operations is very similar to the construction footprints and most ground disturbance, and impacts to historic properties and resources of cultural importance would occur during construction of the RTA. Therefore, since disturbance to historic properties has been accounted for in most areas under construction impacts, impacts to historic properties from training operations will focus on training maneuvers. Training maneuvers consist of vehicle and foot traffic within maneuver areas; no digging would occur within the maneuver areas. However, potential ground disturbance to historic properties in the High Hazard Impact Areas is larger than the footprint for construction and target placement and could occur throughout either of the High Hazard Impact Areas.

Table 4.11-10 summarizes the historic properties impacted by operations for Pagan Alternative 1; impacts associated with construction are summarized in Table 4.11-9. In the High Hazard Impact Areas, five historic properties, also impacted by construction, would be significantly impacted by operations. Although not all of the northern High Hazard Impact Area has been surveyed; it is primarily covered in lava. Should sites be preserved under the lava, impacts are unlikely since the depth of the ground disturbance associated with munitions would be less than the depth of the lava. Other archaeological sites within the isthmus High Hazard Impact Area are unlikely based on the steep topography and lack of accessibility to coastal resources.

Table 4.11-10. Pagan Alternative 1 Summary of Significant Direct Impacts on Historic Properties from Operations

Complex	*Range*	*Number of Historic Properties*
North Range Complex	North High Hazard Impact Area	5*
	Landing Zones	0
	Field Artillery Direct and Indirect Fire Ranges/Mortar Firing Positions	0
	Amphibious Training Areas	1
	Live-Fire Maneuver Area	46
	Isthmus High Hazard Impact Area	2*
	Military Training Trails	0
	Airfield/Base Camp/Bivouac Area/Munitions Storage Area	0
South Range Complex	Non-Live-Fire Maneuver Area	NA
	Total	**54**

Notes: *All of these sites are impacted by vegetation clearing in target areas, but are located outside of the area of proposed clearing. Sites solely in the construction/cleared area are not included in this total.
Legend: NA = not applicable.

Training in the northern maneuver areas includes patrolling, establishing defensive positions, and firing live-fire weapons into and/or around the High Hazard Impact Area and integrating supporting arms (including aviation, artillery, and naval gunfire assets). Where possible, mounted wheeled and tracked vehicle maneuvering would be accomplished in the northern maneuver area as well. Vehicles would move along military training trails as well as other terrain that they could safely navigate. Ground disturbance associated with wheeled and tracked vehicles off of roadways and trails would have a significant direct impact to up to 46 historic properties, including 5 Pre-Contact *latte* sites, 1 Pre-Contact midden site, and 40 Japanese Administration sites. Off-road vehicle use could also impact resources of cultural importance such as medicinal plants and plant gathering areas near the shoreline, but would not impact such resources located along clifflines or on steep slopes. However, training units would be required to identify engagement area locations, direction of attack, targets/threats to be engaged, and types of weapon and ammunition to be used during an engagement. Developed scenarios would be submitted to range control for approval prior to implementation. This process would allow implementation of measures to avoid and protect historic properties and resources of cultural importance.

Foot maneuvers would occur in the South Range Complex. A limited amount of survey has been conducted in the South Range Complex due to steep topography. Information from surveys conducted in the south and interviews with former residents indicate that there are probably at least eight *latte* villages located primarily along coastal areas. However, impacts to historic properties from foot traffic would be minimal, as it would occur primarily on designated pathways or sporadically throughout the maneuver area.

Amphibious training, consisting of swimmer and inflatable boat landings, would occur at six beaches—Red, Green, Blue, South, North, and Gold. Amphibious Assault Vehicles and Landing Craft Air Cushion vessels would be used at Red, Green, and Blue beaches. Landing Craft Air Cushion vessels would be used at Red, Green, Blue, and South beaches. Use by swimmers and inflatable boats would have a minimal impact to any historic properties, including traditional cultural properties, and resources of cultural importance. Use of Amphibious Assault Vehicles and Landing Craft Air Cushion vessels could cause ground disturbance on the beach. Landing Craft Air Cushion vessels would have a significant direct impact to one historic property, a World War II-era Japanese airfield. All beaches have been surveyed and no other resources are recorded within the vicinity of the training areas. The beach areas associated with two potential traditional cultural properties, Red Beach (Shomshon) and South Beach (Regusa), would be disturbed by amphibious landing operations. However, the beach would be restored to its original appearance by contouring and cleaning up expended materials at the end of the exercises (see Section 4.11.2, *Resource Management Measures*). The resulting impact to these potential traditional cultural properties would be less than significant.

Within the surface danger zones, which are safety buffers that surround target areas and live-fire maneuver areas and would contain projectiles, fragments, debris and components resulting from the firing of weapons, the potential for direct impacts from strikes from stray rounds is extremely low. The ranges would be designed to contain live-fire inside the boundaries to minimize the potential for rounds landing outside the surface danger zones. Additionally, if a stray round were to escape the ranges, the chance of it hitting a historic property is remote, given the size of the surface danger zones and dispersal of historic properties.

In general, public access would be allowed to all locations except for the High Hazard Impact Areas, which would be permanently restricted due to the presence of unexploded ordnance, when training is not occurring. It is envisioned that public access would be allowed at times when such training events are not taking place and may be available during other times depending upon the type of training taking place. This may include public access to areas of southern Pagan while training is occurring elsewhere. Therefore, intermittent and temporary loss of public access is not considered a significant indirect impact to cultural resources. Historic properties within the High Hazard Impact Area would already have been significantly impacted by construction activities and loss of access to these areas would be a less than significant impact.

Indirect impacts to historic properties and resources of cultural importance due to visual intrusions and noise-level increase from training would be less than significant. An increase in noise and changes in visual setting may occur during operations in the vicinity of historic properties, including potential traditional cultural properties, when members of the public are present. This change in noise and visual setting would be intermittent and temporary and result in a less than significant impact. Indirect impacts to resources of cultural importance such as Laguna Sanhalom due to contamination by munitions in the northern High Hazard Impact Area would be less than significant due to the implementation of best management practices associated with a Range Training Area Management Plan (see Section 4.11.2, *Resource Management Measures*).

Significant direct impacts would result from Pagan Alternative 1 operational activities. Up to 54 historic properties and resources of cultural importance would be significantly impacted by off-road wheeled and tracked vehicle use in the maneuver areas, munitions training in the High Hazard Impact Areas, and amphibious training. However, as RTA design is finalized, the Department of Defense would seek to further avoid or minimize impacts to historic properties and other resources of cultural importance.

Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.

4.11.4.2 Pagan Alternative 2

4.11.4.2.1 Construction Impacts

Under Pagan Alternative 2, only one, smaller northern High Hazard Impact Area would be established in North Range Complex. This would potentially impact historic properties and resources of cultural importance. Ground disturbance primarily associated with vegetation removal would total 696 acres (283 hectares), or 38 fewer acres (28 hectares) when compared to Pagan Alternative 1 (see Table 2.5-6). Table 4.11-11 summarizes the historic properties impacted by construction-related activities for Pagan Alternative 2. Specific significant impacts to historic properties and resources of cultural importance would be the same as found under Pagan Alternative 1, with the exception being that the isthmus High Hazard Impact Area would not be established. A more detailed description of potential impacts follows the table and is included in Appendix N, *Cultural Resources Technical Memo*.

Table 4.11-11. Pagan Alternative 2: Summary of Significant Direct Impacts on Historic Properties from Construction

Complex	*Range*	*Number of Historic Properties*
North Range Complex	North High Hazard Impact Area	2
	Landing Zones	2
	Field Artillery Direct and Indirect Fire Ranges/Mortar Firing Positions	4
	Amphibious Training Areas	0
	Live-Fire Maneuver Area	0
	Military Training Trails	7
	Airfield/ Base Camp/Bivouac Area/Munitions Storage Area	10
South Range Complex	Non-Live-Fire Maneuver Area	NA
	Total	**25**

Legend: NA = not applicable.

North Range Complex: Construction associated with the High Hazard Impact Area in the north differs from construction under Pagan Alternative 1 as there would be no High Hazard Impact Area on the isthmus. Although the size of the High Hazard Impact Area would be smaller than the northern High Hazard Impact Area under Pagan Alternative 1, the target clearance would be the same. Although most of this area has not been surveyed, in general, the area is covered by lava to depths of over 30 feet (9.1 meters) from recent volcanic eruptions. Historic properties would not be found on the surface in this area. Outside of the lava area, historic properties tend to be found nearer to the coastal areas. Most of the area of potential effects for the firebreak has been surveyed. Construction-related activities associated with the firebreak under Pagan Alternative 2 would have a significant direct impact to the same two historic properties (one Pre-Contact artifact scatter and one World War II–era Japanese defensive site) as under Pagan Alternative 1. Construction would also impact 7 acres (3 hectares) of native forest which could contain resources of cultural importance, such as medicinal plants. No other resources of cultural importance, such as cemeteries or memorials, would be directly impacted by construction in this area.

Like under Pagan Alternative 1, no construction would occur at the amphibious training beaches or within the Live-Fire Maneuver Area. Thirteen Landing Zones would be cleared, which is two more than under Pagan Alternative 1 and five firing points would be cleared for the Mortar Range. Most of the landing zones and artillery firing points have been surveyed or are located on lava. Of the four unsurveyed landing zones and the one unsurveyed firing point associated with the Mortar Range, all are located in steep interior areas surrounding Mount Pagan and have a low potential for containing historic properties. As under Pagan Alternative 1, construction-related activities associated with clearing landing zones and firing points under Pagan Alternative 2 would have a significant direct impact to six historic properties, including one Pre-Contact *latte* site, one pre-World War II Japanese Administration site, and four World War II-era Japanese defensive sites. Significant direct impacts to historic properties from construction of a military trail network would impact the same seven historic properties as under Pagan Alternative 1 (Section 4.11.4.1).

Under Pagan Alternative 2, construction-related impacts associated with the base camp/bivouac area would be the same as found under Pagan Alternative 1 and directly impact the same 10 historic properties as under Pagan Alternative 1 (Section 4.11.4.1). Like under Pagan Alternative 1, although public access would not be allowed in the construction area, the public may be allowed in nearby areas depending upon the type of construction. An increase in noise and changes in visual setting may occur during construction in the vicinity of historic properties, including potential traditional cultural properties, when members of the public are present. This change in noise and visual setting would be intermittent and temporary and result in a less than significant impact.

South Range Complex: Under Pagan Alternative 2, the same non-live-fire maneuver area would be established. There would be no construction-related ground clearance undertaken; therefore, there would be no direct impacts to historic properties or resources of cultural importance from construction. Although public access would not be allowed in the construction area, the public may be allowed in nearby areas in south Pagan when construction is ongoing. An increase in noise and changes in visual setting may occur during construction in the vicinity of historic properties, including potential traditional cultural properties, when members of the public are present. This change in the noise and visual setting would be intermittent and temporary and result in a less than significant impact.

Pagan Alternative 2 would result in significant direct impacts to historic properties and resources of cultural importance from construction activities. It would have a significant direct impact to 25 historic properties in the range complexes and expeditionary area. Historic properties include Pre-Contact *latte* complexes, pre-World War II Japanese Administration sites, and World War II-era Japanese defensive sites. However, as range design is finalized, the Department of Defense will seek to avoid historic properties and resources of cultural importance.

Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.

4.11.4.2.2 Operation Impacts

As described in Section 2.5.3, *Pagan Alternative 2*, operations and maintenance under Pagan Alternative 2 would be similar to Pagan Alternative 1. The primary difference would be that there would only be one, smaller High Hazard Impact Area established in the North Range Complex. In addition, 13 landing zones would be maintained and used; two more than under Pagan Alternative 1. As a result of the smaller High Hazard Impact area in the north and elimination of the High Hazard Impact Area on the isthmus, four fewer historic properties would be impacted by operations. Significant direct impacts would result from Pagan Alternative 2 operational activities to 50 historic properties. Table 4.11-12 summarizes the historic properties impacted by operations for Pagan Alternative 2; impacts associated with construction are summarized in Table 4.11-11. In the High Hazard Impact Area, three historic properties', also impacted by construction, would be significantly impacted by operations. Although not all of the High Hazard Impact Area has been surveyed; it is primarily covered in lava. Should sites be preserved under the lava, impacts are unlikely since the depth of the ground disturbance associated with munitions would be less than the depth of the lava.

Table 4.11-12. Pagan Alternative 2: Summary of Significant Direct Impacts on Historic Properties from Operations

Complex	*Range*	*Number of Historic Properties*
North Range Complex	North High Hazard Impact Area	3*
	Landing Zones	0
	Field Artillery Direct and Indirect Fire Ranges/Mortar Firing Positions	0
	Amphibious Training Areas	1
	Live-Fire Maneuver Area	46
	Military Training Trails	0
	Airfield/ Base Camp/Bivouac Area/Munitions Storage Area	0
South Range Complex	Non-Live-Fire Maneuver Area	NA
	Total	**50**

Note: *All of these sites are impacted by vegetation clearing in target areas, but are located outside of the area of proposed clearing. Sites solely in the construction/cleared area are not included in this total.
Legend: NA = not applicable.

Training in the northern maneuver area would be the same as under Pagan Alternative 1 and would directly impact the same 46 historic properties from tracked and wheeled vehicle use. Foot maneuvers would occur in the South Range Complex, but impacts to historic properties would be minimal, as it would occur primarily on designated pathways or sporadically throughout the maneuver area.

Amphibious training, consisting of swimmer and inflatable boat landings, would occur at six beaches—Red, Green, Blue, South, North, and Gold. Amphibious Assault Vehicles and Landing Craft Air Cushion vessels would be used at Red, Green, and Blue beaches. Landing Craft Air Cushion vessels would be used at Red, Green, Blue, and South beaches. Use by swimmers and inflatable boats would have a minimal impact to any historic properties, including traditional cultural properties, and resources of cultural importance. Use of Amphibious Assault Vehicles and Landing Craft Air Cushion vessels could cause ground disturbance on the beach. Landing Craft Air Cushion vessels could have a significant direct impact to one historic property, a World War II-era Japanese airfield. All beaches have been surveyed and no other resources are recorded within the vicinity of the training areas. The beach areas associated with two potential traditional cultural properties, Red Beach (Shomshon) and South Beach (Regusa), would be disturbed by amphibious landing operations. However, the beach would be restored to its original appearance by contouring and cleaning up expended materials at the end of the exercises (see Section 4.11.2, *Resource Management Measures*). The resulting impact to these potential traditional cultural properties would be less than significant. The potential for direct impacts to historic properties and resources of cultural importance from stray rounds in surface danger zones is considered to be extremely low.

As with Pagan Alternative 1, indirect impacts due to restrictions in public access to historic properties and resources of cultural importance is less than significant since loss of access to all areas except for the High Hazard Impact Area would be intermittent and temporary. Indirect impacts to historic properties and resources of cultural importance due to visual intrusions and noise-level increase from training would be less than significant. Public access would be allowed in certain areas while operations are ongoing depending upon the type of training. An increase in noise and changes in visual setting may occur during operations in the vicinity of historic properties, including potential traditional cultural properties, when members of the public are present. This change in noise and visual setting would be intermittent and temporary and result in a less than significant impact. Indirect impacts to resources of cultural importance such as Laguna Sanhalom due to contamination by munitions in the northern High Hazard Impact Area would be less than significant due to the implementation of best management practices associated with a Range Training Area Management Plan (see Section 4.11.2, *Resource Management Measures*).

Significant direct impacts would result from Pagan Alternative 2 operational activities. Up to 50 historic properties and resources of cultural importance would be significantly impacted by off-road wheeled and tracked vehicle use in the maneuver areas, munitions training in the High Hazard Impact Area, and amphibious training. However, as RTA design is finalized, the Department of Defense would seek to further avoid or minimize impacts to historic properties and other resources of cultural importance.

Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.

4.11.4.3 Pagan No-Action Alternative

Under the Pagan no-action alternative, no military construction or live-fire military training operations associated with the proposed action would occur on Pagan. Limited activities would occur including periodic visits for eco-tourism, scientific surveys, and military training for search and rescue. These activities represent minor disruptions to existing conditions. Therefore, the no-action alternative would have less than significant impacts on cultural resources on Pagan.

4.11.4.4 Summary of Impacts for Pagan Alternatives

Table 4.11-13 provides a comparison of the potential impacts to cultural resources for the two Pagan alternatives and the no-action alternative.

Table 4.11-13. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Cultural Resources	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
North Range Complex	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*LSI*	*LSI*
South Range Complex	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*

Legend: *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.11.4.5 Summary of Potential Mitigation Measures for Pagan Alternatives

Table 4.11-14 provides a summary of the potential mitigation measures for cultural resources for the two Pagan alternatives.

Table 4.11-14. Summary of Potential Mitigation Measures for Pagan Alternatives

Impacts	*Category*	*Potential Mitigation Measures*	*Pagan Phase*	
			Construction	*Operation*
CULTURAL RESOURCES				
All Pagan alternatives would have a significant direct impact to historic properties. • Pagan Alternative 1 would have a significant direct impact to 27 historic properties and resources of cultural importance in the range complexes and expeditionary area due to vegetation clearance, as well as 54 historic properties due to operations. These historic properties include Pre-Contact *latte* complexes, pre-World War II Japanese Administration sites, and World War II-era Japanese defensive sites. • Pagan Alternative 2 would have a significant direct impact to 25 historic properties and resources of cultural importance in the range complexes and expeditionary area due to construction, as well as 50 historic properties due to operations. These historic properties include Pre-Contact *latte* complexes, pre-World War II Japanese Administration sites, and World War II-era Japanese defensive sites.	*SI mitigated to LSI*	Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.	X	X

Legend: *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.12 VISUAL RESOURCES

Section 4.12 analyzes the potential impact of proposed action alternatives to existing landscapes, scenic viewpoints, viewer experience, and overall viewshed value. Impacts that can affect visual resources include:

- Altering the topography and horizon line
- Removing vegetation
- Removing or altering existing buildings and infrastructure (i.e., International Broadcasting Bureau)
- Building new facilities and infrastructure

4.12.1 Approach to Analysis

To determine visual impacts, existing conditions are compared to anticipated conditions after implementation of the proposed action by evaluating specific factors at key observation points identified in Chapter 3.12, *Visual Resources*. Impacts from the proposed action on the viewshed from the key observation points were determined through a visual impact analysis that considers degrees of (1) visual contrast and disruption, and (2) scenic quality from three different distance zones. The value of each individual key observation point is also taken into consideration based on a combination of these parameters.

Although there are no specific regulations that direct the protection of visual resources, various land management agencies, including the Bureau of Land Management, have developed guidance on how to assess impacts to visual resources. Since the environment on Tinian and Pagan is generally open and without much urban infrastructure, the Bureau of Land Management guidance has been utilized for this impact assessment. The Bureau of Land Management guidance provides a rating system to define degrees of visual contrast. This rating system, shown in Table 4.12-1, is applied to the key observation points to determine the degree of contrast that would potentially occur from the key observation points from the introduction of the proposed facilities and activities.

Table 4.12-1. Degree of Visual Contrast Defined

Visual Resource Contrast Defined	*Definition*
None	The element contrast is not visible or perceived.
Weak	The element contrast can be seen but does not attract attention.
Moderate	The element contrast begins to attract attention and begins to dominate the characteristic landscape.
Strong	The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

Source: Bureau of Land Management 1986.

The Bureau of Land Management has also created a rating system to define degrees of impacts to scenic quality. This rating system, shown in Table 4.12-2, is also applied to the key observation points to determine the potential visual impacts from the introduction of the proposed facilities and activities.

Table 4.12-2. Degree of Visual Impact Defined

Degree of Visual Impact Defined	*Definition*
None	No discernable or measureable visual contrast.
Negligible	Impacts that would not diminish the scenic quality of the landscape.
Minor	Impacts that diminish the scenic quality of the landscape to a minimal degree and are potentially noticeable when viewed from moderately sensitive viewpoints.
Moderate	Impacts that would diminish the scenic quality of the landscape and would easily be noticeable from sensitive viewpoints.
Major	Impacts resulting from construction disturbances and the long-term presence of new facilities would substantially alter the scenic value of the landscape and would dominate views from sensitive viewpoints.

Source: Bureau of Land Management 1986.

In addition to the criteria outlined in Table 4.12-1 and Table 4.12-2, three different distance zones were considered as part of the visual impact analysis. Distance zones are defined as:

- Foreground – up to 0.25 mile (0.4 kilometer)
- Middle ground – between 0.25 mile (0.4 kilometer) and 3 miles (4.8 kilometers)
- Background – greater than 3 miles (4.8 kilometers)

With these rating categories and criteria applied to individual key observation points, a determination was made as to the level of aesthetic impact to the key observation points by a proposed action alternative. These same criteria were generally applied to scenic sites on Pagan as well, although no key observation points are identified.

For the purpose of this analysis, impact significance was determined based on a combination of the rating systems described above. Visual resource contrast and impact ratings of “none” would result in no impacts to visual resources. Contrast ratings of “weak” and/or “moderate,” combined with an impact rating of “minor” and/or “moderate” would result in less than significant impacts to visual resources. A contrast rating of “strong” combined with an impact rating of “major” would result in significant impacts to the visual resource.

4.12.2 Resource Management Measures

Resource management measures that are applicable to visual resources include the following best management practices:

- Clear only the areas directly associated with the proposed training facilities (disturbance contained within the smallest footprint possible)
- Use native flora to create natural-appearing “screen” around the proposed improvements at the Port of Tinian and proposed base camp

For further information on all resource management measures refer to Appendix D, *Best Management Practices*.

4.12.3 Tinian

4.12.3.1 Tinian Alternative 1

4.12.3.1.1 Construction Impacts

Figure 4.12-1 shows the key observation points, range complexes, and training facilities associated with Tinian Alternative 1. Construction would include base camp; munitions storage area; Tinian International Airport improvements; Port of Tinian improvements, including bulk fuel storage tank, and supply route; access road improvements, fence lines, and gates; and range and training areas.

Base camp construction activities would be visible from key observation point #10 (8th Avenue-North of the Airport) and is discussed under Section 4.12.3.1.2, *Operation Impacts*.

Munitions Storage Area construction would not be visible from any identified key observation point.

Tinian International Airport improvements would not be visible from any identified key observation point but would impact the views from within the Tinian International Airport and its runways by creating additional pavement and chain linked fences.

Port of Tinian improvements would not be visible from any identified key observation point. However, the proposed Port of Tinian facilities, the tracked vehicle transit lanes, and proposed supply route would be constructed within an existing open grass area with trees. Views from the public boat ramp and a few dispersed residents west of 8th Avenue would be altered to include the structures, parking areas, and lights for night operations. Minimizing the removal of the existing trees located along the northeast side of the property would decrease the impact to residents west of 8th Avenue. In addition, incorporating additional tree plantings along the perimeter of the constructed facilities would decrease the visual impact to views from the public boat ramp and surrounding area.

Access Road improvements would result in visual changes associated with the structural improvements to 8th Avenue (public use anticipated), construction of the new road to the Munitions Storage Area, unpaved roads within the Military Lease Area, and the tracked-vehicle training trail. Portions of the road improvements would be visible from identified key observation points and are discussed under Section 4.12.3.1.2, *Operation Impacts*.

Fence Lines and Gates would be employed for access control and security at Base Camp, Munitions Storage Area, High Hazard Impact Area(s), and training facilities, including Surface Radar sites, within the Military Lease Area.

Range Training Area (e.g., target objectives, Landing Zones, target placements, engagement areas) construction would result in varying degrees of visual disruption and visual contrast from key observation points. The construction process (e.g., vegetation clearing and grading) for the Tinian RTA is proposed to take place over a period of 8 to 10 years. Locations of active construction areas would vary throughout the construction period. Some activities (e.g., landing area for Amphibious Assault Vehicles on Unai Chulu) would be an area-focused activity and would most likely occur continually for a given amount of time. Other activities (e.g., range development) would be accomplished over a short period of time but occur sequentially over the 8 to 10 years construction period. During this same period, training would gradually increase to a final training tempo of 20 weeks per year.

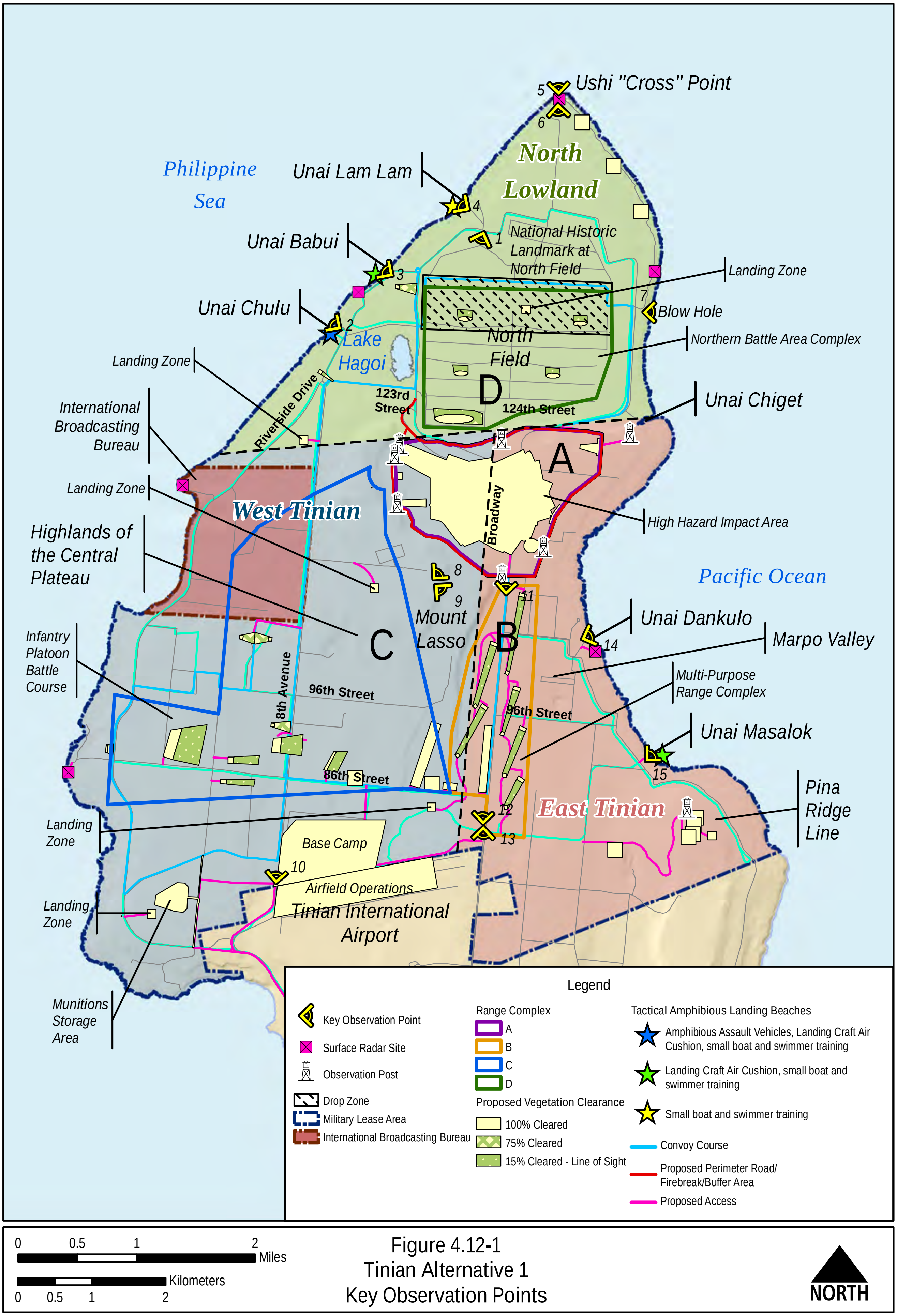


Figure 4.12-1
Tinian Alternative 1
Key Observation Points

Because of the overlap between the construction period and operation, permanent visual impacts from the proposed action are presented under Section 4.12.3.1.2, *Operation Impacts*.

4.12.3.1.2 Operation Impacts

Operation impacts associated with Tinian Alternative 1 would result from range complexes, training facilities, lighting, and landscape changes as visible from the key observation points. Lighting would be installed at the base camp and the Munitions Storage Area. Lighting at these locations would result in an increase in nighttime light but in areas located away from human receptors (i.e., residential areas south of the Military Lease Area and in the village of San Jose). There are no permanent lighting features proposed for the training facilities or the airport improvements; however, portable lighting would be employed at the airfield for night operations and limited portable lighting would be employed as part of night training (i.e., areas where personnel would congregate). Lighting at these locations would result in an increase in nighttime light but in areas located away from human receptors (i.e., residential areas south of the Military Lease Area and in the village of San Jose).

Figure 4.12-1 shows the key observation points, range complexes, and training facilities associated with Tinian Alternative 1. Key observation points are grouped together in the following impact discussion where they are geographically and visually related.

4.12.3.1.2.1 National Historic Landmark at North Field (#1)

This complex of facilities and buildings centered on the North Field apron area is located within Range Complex D. The key observation point is looking toward the south and illustrates the general character exhibited within the National Historic Landmark. The proposed Drop Zone/Landing Zone would be visible at this key observation point since vegetation would be cleared from this area. Due to the dense vegetative cover surrounding the apron, the other training facilities (i.e., objective areas) within Range Complex D would not be visible from this key observation point.

The proposed vegetation clearing on either side of the runway would result in a change in visual cues to its character and length, and, as a result, would highlight the historic use and associated character (nature) of the visual environment of North Field. Therefore, implementation of Tinian Alternative 1 would result in beneficial direct and indirect impacts to these visual resources.

- Visual Contrast: Moderate (beneficial)
- Overall Visual Impact Rating: Negligible

4.12.3.1.2.2 Unai Chulu (#2), Unai Babui (#3) and Unai Lam Lam (#4)

These three key observation points are located west and northwest of Range Complex D and have a west-northwest orientation, looking out over the ocean. These beaches would be used as tactical amphibious landing beaches. As stated in Section 4.2, *Geology and Soils,* beach topography would be restored using non-mechanized means such as hand-held tools after amphibious operations. Therefore, there would not be a visual impact to these beaches from amphibious operations. The amphibious landing ramp at Unai Chulu would be underwater, unable to be seen by beach visitors from the shore, and the tracked vehicle driver's course would be located inland of ocean-facing key observation points; therefore, the view towards the ocean and the horizon would not be impacted. However, minor changes to the topography of the shoreline due to the amphibious beach landing activities may occur and could potentially result in minor visual impacts. No other training facilities would be visible from these key observation points. Therefore, implementation of Tinian Alternative 1 would result in less than significant direct or indirect impacts to these visual resources.

- Visual Contrast: Weak
- Overall Visual Impact Rating: Minor

4.12.3.1.2.3 Ushi "Cross" Point A and B (#5 and #6)

These key observation points are located north of Range Complex D on the northern tip of Tinian.

Ushi "Cross" Point A (#5)

Ushi "Cross" Point A (#5) has a northern orientation looking out over the ocean. There are three artillery firing points along the northeast side of the island and south-southeast of the key observation points. Additionally, there is a Surface Radar site adjacent and south of this key observation point. None of these artillery firing points or the Surface Radar site would be visible from this key observation point. Therefore, implementation of Tinian Alternative 1 would result in no direct or indirect impacts to these visual resources.

- Visual Contrast: None
- Overall Visual Impact Rating: None

Ushi "Cross" Point B (#6)

Ushi "Cross" Point B (#6) has a southern orientation looking towards North Field. The three artillery firing points would not be visible from this key observation point because of the thick vegetation adjacent to this area, their distance from the viewer, relatively flat terrain, and they are generally outside of the viewer's vantage point. However, the Surface Radar site would be in the foreground of this key observation point and would cause a significant visual contrast and change from what is currently visible looking south from Ushi "Cross" Point. Therefore, the Surface Radar site would have a significant direct impact to this visual resource.

- Visual Contrast: Major
- Overall Visual Impact Rating: Strong

4.12.3.1.2.4 Blow Hole (#7)

This key observation point is located east of Range Complex D and has a view looking east out over the ocean. The tracked vehicle drivers course and convoy course are located west of the key observation point and would not be located within the east-facing viewshed. A Surface Radar site would be constructed over one-quarter of a mile north of the Blow Hole and would be visible in the middle ground upon approach to the Blow Hole. However, it would not be located within the immediate viewshed of this key observation point. Therefore, implementation of Tinian Alternative 1 would result in less than significant impacts to this visual resource.

- Visual Contrast: Weak
- Overall Visual Impact Rating: Minor

4.12.3.1.2.5 Mount Lasso Lookout A and B (#8 and #9)

These key observation points are located between Range Complexes A and B. The viewshed from the Mount Lasso Lookout encompasses approximately one third of the island of Tinian, from the Pina ridge line in the south, the eastern portion of the island to Ushi "Cross" Point in the north, and beyond to the southern tip of Saipan to the horizon.

Mount Lasso Lookout A (#8)

Mount Lasso Lookout A (#8) has a northeast orientation looking towards Range Complex A. The existing viewshed from Mount Lasso Lookout A (#8) is primarily a view of dense vegetation

The following facilities would be visible from Mount Lasso Lookout A (#8)

- Range Complex A
  - High Hazard Impact Area, which would have vegetation maintained at a height of 6 inches (15 centimeters)
  - Perimeter road/firebreak buffer
  - Convoy Course around the eastern boundary of the range complex
  - Range Control Observation Posts
  - Mortar firing points
- Range Complex D
  - Landing Zone
  - Northern Battle Area Complex

With approximately two-thirds of Range Complex A visible from Mount Lasso Lookout A (#8), these alterations would create significant visual contrast and change from what is currently visible from the Mount Lasso Lookout A. Four Range Control Observation Posts may be visible in the middle ground from the Mount Lasso Lookout A (#8). At 30 feet (9 meters) in height, these structures would extend above vegetation. The nearest Range Control Observation Post would be approximately 0.5 mile (0.8 kilometer) from the key observation point, and the farthest Range Control Observation Post would be approximately 2 miles (3.2 kilometers) from the key observation point, placing them in the middle ground distance zone. This would minimize the visual impact due to the relative size of the Range Control Observation Points and distance from the viewer.

Portions of Range Complex D would also be visible in the background of the viewshed from Mount Lasso Lookout A (#8), north of Range Complex A. However, the proposed cleared areas associated with Range Complex D would be visible at a much smaller scale than the viewshed described for Range Complex A. Due to the viewer's focus from this key observation point being towards the larger proposed cleared area of Range Complex A, the cleared areas associated with Range Complex D would not likely be noticeable from this distance. Large scale vegetation clearance and maintenance of the High Hazard Impact Area in Range Complex A associated with Tinian Alternative 1 would result in significant direct and indirect impacts to this visual resource. No mitigation is proposed for this significant impact.

- Visual Contrast: (#8) Major
- Visual Impact Rating: (#8) Strong

Mount Lasso Lookout B (#9)

Mount Lasso Lookout B (#9) has a southeast orientation looking towards Range Complex B and Broadway Avenue. However, Range Complex B and Broadway Avenue, as it passes through Range Complex B, are not visible from the Mount Lasso Lookout B (#9) due to an escarpment plateau extending east from Mount Lasso. While some cleared areas on the east side of Broadway Avenue may be visible from the Mount Lasso Lookout B (#9), these areas would be both minimal and located approximately 2 miles (3.2 kilometers) from the Mount Lasso Lookout B (#9), in the middle ground distance zone, minimizing the visual impact.

One Range Control Observation Post may be visible from the Mount Lasso Lookout B (#9). At 30 feet (9 meters) in height, this structure would extend slightly above vegetation. However, this structure would be approximately 2.75 miles (3.2 to 4.4 kilometers) from the Mount Lasso Lookout B, placing it in the middle ground distance zone with dense vegetation in between, minimizing the visual impact due to its relative size and distance from the viewer. There would also be a Surface Radar site approximate 1.5 miles (2.4 kilometers) from the key observation point. As with the Range Control Observation Post, this structure would be in the middle ground distance zone with dense vegetation in between, thereby minimizing the visual impact due to its relative size and distance from the viewer. Therefore, the Range Control Observation Post and Surface Radar site for Tinian Alternative 1 would result in less than significant direct or indirect impacts to this visual resource.

- Visual Contrast: (#9) Moderate
- Visual Impact Rating: (#9) Moderate

4.12.3.1.2.6 8th Avenue-North of the Airport (#10)

The 8th Avenue-North of the Airport (#10) key observation point has a view to the north looking up 8th Avenue towards 86th Street, the base camp and Range Complex C. Although this key observation point is not associated with historic resources or a typical scenic vista, it is located within a public roadway that would serve as the primary route to the National Historic Landmark and other locations within the Military Lease Area. The base camp and proposed improvements at the northern portion of the Tinian International Airport are adjacent to, and would be visible from, 8th Avenue-North of the Airport (#10) key observation point. The proposed action would result in a change in condition to the surrounding area. The proposed development of permanent structures, including a gate, would be visible in the foreground to viewers along 8th Avenue from both the north and the south. Incorporating landscape features (trees, shrubs, berms) along the perimeter of the road and around the constructed facilities would decrease the visual impact to views from the road. The upper portion of the proposed 200-foot (61-meter) communication tower at the base camp would be visible within the middle ground. The lower portion of the tower would be blocked by vegetation and associated tower building. The base camp and airport expansion development would also be visible to air travelers at Tinian International Airport when landing and departing. While the visual contrast is strong, the value of this key observation points is limited because it does not provide a unique or particularly high quality visual experience. The view north is similar to various view corridors along Broadway Avenue and further north along 8th Avenue. Therefore, implementation of Tinian Alternative 1 would result in less than significant direct or indirect impacts to this visual resource.

- Visual Contrast: Strong

- Overall Visual Impact Rating: Moderate

4.12.3.1.2.7 Broadway North (#11)

This key observation point is located on the northern boundary of Range Complex B and has a view to the north looking into Range Complex A. The cleared areas proposed in Range Complex A would not be visible from this key observation point. However, a proposed gate across Broadway Avenue and a fence surrounding Range Complex A would be visible looking north from this key observation point. The view of these structures would result in a weak visual contrast, as the structures would not exceed the height of the existing vegetation. While the gate would cross Broadway Avenue, no highly unique visual experience exists at this location. Range Complex B facilities would not be visible from this key observation point. Therefore, implementation of Tinian Alternative 1 would result in less than significant direct or indirect impacts to this visual resource.

- Visual Contrast: Weak
- Overall Visual Impact Rating: Negligible

4.12.3.1.2.8 Broadway South A and B (#12 and #13)

These key observation points are located at the southern end of Range Complex B inside the Military Lease Area fence line.

Broadway South A (#12)

This key observation point has a view looking north into Range Complex B. The north view up Broadway Avenue, which would serve as a portion of the Convoy Course, would mirror the view of key observation point Broadway North (#11). Range Complex B would not be visible from this key observation point, except for potentially portions of the Tracked Vehicle Driver's Course proposed west and east of Broadway. Therefore, implementation of Tinian Alternative 1 would result in less than significant direct or indirect impacts to this visual resource.

- Visual Contrast: Weak
- Overall Visual Impact Rating: Negligible

Broadway South B (#13)

Key observation point Broadway South B (#13) has a view looking south from the Military Lease Area fence line toward an expansive view of the town of San Jose and the Pina and Kastiyu ridge lines. Due to its orientation away from the Military Lease Area, this key observation point would not be impacted by Range Complex B. Therefore, implementation of Tinian Alternative 1 would result in no direct or indirect impacts to this visual resource.

- Visual Contrast: None
- Overall Visual Impact Rating: None

4.12.3.1.2.9 Unai Dankulo (#14) and Unai Masalok (#15)

These key observation points both have east-northeast views looking out over the ocean. The beaches, natural terrain, and sand dunes, as well as the access trails to the beaches, may be visually impacted by the proposed action.

Unai Dankulo (#14)

Unai Dankulo is not proposed for military training. The Tracked Vehicle Driver's Course would be inland from the ocean-facing key observation points. There would be a Surface Radar site constructed adjacent and south of Unai Dankulo that would be visible from the beach, but is not within the viewshed of this key observation point, which faces toward the ocean and the horizon. The view towards the ocean and the horizon would not be impacted.

Therefore, implementation of Tinian Alternative 1 would result in less than significant direct or indirect impacts to these visual resources.

- Visual Contrast: Weak
- Overall Visual Impact Rating: Negligible

Unai Masalok (#15)

Unai Masalok would be used for combat swimmer training, small boat landings, and Landing Craft Air Cushion vessel landings. The Tracked Vehicle Driver's Course would be inland from the ocean-facing key observation point. The view towards the ocean and the horizon would not be impacted. No permanent structures would be built at Unai Masalok. No training facilities would be visible from this key observation point since the view orientation is over the ocean. Therefore, implementation of Tinian Alternative 1 would result in less than significant direct or indirect impacts to these visual resources.

- Visual Contrast: Weak
- Overall Visual Impact Rating: Negligible

4.12.3.1.3 Summary of Impacts

Table 4.12-3 provides a summary of the visual impacts associated with Tinian Alternative 1.

Table 4.12-3 Tinian Alternative 1 Summary of Visual Impacts

Key Observation Point	*Visual Contract Rating*	*Overall Visual Impact Rating*
National Historic Landmark at North Field (#1)	Moderate	Negligible
Unai Chulu (#2)	Weak	Minor
Unai Babui (#3)	Weak	Minor
Unai Lam Lam (#4)	Weak	Minor
Ushi "Cross" Point A (#5)	None	None
Ushi "Cross" Point B (#6)	Major	Strong
Blow Hole (#7)	Weak	Minor
Mount Lasso Lookout A (#8)	Major	Strong
Mount Lasso Lookout B (#9)	Moderate	Moderate
8th Avenue-North of the Airport (#10)	Strong	Moderate
Broadway North (#11)	Weak	Negligible
Broadway South A (#12)	Weak	Negligible
Broadway South B (#13)	None	None
Unai Dankulo (#14)	Weak	Negligible
Unai Masalok (#15)	Weak	Negligible

4.12.3.2 Tinian Alternative 2

4.12.3.2.1 Construction Impacts

Figure 4.12-2 shows the key observation points, range complexes, and training facilities associated with Tinian Alternative 2. Construction impacts to visual resources under Tinian Alternative 2 would be the same as those described for Tinian Alternative 1. See Section 4.12.3.1, *Tinian Alternative 1*, for a discussion of impacts. Because of the overlap between the construction period and operation, permanent visual impacts from the proposed action are presented under *Operation Impacts*.

4.12.3.2.2 Operation Impacts

The impacts to visual resources from the Tinian Alternative 2 operations would be similar to those described for Tinian Alternative 1. See Section 4.12.3.1, *Tinian Alternative 1*, for a discussion of impacts. Figure 4.12-2 shows the key observation points, range complexes, and training facilities associated with Tinian Alternative 2. Under Tinian Alternative 2, the International Broadcasting Bureau antenna facilities would be removed to allow for the construction of the southern Battle Area Complex. Some of the associated structures may remain for use in military operations as urban terrain assault courses. The removal of these antennae would generally result in a beneficial visual impact to view corridors on the west side of Tinian where the antennae are visible, and for air travelers landing and departing from Tinian International Airport. However, the International Broadcasting Bureau is not visible from any key observation points.

The proposed footprint of Range Complex C differs from Tinian Alternative 1 and includes objective areas on both sides of 8th Avenue. However, these objectives areas would not be visible from any identified key observation point. Therefore, implementation of Tinian Alternative 2 would result in significant direct and indirect impacts to visual resources from key observation points Ushi “Cross” Point B (#6) and Mount Lasso Lookout A (#8); less than significant direct or indirect impacts to all other visual resources from key observation points National Historic Landmark at North Field (#1), Unai Chulu (#2), Unai Babui (#3) and Unai Lam Lam (#4), Mount Lasso Lookout B (#9), 8th Avenue-North of the Airport (#10), Broadway North (#11), Broadway South A (#12), Unai Dankulo (#14), and Unai Masalok (#15); and no direct or indirect impacts from key observation points Ushi “Cross” Point A (#5), Blow Hole (#7), Broadway South B (#13).

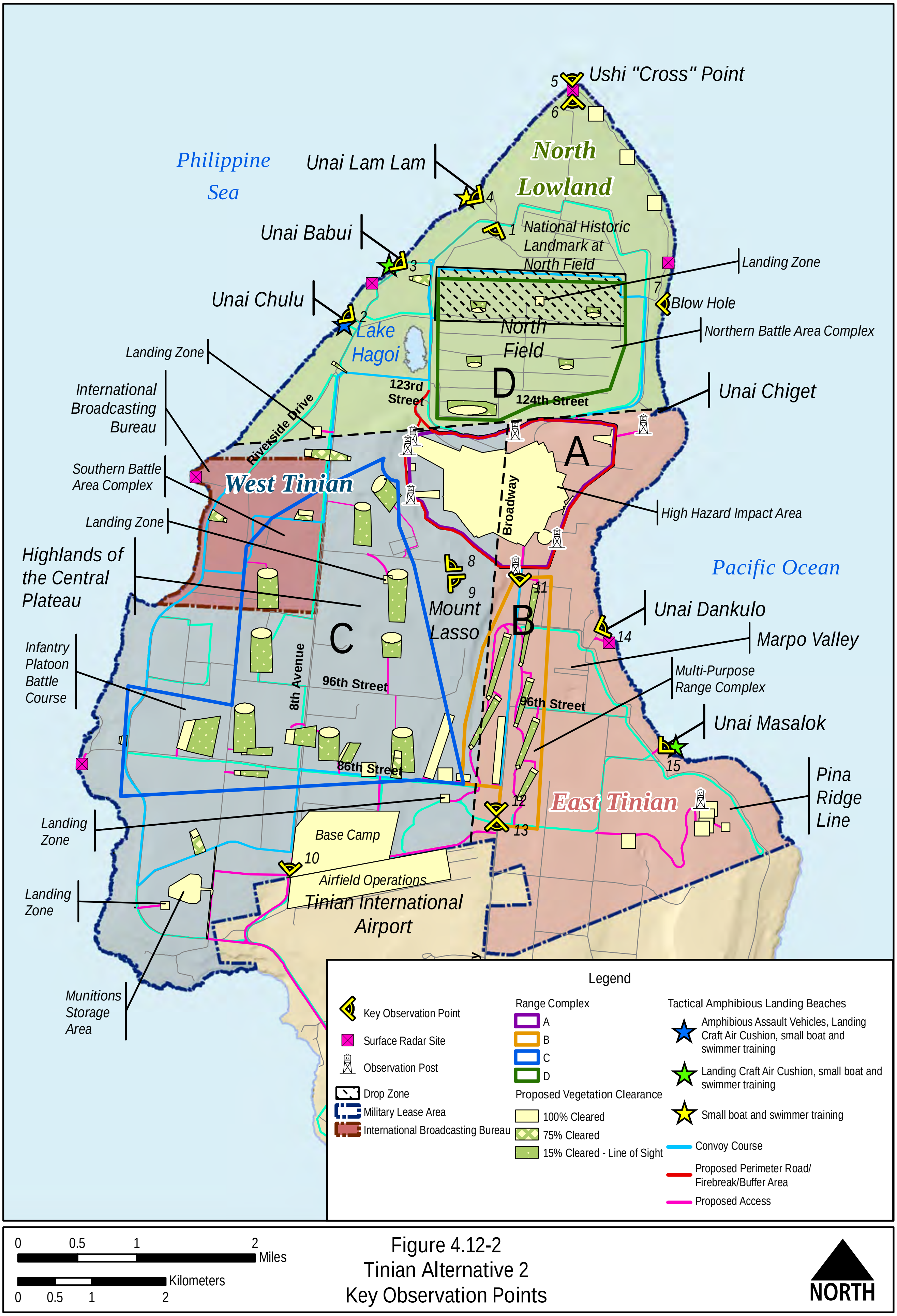


Figure 4.12-2
Tinian Alternative 2
Key Observation Points

4.12.3.2.3 Summary of Impacts

Table 4.12-4 provides a summary of the visual impacts associated with Tinian Alternative 2.

Table 4.12-4. Tinian Alternative 2 Summary of Visual Impacts

Key Observation Point	*Visual Contract Rating*	*Overall Visual Impact Rating*
National Historic Landmark at North Field (#1)	Moderate	Negligible
Unai Chulu (#2)	Weak	Minor
Unai Babui (#3)	Weak	Minor
Unai Lam Lam (#4)	Weak	Minor
Ushi "Cross" Point A (#5)	None	None
Ushi "Cross" Point B (#6)	Major	Strong
Blow Hole (#7)	Weak	Minor
Mount Lasso Lookout A (#8)	Major	Strong
Mount Lasso Lookout B (#9)	Moderate	Moderate
8th Avenue-North of the Airport (#10)	Strong	Moderate
Broadway North (#11)	Weak	Negligible
Broadway South A (#12)	Weak	Negligible
Broadway South B (#13)	None	None
Unai Dankulo (#14)	Weak	Negligible
Unai Masalok (#15)	Weak	Negligible

4.12.3.3 Tinian Alternative 3

4.12.3.3.1 Construction Impacts

Figure 4.12-3 shows the key observation points, range complexes, and training facilities associated with Tinian Alternative 3. Construction impacts to visual resources under Tinian Alternative 3 would be the same as those described for Tinian Alternative 1. See Section 4.12.3.1, *Tinian Alternative 1*, for a discussion of impacts. Because of the overlap between the construction period and operation, permanent visual impacts from the proposed action are presented under *Operation Impacts*.

4.12.3.3.2 Operation Impacts

The impacts to visual resources from the Tinian Alternative 3 operations would be similar to those described for Tinian Alternative 1. See Section 4.12.3.1, *Tinian Alternative 1*, for a discussion of impacts. Figure 4.12-3 shows the key observation points, range complexes, and training facilities associated with Tinian Alternative 3. Under Tinian Alternative 3, as in Tinian Alternative 2, the International Broadcasting Bureau antenna facilities would be removed to allow for the construction of the southern Battle Area Complex and Range Complex C would include objective areas on both sides of 8th Avenue. As in Tinian Alternative 2, these objectives areas would not be visible from any identified key observation point as in. Therefore, implementation of Tinian Alternative 3 would result in significant direct and indirect impacts to visual resources from key observation points Ushi "Cross" Point B (#6) and Mount Lasso Lookout A (#8); less than significant direct or indirect impacts to all other visual resources from key observation points National Historic Landmark at North Field (#1), Unai Chulu (#2), Unai Babui (#3) and Unai Lam Lam (#4), Mount Lasso Lookout B (#9), 8th Avenue-North of the Airport (#10), Broadway North (#11), Broadway South A (#12), Unai Dankulo (#14), and Unai Masalok (#15); and no direct or indirect impacts from key observation points Ushi "Cross" Point A (#5), Blow Hole (#7), Broadway South B (#13).

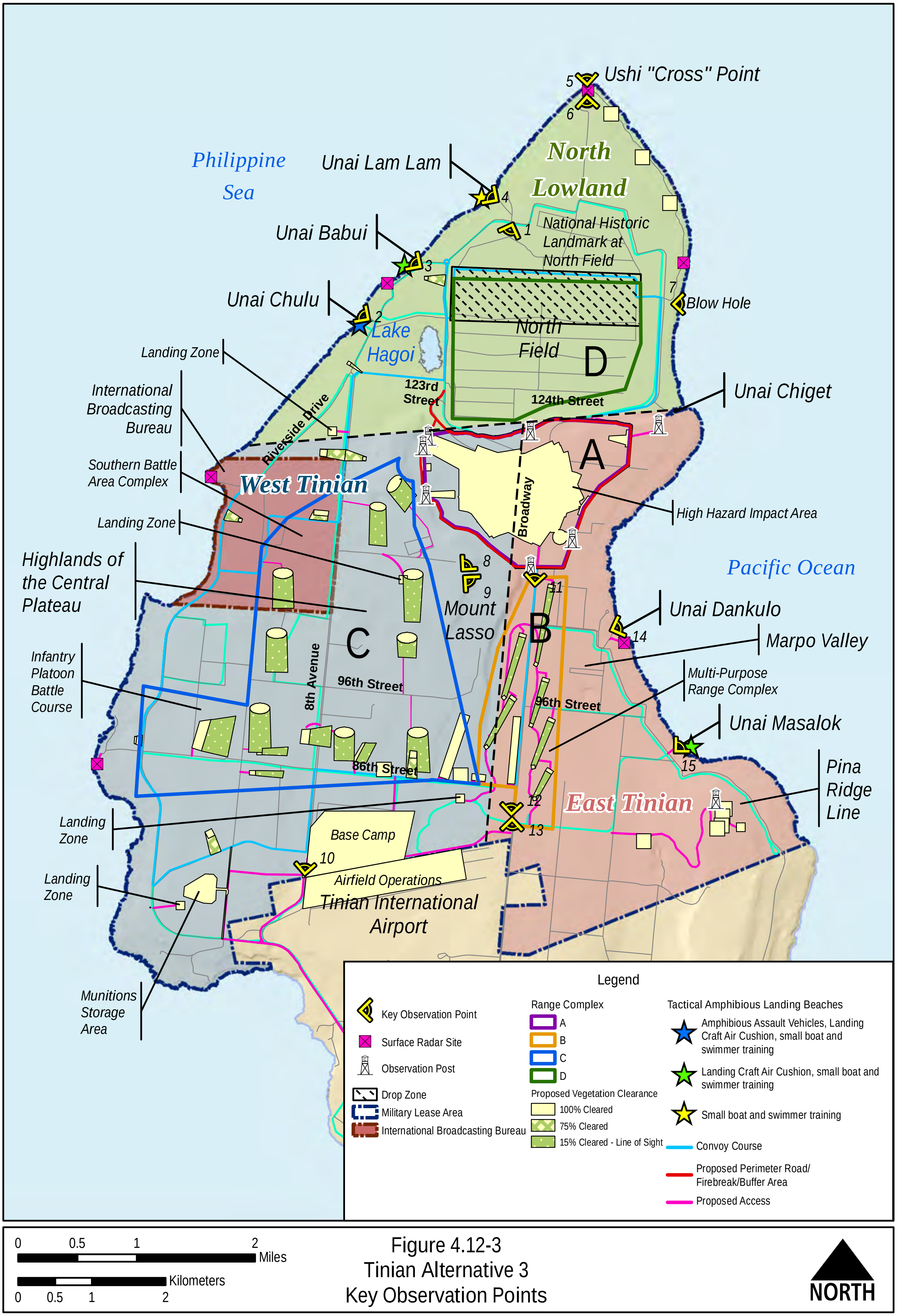


Figure 4.12-3
Tinian Alternative 3
Key Observation Points

4.12.3.3.3 Summary of Impacts

Table 4.12-5 provides a summary of visual impacts associated with Tinian Alternative 3.

Table 4.12-5 Tinian Alternative 3 Summary of Visual Impacts

Key Observation Point	*Visual Contract Rating*	*Overall Visual Impact Rating*
National Historic Landmark at North Field (#1)	Moderate	Negligible
Unai Chulu (#2)	Weak	Minor
Unai Babui (#3)	Weak	Minor
Unai Lam Lam (#4)	Weak	Minor
Ushi “Cross” Point A (#5)	None	None
Ushi “Cross” Point B (#6)	Major	Strong
Blow Hole (#7)	Weak	Minor
Mount Lasso Lookout A (#8)	Major	Strong
Mount Lasso Lookout B (#9)	Moderate	Moderate
8th Avenue-North of the Airport (#10)	Strong	Moderate
Broadway North (#11)	Weak	Negligible
Broadway South A (#12)	Weak	Negligible
Broadway South B (#13)	None	None
Unai Dankulo (#14)	Weak	Negligible
Unai Masalok (#15)	Weak	Negligible

4.12.3.2 Tinian No-Action Alternative

The continuation of periodic military non-live-fire training in the Military Lease Area on Tinian would not be expected to produce any significant changes to the visual environment. There has been, and it would be anticipated that there would be in the future, minor, if any, vegetation clearing and the dense overgrowth would continue to dominate viewsheds on the island. As documented in the Guam and CNMI Military Relocation EIS (DoN 2010b), the planned four live-fire training ranges would be established within the Military Lease Area that would require substantial vegetation clearing and alteration of vistas from several vantage points. As documented in that EIS, the creation of the four ranges would have significant but mitigable impacts (see Table 13.2-4, *Summary of Impacts*; DoN 2010a) on Tinian. There would be no visual resources impacts incurred by Mariana Islands Range Complex training (DoN 2010a). Therefore, the no-action alternative would introduce significant but mitigable impacts to visual resources given the introduction of the four proposed ranges as documented in the Guam and CNMI Military Relocation EIS (DoN 2010b). The mitigation measures documented in the Guam and CNMI Military Relocation EIS (DoN 2010b) would reduce adverse vistas from Mount Lasso and Broadway Avenue through use of design guidelines to minimize land clearing and grading as well as using native flora to create a natural screening effect. With these measures, overall, the no-action alternative would have less than significant impacts on visual resources on Tinian.

4.12.3.3 Summary of Impacts for Tinian Alternatives

Table 4.12-6 contains a comparison of the potential impacts to visual resources for the three Tinian alternatives and the no-action alternative.

Table 4.12-6. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Visual Resources	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
National Historic Landmark at North Field (#1)	*Not applicable*	*BI/LSI*	*Not applicable*	*BI/LSI*	*Not applicable*	*BI/LSI*	*Not applicable*	*Not applicable*
Unai Chulu (#2), Unai Babui (#3) and Unai Lam Lam (#4)	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*Not applicable*
Ushi "Cross" Point A and B (#5 and #6)	*Not applicable*	*NI (#5); SI (#6)*	*Not applicable*	*NI (#5); SI (#6)*	*Not applicable*	*NI (#5); SI (#6)*	*Not applicable*	*Not applicable*
Blow Hole (#7)	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*Not applicable*
Mount Lasso Lookout A and B (#8 and #9)	*Not applicable*	*SI (#8); LSI (#9)*	*Not applicable*	*SI (#8); LSI (#9)*	*Not applicable*	*SI (#8); LSI (#9)*	*Not applicable*	*LSI*
8th Avenue-North of the Airport (#10)	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*Not applicable*
Broadway North (#11)	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*
Broadway South A and B (#12 and #13)	*Not applicable*	*LSI (#12); NI (#13)*	*Not applicable*	*LSI (#12); NI (#13)*	*Not applicable*	*LSI (#12); NI (#13)*	*Not applicable*	*LSI*
Unai Dankulo (#14) and Unai Masalok (#15)	*Not applicable*	*LSI (#14-15)*	*Not applicable*	*LSI (#14-15)*	*Not applicable*	*LSI (#14-15)*	*Not applicable*	*Not applicable*

Legend: *BI* = beneficial impact; *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts.

4.12.4 Pagan

4.12.4.1 Pagan Alternative 1

4.12.4.1.1 Construction Impacts

Unlike Tinian, training on Pagan would be expeditionary and would include minimal construction of permanent facilities. Figure 4.12-4 shows the visual resources, range complexes, and training facilities associated with Pagan Alternative 1.

Construction would be required on the north end of the island for military training trails around the perimeter of Mount Pagan, clearance of volcanic rock covering over half of the old airstrip, and installation of concrete pads for operations (e.g., Munitions Storage Area). The Munitions Storage Area would be secured by chain-link fencing with barbed wire. Only a small portion of the High Hazard Impact Area centered on Mount Pagan would be improved (e.g., vegetation clearing) for target placement since target placement is anticipated to be within barren lava fields (i.e., lacks vegetation) to the greatest extent possible. Vegetation clearing is also anticipated within the North Range Complex to construct the landing zones and establish a firebreak around the perimeter of the High Hazard Impact Area. Limited land area would be disturbed in the High Hazard Impact Area on the isthmus to incorporate targets and to create a fire break. No construction activities would occur in south Pagan. A fence would be constructed where physically possible and signs would be posted to delineate the boundary of the High Hazard Impact Areas.

The construction of the training facilities would mostly involve cutting vegetation and filling, clearing, and grading of terrain. Because of the overlap between the construction period and operation, visual impacts are presented under Section 4.12.4.1.2, *Operation Impacts*.

4.12.4.1.2 Operation Impacts

4.12.4.1.2.1 North Pagan

Permanent changes to the visual environment in the northern portion of Pagan from Pagan Alternative 1 operations would include changes in the landscape within the northern High Hazard Impact Area resulting from targets, fencing, and signage and maintenance of vegetation cleared for the base camp, munitions storage area, and airfield. The existing dark barren landscape of the lava fields would remain the same; however, craters caused by military training operations (i.e., impact craters from naval gunfire, aviation, artillery, mortar ordnance) would modify the topography of the barren lava fields over time.

4.12.4.1.2.2 Central Pagan

Permanent changes to the visual environment in the central portion of Pagan from Pagan Alternative 1 operations would include changes in the landscape within the High Hazard Impact Area located on the isthmus resulting from targets, fencing, and signage and maintenance of vegetation cleared for targets and the fire break established during construction. The existing vegetated landscape would now have barren areas created by (i.e., impact craters from aviation, artillery, mortar ordnance). These areas are anticipated to lack vegetation and appear dark until the vegetation is allowed to recover.

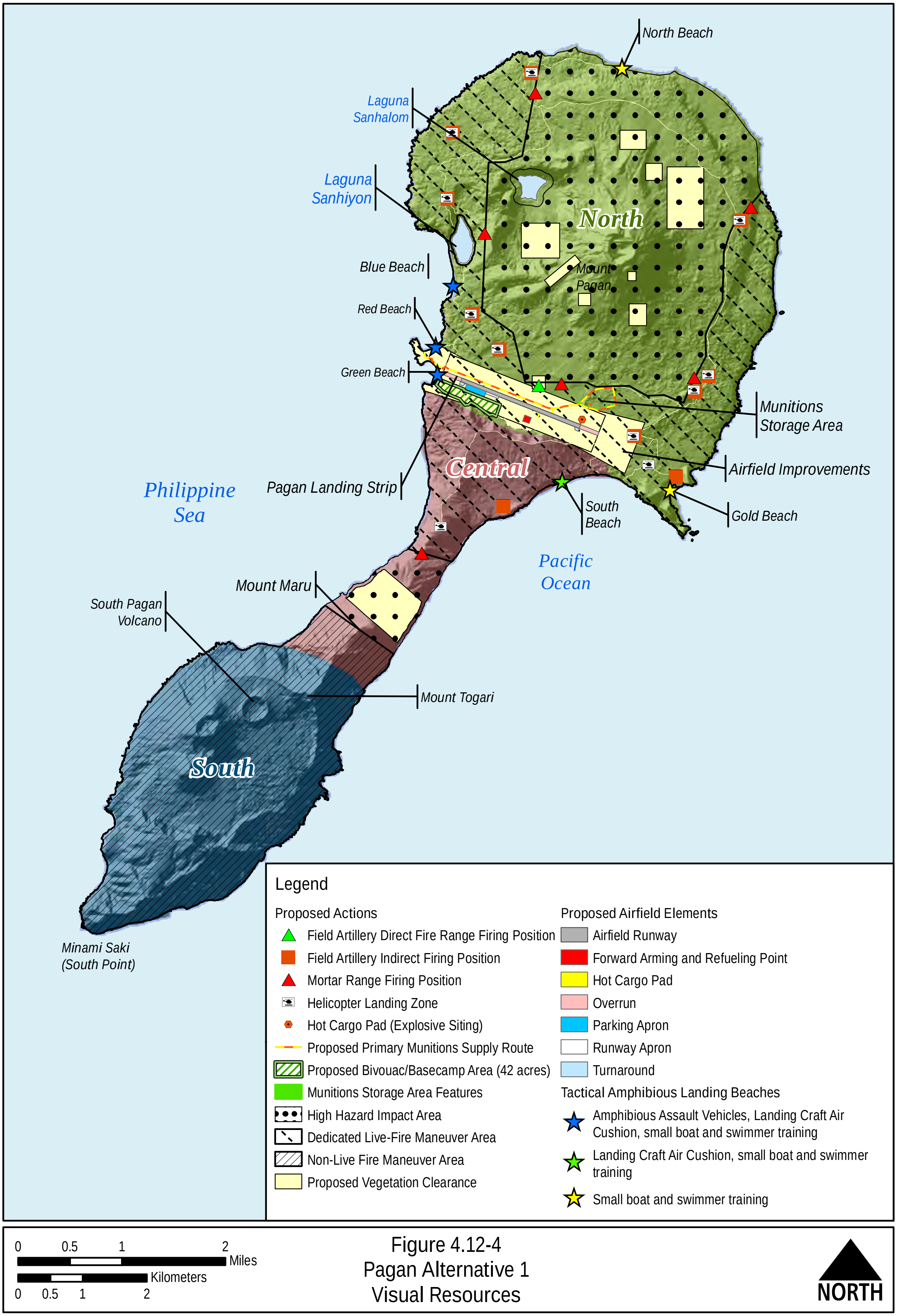


Figure 4.12-4
Pagan Alternative 1
Visual Resources

4.12.4.1.2.3 South Pagan

Pagan Alternative 1 would result in minimal impacts to visual resources in the southern portion of Pagan as training operations would be limited only to foot traffic. Ground maneuvering would result in the trampling and breaking of vegetation and the creation of temporary trails and mobility corridors; however, this would only occur up to 16 weeks per year and the vegetation on Pagan is fairly robust and it is expected that vegetation would regrow rather rapidly.

Due to the lack of visual receptors as described in Section 3.12, *Visual Resources*, Pagan Alternative 1 would result in less than significant direct or indirect impacts to visual resources.

4.12.4.2 Pagan Alternative 2

4.12.4.2.1 Construction Impacts

Construction impacts to visual resources under Pagan Alternative 2 would be similar to those described for Pagan Alternative 1. See Section 4.12.4.1, *Pagan Alternative 1*, for a discussion of impacts. Figure 4.12-5 shows the visual resources, range complexes, and training facilities associated with Pagan Alternative 2. Under Pagan Alternative 2 construction would be limited to a smaller High Hazard Impact Area centered on Mount Pagan (compared to Pagan Alternative 1) as the High Hazard Impact Area on the isthmus would not be constructed. A total of five firing positions associated with the Mortar Range (one less than under Pagan Alternative 1) and thirteen Landing Zones (two more than under Pagan Alternative 1) would be constructed under Pagan Alternative 2. Because of the overlap between the construction period and operation, visual impacts for the training facilities are presented under Section 4.12.4.2.2, *Operation Impacts*.

4.12.4.2.2 Operation Impacts

Permanent changes to the visual environment of northern and southern Pagan during Pagan Alternative 2 operations would be the similar to those described for Pagan Alternative 1. See Section 4.12.4.1, *Pagan Alternative 1*, for a discussion of impacts.

Pagan Alternative 2 would result in minimal impacts to the central portion of Pagan as training operations would be limited only to foot traffic because training associated with the High Hazard Impact Area on the isthmus would not occur. The South Range Complex maneuver area would be the same as found under Pagan Alternative 1. Ground maneuvering would result in the trampling and breaking of vegetation and the creation of temporary trails and mobility corridors; however, this would only occur up to 16 weeks per year and the vegetation on Pagan is fairly robust so it is expected that vegetation would regrow rather rapidly. Due to the lack of visual receptors as described in Section 3.12, *Visual Resources,* Pagan Alternative 2 would result in less than significant direct or indirect impacts to visual resources.

4.12.4.3 Pagan No-Action Alternative

The no-action alternative would have minor activities associated with periodic visits to Pagan for eco-tourism, scientific surveys and military training exercises related to search and rescue. Given these short term and minor activities, there would be no significant impacts to visual resources on Pagan.

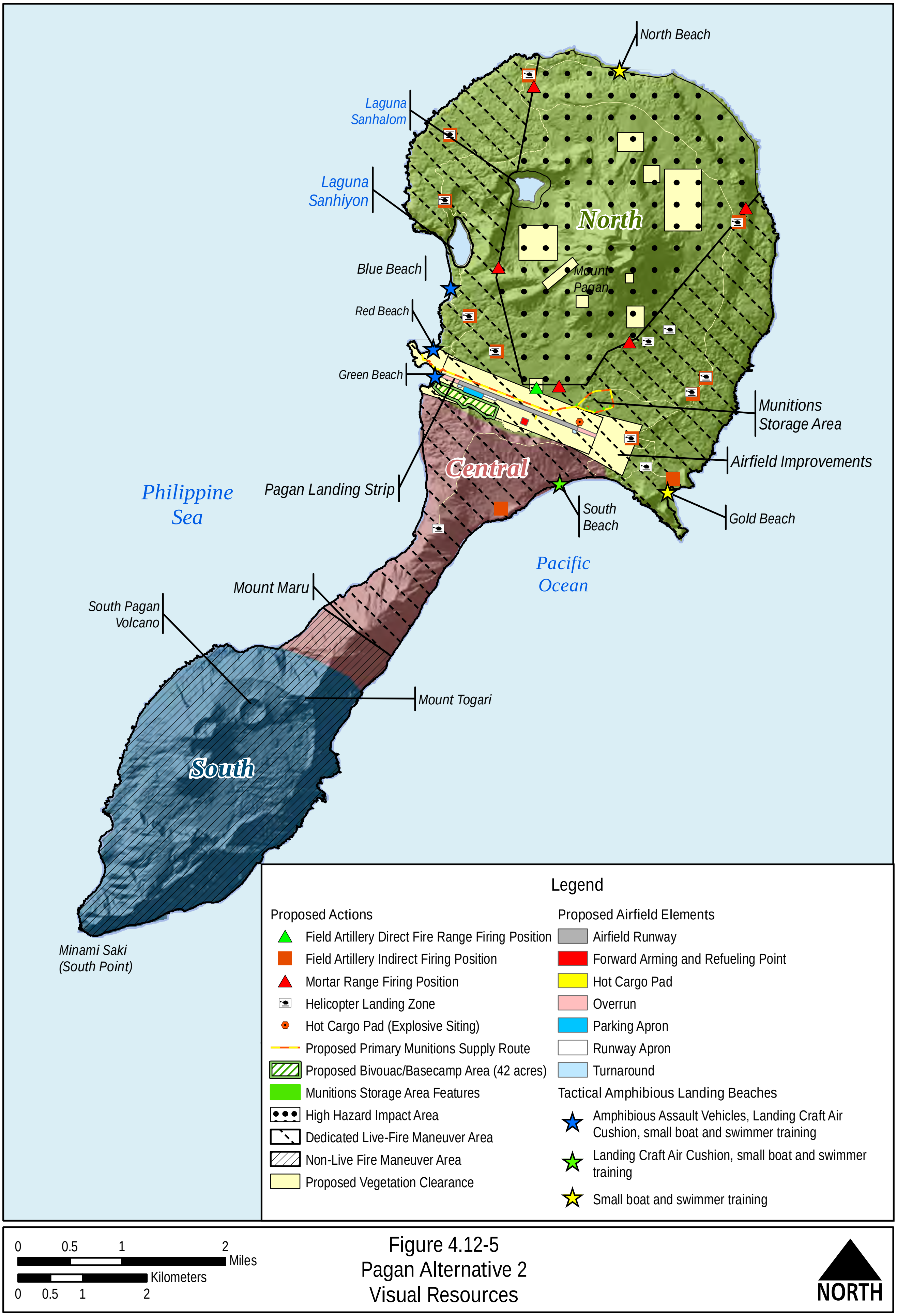


Figure 4.12-5
Pagan Alternative 2
Visual Resources

4.12.4.4 Summary of Impacts for Pagan Alternatives

Table 4.12-7 contains a comparison of the potential impacts to visual resources for the two Pagan alternatives and the no-action alternative.

Table 4.12-7. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Visual Resources	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Visual Resources	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*

Legend: *LSI* = less than significant impact; *NI* = no impact.

4.13 TRANSPORTATION

Section 4.13 addresses the components of the proposed action that could affect the existing air, ground, and marine transportation resources. Potential impacts to Tinian and Pagan's transportation network are analyzed, and include both construction and operational elements of the proposed action alternatives that could affect air, ground, and marine transportation.

4.13.1 Approach to Analysis

4.13.1.1 Air Transportation

The air transportation section evaluates the existing operational capacity of the Tinian International Airport facilities and Pagan airfield to meet the air transportation demand for the proposed action and the potential impacts of the air transportation demand on these airport facilities. Airfield demand/capacity was analyzed to determine the ability of the Tinian International Airport and Pagan airfield to accommodate forecasted operation levels with the implementation of the proposed action, and to identify additional airport facilities, if required.

Factors considered in defining airfield facility requirements include:

- Impact to the efficiency and safety of existing facilities
- Increase in level of aviation operation, which determines the requirements for runway and taxiways
- Increase in mix of aircraft projected to operate at Tinian International Airport and Pagan airfield

The impact analysis considered the following potential effects to air transportation from the proposed action:

- Increase in aviation operation demand to a level that approaches the airfield capacity resulting in operational delays, limited growth of airport operations, use of larger aircraft, and/or cancellation or consolidation of flights during peak delay periods.
- Shortfalls in the existing airport facilities, such as the pavement strength, aircraft parking apron, passenger terminal and vehicular parking facilities that would severely impede the public access to these facilities.
- Obstructions to air navigation, navigational aids, or navigational facilities which are hazardous to the usage of the airport.

Like the highway system and traffic laws, Federal Aviation Administration regulations establish how and where aircraft may fly. Collectively, the Federal Aviation Administration uses these regulations to make airport use as safe, efficient, and compatible as possible for all types of aircraft; from private propeller-driven planes to large, high-speed commercial and military aircraft. The impact analysis on air transportation resources for this EIS/OEIS is developed in consultation with the Federal Aviation Administration and assists the Federal Aviation Administration in fulfilling their requirement to complete an aeronautical study. The Federal Aviation Administration will prepare two separate aeronautical studies, one for Tinian and one for Pagan, to determine the aeronautical effects of potential obstructions to air navigation. The separate aeronautical study will review the existing airspace structure and use, and contain an analysis of the potential impacts of the proposed action alternatives on civil aviation. Refer to Section 4.6, *Airspace* for details on the impacts to airspace and air traffic.

4.13.1.2 Ground Transportation

The analysis for ground transportation on Tinian addresses potential impacts to traffic and circulation associated with the proposed action. The analysis uses past traffic analyses and engineering evaluations, currently available traffic data, and Highway Capacity Manual (Transportation Research Board 2000) to determine specific roadways' projected Level of Service. For a definition of Level of Service, see Section 3.13.1*, Definition*.

This approach was not used for Pagan, because only all-terrain pathways currently exist and the Highway Capacity Manual methodology does not address the unique characteristics of all-terrain pathways or trail users.

As part of the 1999 amendment to the 1975 Technical Agreement, the Department of Defense transferred ownership of the roads (public rights of way) within the lease-back portion of the Military Lease Area on Tinian back to the CNMI (as described in Section 3.7, *Land and Submerged Land Use*), for the purposes of maintaining roads used by the civilian population and to alleviate public safety concerns for those requiring access to the Lease Back Area (Northern Mariana Islands 1975). Roads within the Exclusive Military Use Area were retained by the military with a maintenance agreement between the CNMI and the Department of Defense, to facilitate public access to the historic areas within the Military Lease Area. Development within the Military Lease Area as part of proposed action would require a review of the 1999 amendment to the 1984 Tinian lease agreement on road ownership and maintenance.

Roadways on Tinian would be designed and constructed in accordance with standards included in the Federal Highway Administration's *A Policy on Geometric Design of Highways and Streets* (American Association of State Highway and Transportation Officials 2011) and criteria included in the United Facilities Code 3-250-18FA, *General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas* (Department of Defense 2006).

The significance of impacts were determined based on the degree of change between pre- and post-proposed action conditions. Significant impacts to ground transportation would occur if execution of the proposed action alternative would cause the following:

- Substantial increase in traffic volumes (average daily traffic) on existing roadways, such that the available capacity would be exceeded and the Level of Service would degrade to unacceptable conditions (i.e., Level of Service E or Level of Service F, as defined in Appendix O, *Transportation Study*)
- Significant non-compliance with jurisdictional transportation policies, plans, or mandated improvement programs

4.13.1.3 Marine Transportation

The analysis for marine transportation addresses the potential impacts to facility access at the Port of Tinian. The analysis assessed effects to general vessel access, loading/unloading of ships, and vessel handling requirements. This analysis was not done for Pagan alternatives, as Pagan does not currently have an active harbor. A separate analysis addressed sea space restriction requirements for training activities around Tinian and Pagan and identified effects to marine vessel transportation.

Significance of impacts was determined qualitatively based on the degree of change between pre- and post-proposed action alternative conditions. Significant impacts to marine transportation would occur in the event that execution of the alternative caused either of the following:

- Conflict with transportation policies, plans, or programs
- Substantially affect marine transportation routes, in-harbor procedures, or infrastructure

4.13.2 Resource Management Measures

4.13.2.1 Air Transportation

Resource management measures that are applicable to air transportation include the following:

4.13.2.1.1 Avoidance and Minimization Measures

- Contractor coordination with the Commonwealth Ports Authority and the various air and sea carriers in advance for transport arrangement during peak season when the majority of construction personnel and dependents may travel at the same time (i.e. during Christmas Exodus break), to possibly spread out the departure/arrival times and to utilize different modes of transport to mitigate temporary strain on air transportation infrastructure.
- Adjustment of construction timing and phasing to accommodate the civil and commercial usage of the existing airport facilities.

4.13.2.1.2 Best Management Practices and Standard Operating Procedures

- Erosion Control Plan
- Hazardous Materials Management Plan
- Hazardous Waste Management Program
- Spill Prevention, Control and Countermeasures Plans and Facility Response Plans
- Biosecurity Outreach and Education
- Traffic Management Plan and Work Zone Traffic Management
- Notice to Air Traffic – The Federal Aviation Administration will announce in the Notice to Airmen the proposed schedule for the use of the surface danger zone to inform vessel operators of periods of potential airspace use
- Range Training Area Management Plan
- Bird-Aircraft Strike Hazard Plan
- Construction Safety and Phasing Plan – Which would be approved by the Federal Aviation Administration and would require coordination with Commonwealth Ports Authority and commercial aviation operators

4.13.2.2 Ground Transportation

Resource management measures that are applicable to ground transportation include the following:

4.13.2.2.1 Avoidance and Minimization Measures

- Low Impact Development

4.13.2.2.2 Best Management Practices and Standard Operating Procedures

- Range Training Area and Management Plan
- Traffic Management Plan and Work Zone Traffic Management
- Erosion Control Plan

4.13.2.3 Marine Transportation

Resource management measures that are applicable to marine transportation include the following:

4.13.2.3.1 Best Management Practices and Standard Operating Procedures

- Range Training Area and Management Plan
- Notice to Mariners

A complete listing of best management practices is provided in Appendix D, *Best Management Practices.*

4.13.3 Tinian

4.13.3.1 Tinian Alternative 1

4.13.3.1.1 Construction Impacts

4.13.3.1.1.1 Air Transportation

The average annual population of construction personnel, including their dependents, coming from outside of Tinian is estimated to be approximately 450 to 600 during the 8 to 10 years of the construction period of the proposed action (Appendix Q, *Socioeconomic Impact Assessment Study*) (DoN 2014a). There would be some increase in air passenger volume if they transport to and from Tinian by air, especially if the construction personnel and dependents return home at the same time (e.g. during Christmas Exodus break). It is anticipated that the construction personnel and dependents are likely to take the following transport scenarios:

- By sea
- By air to nearby airport, such as Saipan International Airport, and connect to Tinian by sea
- By air to nearby airport, such as Saipan International Airport, and connect to Tinian by air
- By chartered plane to Tinian International Airport directly (varies from approximately 3 to 6 flights for regional jets with approximately 100 to 200 seats, to approximately 20 flights by twin-engine Short 360 aircraft with 30 seats)

If Tinian International Airport is the first port of entry to the U.S. for some of the foreign construction personnel and dependents, arrangements for immigration and customs services must be made in advance with the Chief Immigration Judge Saipan, and coordination with Transportation Security Administration would be required for security screening.

The existing airfield annual service volume capacity of Tinian International Airport is approximately 164,000 operations, with hourly capacities during visual flight rules and instrument flight rules of approximately 50 and 45 operations, respectively. The existing total operations at Tinian International Airport were 49,116 in 2013, which represents approximately 30% of the annual service volume. The Federal Aviation Administration recommends a detailed planning analysis for airfield enhancements when annual operations reach 60% of the annual service volume (98,400 operations at Tinian International Airport) and implementing the enhancements when annual operations approach 80% of the annual service volume (131,200 operations at Tinian International Airport). There is approximately 50% of the airfield capacity (i.e., 82,000 annual service volume) at the existing Tinian International Airport available before any enhancements are required. Based on the above estimates, the capacity of the existing airfield facilities is sufficient to handle the increase in air travel demand during the 8 to 10 year construction period.

It is anticipated that the primary transport of construction equipment and materials to Tinian would be by sea instead of by air, in view of the delivery costs. Although some of the light construction equipment and materials may potentially be delivered by air, the increase in air cargo during the construction period would be minimal.

Construction of the proposed training facilities, such as new taxiways connecting to the north of existing Runway 08/26 and the required expeditionary (non-permanent) navigation lights are within the existing airport boundary, and would have temporary impacts to the existing airport facilities during construction, such as intermittent delays from unanticipated construction issues and time-sensitive construction operations. To the extent practical construction within runway critical areas, such as the runway safety area, would be completed during off-peak hours. Coordination with the Commonwealth Ports Authority and commercial aviation operators is required as part of the Construction Safety and Phasing Plan and would reduce these impacts and/or develop phasing strategies to remove the impacts. Development of the Construction Safety and Phasing Plan is to begin during engineering design stages of the project. Federal Aviation Administration Form 7460-1, Notice of Proposed Construction or Alteration, including the Construction Safety and Phasing Plan, has to be submitted prior to construction on the airport, and for any construction that is within an imaginary surface extending outward and upward at 100 to 1 for a horizontal distance of 20,000 feet (6,096 meters) from the nearest point of Runway 08/26.

Through the implementation of resource management measures, including contractor coordination with the Commonwealth Ports Authority and the various air and sea carriers in advance for transportation arrangements during the peak transportation seasons, and adjusting construction timing to accommodate civil and commercial usage of airport facilities, impacts to transportation facilities would be less than significant during the construction period.

4.13.3.1.1.2 Ground Transportation

Figure 4.13-1 shows the proposed ground transportation improvements and road closures. New road construction and existing roadway improvements are planned as part of the proposed action, and necessary to support tactical vehicles and military training activities on Tinian, as well as to improve access to areas within the Military Lease Area for civilians. Improvements may include, but would not be limited to, clearing, grading, resurfacing, and reinforcing/strengthening existing roads that are currently in poor condition. The following roadway improvements and new roadway construction would be considered for implementation and are detailed in Section 2.4.1.1, *Construction and Improvements.*

- Improve road right-of-way for utilities
- Repair existing road for public use
- Repair existing road to a public access boulevard
- Construct new paved roads
- Repair existing road for general use
- Construct new gravel roads
- Establish military training roads
- Establish perimeter patrol road

The following cargo transit and tracked vehicle transit routes would be established:

- Outside of the Military Lease Area a cargo transit route/tracked vehicle transit lane would be established
- Within the Military Lease Area a tracked vehicle training trail would be established

Construction activities associated with the proposed action are anticipated to span 8 to 10 years. On Tinian, the construction of training facilities, support facilities, and infrastructure would be limited in most cases to grading and excavation. Some localized construction of structures (e.g., port improvements, base camp, Munitions Storage Area, Observation Posts) and installation of automation equipment within the Military Lease Area would take place (Section 2.4.1.1, *Construction and Improvements*).

Depending on how rapidly construction is completed, the average number of construction workers, including their dependents, would range from approximately 450 to 600 on Tinian for each year of the 8- to 10 year construction period, and most off-island construction workers would be expected to live in workforce housing that is currently located behind the Tinian Dynasty Hotel and Casino (Appendix Q, *Socioeconomic Impact Assessment Study* (DoN 2014a).

Throughout the 8- to 10-year construction period of Tinian Alternative 1, intermittent impacts to traffic circulation may result from the movement of trucks containing construction and debris removal materials, as well as from construction workers commuting. It is assumed that construction workers residing in workforce housing would be bused to the construction site in 40-passenger buses (between 12 and 15 bus trips per work day). This increase in traffic volumes on Tinian roadways would not significantly adversely affect traffic circulation or roadway Level of Service.

Figure 4.13-1
Ground Transportation Improvements

Construction truck movements may result in generally isolated impacts that could include, but would not be limited to, congestion, slower speeds in construction zones, temporary roadway closures, and short detours that may be caused by equipment movement, delivery of construction materials, removal of construction debris, and construction of roadway improvements.

Most of the construction activities would occur on military property, and as such, very limited transportation and circulation impacts from construction are anticipated. Projects at the port or road and utility improvements from the port to the base camp would impact the community. The traffic management plan and work zone traffic management would minimize construction impacts on vehicular travel and bicycle and pedestrian circulation, and access to destinations near the construction area.

With implementation of best management practices (Appendix D), which would include a comprehensive Traffic Management Plan, work zone traffic management strategies, and appropriate roadway and public right-of-way maintenance, construction under Tinian Alternative 1 would not significantly increase the potential for impacts to traffic circulation or roadway Level of Service for vehicles, public transit, pedestrians, or bicycles, increase the rate of traffic related accidents, or reduce transportation safety. Therefore, construction activities associated with Tinian Alternative 1 would result in less than significant direct and indirect impacts to ground transportation resources.

4.13.3.1.1.3 Marine Transportation

Construction of proposed training ranges and support facilities would increase use of Tinian's port facilities. Several vessel visits would be required to transport the initial equipment, materials, and personnel (temporary and permanent) associated with construction of the training and supporting facilities. Use of the port would be increased over the entire 8 to 10 year course of the construction period.

All vessels associated with the construction would dock at Tinian's commercial harbor. Tinian Alternative 1 does not include improvements to the harbor. However, port improvements (on land) would include enhancements to the existing old public boat ramp to accommodate use by Amphibious Assault Vehicles, new military-only bulk fuel storage tanks, a new military-only biosecurity facility, and a military-only vehicle washdown facility. The improvements are described in Chapter 2, *Proposed Action and Alternatives,* Sections 2.4.1.2.4 and 2.4.1.2.5, and shown on Figure 2.4-5. These improvements would not affect the port's current ability to process vessels transporting personnel and cargo. Therefore, construction activities associated with Tinian Alternative 1 would result in less than significant impacts to marine transportation resources.

4.13.3.1.2 Operation Impacts

4.13.3.1.2.1 Air Transportation

The existing capacity of Tinian International Airport facilities and the air transportation demand for the proposed action have been analyzed. Based on the airfield demand/capacity analysis, the airport would not experience airfield-capacity constraints with the additional air transportation demand under the proposed action. Details of the analysis are given in Appendix O, *Transportation Study* (DoN 2014b).

No runway pavement additions, or strengthening of existing runway pavement, are anticipated. The existing runway length would be sufficient to accommodate the fleet mix with reduced maximum takeoff weights (i.e., limited allowable gross weights) for 747-400, C-17, and C-130.

A new aircraft parking apron and associated taxiway for the U.S. military would be provided to the north of Runway 08/26, and would be separated from the existing civilian apron and taxiways. It is anticipated that usage of the existing civilian apron and taxiways for the proposed action would be limited once the military apron and taxiways are in operation. Runway 08/26 would be the only major shared-use airport facility.

The personnel associated with the proposed action, including all support personnel, would enplane and deplane separate from civilian passengers and would then be bused to the base camp in designated vehicles, or walk to the base camp through a proposed gate in the joint airport/base camp security fence. It is anticipated that personnel would not be processed in the existing passenger terminal. No additional requirement for passenger processing in the existing passenger terminal is anticipated. If Tinian International Airport is the first port of entry to the U.S. for foreign allies or participants from overseas military facilities, clearance for immigration, customs, and quarantine control would be carried out at designated staging areas separate from the existing airport terminal facilities. Therefore, no additional requirement for customs, immigration, or quarantine facilities would be needed at the existing passenger terminal.

A communication tower is proposed at the base camp. Under the CFR Title 14 Part 77, Subpart B, Federal Aviation Administration Form 7460-1, Notice of Proposed Construction or Alteration, must be filed before construction. The Federal Aviation Administration would complete an obstruction evaluation/airport airspace analysis to determine whether the effects of the proposed tower would constitute a hazard to air navigation. An application for a license from the Federal Communications Commission must also be filed, if applicable.

Periodic impacts to the existing airfield facilities (mainly Runway 08/26) would be expected due to the implementation of Tinian Alternative 1. Intermittent delays could occur periodically when military training occupies the runway or during other activities (such as arming/dearming aircraft). However, potential delays would be sporadic and typically on the order of 5 minutes or less. In addition, coordination with the Commonwealth Ports Authority and commercial aviation would minimize these impacts. The training event timing could be coordinated with the civil and commercial usage of the existing airport facilities. Increase in maintenance requirements for Runway 08/26 are anticipated as a result of the increase in usage for the military training exercises.

In summary, implementation of Tinian Alternative 1 would result in less than significant direct or indirect impacts to air transportation resources.

4.13.3.1.2.2 Ground Transportation

In general, roadways would be maintained to ensure their serviceability, and would be designed in accordance with the American Association of State Highway and Transportation Officials' *A Policy on the Geometric Design of Highways and Streets, 6th Edition* (American Association of State Highway and Transportation Officials 2011) and United Facilities Criteria 3-250-18FA, *General Provisions and Geometric Design For Roads, Streets, Walks, and Open Storage Areas* (Department of Defense 2006). Exceptions to design standards (e.g., lane width, shoulder width, vertical alignment, stopping sight distance, clear recovery zones) may be requested in some cases, with sufficient justification and documentation of reasons for the request. Examples of reasons for which exceptions have been granted include reducing or avoiding significant right-of-way, and environmental and/or socioeconomic impacts. Existing roads around the North Field Runway (e.g., 123rd Street, Ushi Point Road, and Lennox Avenue) would be maintained by the U.S. military to allow tour bus access.

Roadway alignments were evaluated for both feasibility and constructability. Permanent erosion control and bank stabilization measures are recommended for implementation on segments with steep grades and/or side slopes. Detailed information, including illustrations of the proposed roadway network, typical cross-sections, and elevation profiles are included in Appendix O, *Transportation Study*. Planned roadway improvements are preliminary and are subject to change pending ongoing engineering and feasibility studies.

Vehicles

Each unit would bring the type and amount of vehicles and equipment required for its own training. The type and amount of vehicles and equipment required would vary depending on the training activities being conducted. Examples of the type of vehicles and equipment that would be used on Tinian are shown and described in Table 2.2-2, *Representative Weaponry and Equipment*. Vehicles would include, but not limited to, the following:

- High Mobility Multi-purpose Wheeled Vehicle (Humvee)
- Light Armored Vehicle (e.g., C2 variant of LAV-25)
- Amphibious Assault Vehicle (e.g., AAV-7A1)
- Medium Tactical Vehicle Replacement 7-ton Truck

In addition, various types of military and commercial vehicles are planned for personnel movement and permanent support of administrative and range maintenance functions. These are listed in Section 2.4, *Ground Transportation*.

To minimize the need for shipping equipment to Tinian, parking for permanently staged vehicles would be provided within the Military Lease Area.

Pre-Training Preparation

Pre-training preparation would include an advance team performing administrative functions within the Tinian RTA. Pre-training preparation activities consist of a check-out of base camp facilities, clearing the Military Lease Area of non-participating personnel, establishing check points/road blocks, and conducting communications checks. Vehicles involved in pre-training preparation would travel minimally on roadways outside the Military Lease Area and would involve vehicles to be supplied from the base camp motor pool. The minimal, infrequent, and temporary increase in traffic volumes associated with pre-training preparation would result in no impacts to traffic circulation or roadway Level of Service. Pre-training preparation activities, (i.e., establishing check points/road blocks and clearing the Military Lease Area of non-participating personnel) would reduce the risk of safety hazards, accidents, and collisions.

Arrival/Departure

The periods of peak demand on roadways outside the Military Lease Area would be expected to occur immediately following the arrival, and preceding the departure, of personnel and equipment. The Port of Tinian and Tinian International Airport would serve as the primary embarkation and disembarkation points for transportation of personnel and equipment by sea and air, respectively. Personnel arriving at Tinian would disembark and proceed to base camp by vehicle, bus, or on foot.

The expected primary route for personnel traveling between The Port of Tinian and the base camp is approximately 3.44 miles (5.54 kilometers) in length and includes the following roadways outside of the Military Lease Area: new parallel roadway south of West Street, new parallel roadway west of 6th Avenue and Tinian Power Plant, and 8th Avenue. The expected primary route for personnel traveling between Tinian International Airport and base camp is less than 0.5 mile (0.8 kilometer) in length and does not require travel on roadways outside the Military Lease Area.

For purposes of impact analysis a scenario with the maximum potential for adverse effects was used; assuming a training population of 3,000 (the maximum number of personnel the base camp could accommodate) arrive on the same day, disembark from the Port of Tinian, and are transported to base camp by bus, 150 round-trips (450 passenger vehicle equivalents) would be required. Daily traffic volumes on 8th Avenue, outside the Military Lease Area, would increase from 115 to 565 vehicles (measured in passenger car equivalents). Although substantial, this estimated increase in traffic volumes (average daily traffic) would not exceed available capacity and this roadway would continue to operate at the acceptable Level of Service A with free-flowing traffic and little or no delay to motorists.

During the arrival and departure periods, brief traffic delays and increased traffic congestion would likely occur due to transport of personnel and equipment. Increases in traffic volumes associated with the arrival of military personnel would be temporary and all Tinian roadways would continue to operate at the acceptable Level of Service A. Traffic levels on the majority of roadways within the village of San Jose would not be affected, and traffic volumes on military transit corridors outside the Military Lease Area would return to baseline conditions following arrival. Ground transportation conditions during departure would be similar to arrival. The temporary increase in vehicular traffic volumes during the arrival and departure periods would result in no impacts to traffic circulation or roadway Level of Service.

Training

Ingress to and egress from the four range complexes would not result in a direct increase in traffic on roadways outside the Military Lease Area. Personnel departing base camp destined for any of the range complexes would follow the most direct route available, as described in Appendix O, *Transportation Study*.

In addition to the training facilities associated with the four range complexes, several training facilities would be distributed throughout the Military Lease Area, including a Convoy Course, Tracked Vehicle Driver's Course, and maneuver areas (for both light and amphibious forces). Vehicle maneuvering would only occur on developed roads and trails within the Military Lease Area, or within designated range areas. Tracked vehicles would travel only along designated tracked vehicle trails or within designated range areas (i.e., the Tracked Vehicle Driver's Course). Tactical vehicles involved in exercises at Military

Lease Area-wide training facilities would not result in an increase in the amount of traffic on roadways outside the Military Lease Area.

Supporting activities, such as transportation of munitions and hazardous waste, would require use of roadways outside the Military Lease Area.

The primary proposed supply route, which would be used for transport of munitions, as well as other supplies, is illustrated in Chapter 2, *Proposed Action and Alternatives,* Figure 2.4-3 and runs from the Port of Tinian to the Munitions Storage Area. Transportation of munitions would result in a minor increase in the amount of vehicular traffic on roadways outside of the Military Lease Area. All roadways that comprise the proposed supply route currently operate under capacity at the acceptable Level of Service A and are able to accommodate the marginal increase in vehicular traffic. Therefore, the increase in vehicular traffic along the proposed supply route would not adversely affect roadway Level of Service.

Transportation of Hazardous Materials

Vehicles transporting hazardous materials (including munitions) will travel from the Port of Tinian to the proposed Munitions Storage Area, base camp, and/or the northern part of Tinian International Airport via the primary proposed supply route (see Chapter 2, *Proposed Action and Alternatives;* Figure 2.4-3), which utilizes roads outside of the Military Lease Area and away from populated neighborhoods. A secondary proposed supply route would connect the Munitions Storage Area to munitions holding pads at the northern part of Tinian International Airport. The secondary proposed supply route would utilize roads within the Military Lease Area, including 8th Avenue, 86th Street, and Broadway Avenue. This secondary route bypasses roads which run through the Tinian International Airport and would help to prevent potential conflicts with airfield operation, which could result from temporary road closures for transport of munitions. During training activities, all roads within the Military Lease Area may be used for the transport of munitions as necessary to live-fire training facilities.

Transportation of hazardous materials would result in a minor increase in the amount of vehicular traffic on roadways outside of the Military Lease Area. All roadways that comprise the proposed supply route currently operate under capacity at the acceptable Level of Service A and are able to accommodate the marginal increase in vehicular traffic. U.S. Department of Transportation regulations establish the requirements for transporting hazardous substances. Transportation of all materials would be conducted in compliance with the U.S. Department of Transportation regulations and CFR Title 49.

Transportation of hazardous materials under Tinian Alternative 1, and the minimal incremental increase in traffic associated with the transportation of hazardous materials, would not significantly increase the potential for impacts to traffic circulation or roadway Level of Service for vehicles, public transit, pedestrians, or bicycles, increase the rate of traffic related accidents, or reduce transportation safety. Therefore, transportation of hazardous materials under Tinian Alternative 1 would result in less than significant direct and indirect impacts to ground transportation resources.

Liberty

Military personnel training on Tinian are expected to have 1 day of liberty per training cycle. While off-duty, military personnel would have liberty to go into town. Military personnel would not have access to privately owned vehicles and would be bused to town and/or other destinations on Tinian. The number of bus trips required to transport off-duty personnel would vary depending on the training cycle.

The minimal incremental increase in traffic associated with transportation of military personnel to and from town, or other destinations on Tinian, under Tinian Alternative 1 would not be expected to significantly increase the potential for impacts to traffic circulation or roadway Level of Service for vehicles, public transit, pedestrians, or bicycles, increase the rate of traffic related accidents, or reduce transportation safety. Therefore, liberty under Tinian Alternative 1 would result in less than significant direct and indirect impacts to ground transportation resources.

Operations and Management

Base camp and training operations would require some permanent employment. In total, about 95 full-time positions would be needed to maintain a functional operation. This increase in population would result in an insubstantial increase in traffic volumes on Tinian roadways.

The minimal incremental increase in traffic associated with operations-related employment under Tinian Alternative 1 would not significantly increase the potential for impacts to traffic circulation or roadway Level of Service for vehicles, public transit, pedestrians, or bicycles, increase the rate of traffic related accidents, or reduce transportation safety. Therefore, operations and management under Tinian Alternative 1 would result in less than significant direct and indirect impacts to ground transportation resources.

Access

Mandatory vehicle access control to military installations is a Department of Defense requirement (Department of Defense Directives 5200.08-R and 5200.08 [2009, 2014]). Gates at 8th Avenue and Broadway Avenue would be manned to allow Military Lease Area access to authorized personnel (including International Broadcasting Bureau employees). Common to all alternatives would be the prohibition of public access at any time to the High Hazard Impact Area, Munitions Storage Area, base camp, all fenced and gated training facilities, and the range Observation Posts.

During the training period, varying degrees of public access may be afforded, and would depend on the areas being used for training. It is estimated that civilian use and access would be affected up to 20 weeks per year.

The proposed action would result in the following permanent and temporary road and/or intersection closures:

- Permanent road closure – Existing roads within the High Hazard Impact Area, including portions of Broadway Avenue and 116th Street, would be closed under all alternatives.
- Temporary road closure –
    - Outside the Military Lease Area: transportation of munitions would result in the temporary closure of intersections along the proposed supply route (see Chapter 2, *Proposed Action and Alternatives,* Figure 2.4-3).
    - Within the Military Lease Area: Only certain portions would be open during the training period. As training cycles are better defined, an access plan would be developed and published for public information.

Permanent closure of existing roads within the High Hazard Impact Area (including portions Broadway Avenue and 116th Street) would limit route choice and restrict vehicular access to areas of northern Tinian. A new perimeter road would be constructed around the High Hazard Impact Area. However, given the projected high utilization and frequency of live-fire training activities along Broadway Avenue (i.e., at Range Complex A and Range Complex B), motorists would be diverted to alternate routes (i.e., 8th Avenue) to access areas within the Military Lease Area. Motorists who currently travel on Broadway Avenue (280 daily vehicle trips) would be diverted to 8th Avenue during periods when access to areas within the Military Lease Area is allowed. The estimated peak hour vehicle demand at the proposed 8th Avenue gate would be fewer than 50 vehicles. This estimated peak hour demand would not exceed the gate capacity of 300 vehicles per hour. Adequate vehicle storage would be provided and queues would not be expected to spillback onto adjacent roadways. Therefore, the proposed gate at 8th Avenue would provide the security level required with little or no disruption to the ingress and egress of the installation.

Additionally, planned roadway improvements along 8th Avenue (e.g., resurfacing, realignment, and vegetation clearance) would ensure adequate capacity to accommodate the projected traffic volumes (approximately 345 daily vehicles). The altered circulation patterns resulting from the permanent closure of existing roads within the High Hazard Impact Area under Tinian Alternative 1 would not significantly increase the potential for impacts to traffic circulation or roadway Level of Service for vehicles, public transit, pedestrians, or bicycles; or increase the rate of traffic related accidents; or reduce transportation safety.

Temporary closure of roads and intersections along the proposed supply route would occur during transportation of munitions. To minimize the potential negative adverse effect of roadway closures and resulting altered circulation patterns, the U.S. military would coordinate with the village of San Jose, Commonwealth Department of Public Works, and other local authorities to provide as much advance notice as possible of the date and times public access would be both restricted and afforded to areas within the Military Lease Area. With implementation of resource management measures which would include a Range Training Area Management Plan, access controls and the permanent and temporary closure of roads under Tinian Alternative 1 would not significantly increase the potential for impacts to traffic circulation or roadway Level of Service for vehicles, public transit, pedestrians, or bicycles, increase the rate of traffic related accidents, or reduce transportation safety. Therefore, access controls and the permanent and temporary closure of roads from implementation of Tinian Alternative 1 would result in less than significant direct and indirect impact to ground transportation resources.

Planned roadway improvements would support access to base camp and training support facilities and would result in beneficial impacts to traffic circulation for vehicles, pedestrians, and bicycles, and would decrease accident rates and increase overall transportation safety on Tinian.

4.13.3.1.2.3 Marine Transportation

Increases in marine vessel traffic and harbor use during Tinian Alternative 1 operations would be limited to vessel trips required for transport of personnel, equipment, and materials at the beginning and end of each training cycle. Personnel would arrive and depart to and from Tinian via a mix of air and sea transportation. For the marine transportation analysis, it is assumed that all personnel would arrive and depart via sea transportation, and that a surge-level of personnel would be both embarking and disembarking at once.

At the Port of Tinian, Amphibious Assault Vehicles and Rubber Raiding Craft used during training activities would use an improved public boat ramp, shown in Chapter 2, *Proposed Action and Alternatives*, Figure 2.4-5. Other existing port facilities could be used during training operations. None of the proposed improvements to existing port facilities is expected to impact harbor capacity.

Proposed danger zones are shown in Chapter 2, *Proposed Action and Alternatives*, Figures 2.4-17 and 2.4-20. As stated in 33 CFR Part 334, Navigable Waters (surface danger zone and Restricted Area Regulations); operation of the Tinian RTA would exclude traffic from these areas of sea space on a full-time or intermittent basis, depending on the requirements of training. Consistent with military safety requirements, danger zones would be open to the public only when hazards are minimized to assure safety of the non-participating public. In addition to the danger zones, adjacent restricted areas may be required to accommodate warning areas that separate military operations from non-participating marine vessels.

Cargo vessels traveling from Saipan would be impacted by the danger zones, as these vessels typically traverse in shallow waters off the western shore (100 feet to 1 mile [30 meters to 2 kilometers] offshore) from the northern tip of Tinian to the Port of Tinian, which would be encumbered by the danger zones. Cargo vessels will either have to schedule travel through danger zones during times when the range is not in use, or detour around the danger zones. These impacts would be intermittent.

Range control would be conducted to maximize safety for both the public and military units. Training schedules would be published through Notice to Mariners. The range control facility would remotely survey the range and danger zones via Surface Radar, and visual inspection cameras and/or thermal imaging, and communicate with personnel involved in training to identify conflict prior to, and during use. Procedures would be implemented for the immediate cessation of training if a vessel entered a restricted area. Active training is proposed for 20 weeks per year.

Therefore, Tinian Alternative 1 operations would result in less than significant direct or indirect impacts to marine transportation resources.

4.13.3.2 Tinian Alternative 2

4.13.3.2.1 Construction Impacts

4.13.3.2.1.1 Air Transportation

The impacts to air transportation resources resulting from Tinian Alternative 2 construction activities would be the same as those identified for Tinian Alternative 1, discussed in Section 4.13.3.1. Through the implementation of resource management measures, including contractor coordination with the Commonwealth Ports Authority and the various air and sea carriers in advance for transportation arrangements during the peak transportation seasons, and adjusting construction timing to accommodate civil and commercial usage of airport facilities, Tinian Alternative 2 construction activities would result in less than significant direct and indirect impacts to air transportation resources.

4.13.3.2.1.2 Ground Transportation

Impacts to ground transportation resources during Tinian Alternative 2 construction activities would be the same as those identified for Tinian Alternative 1, discussed in Section 4.13.3.1.

With implementation of best management practices (Appendix D), which would include a comprehensive Traffic Management Plan and appropriate work zone traffic management strategies, Tinian Alternative 2 construction activities would not significantly increase the potential for impacts traffic circulation or roadway Level of Service for vehicles, public transit, pedestrians, or bicycles, increase the rate of traffic related accidents, or reduce transportation safety. Therefore, construction activities associated with Tinian Alternative 2 would result in less than significant direct and indirect impacts to ground transportation resources. In addition, planned roadway improvements would result in an overall beneficial impacts to traffic circulation for vehicles, pedestrians, and bicycles, and would decrease accident rates and increase overall transportation safety on Tinian.

4.13.3.2.1.3 Marine Transportation

Impacts to marine transportation resources during Tinian Alternative 2 construction activities would be the same as those identified for Tinian Alternative 1, discussed in Section 4.13.3.1.

Construction activities associated with Tinian Alternative 2 would not affect the port's ability to process vessels transporting personnel and cargo. Therefore, Tinian Alternative 2 construction activities would result in less than significant direct and indirect impacts to marine transportation resources.

4.13.3.2.2 Operation Impacts

4.13.3.2.2.1 Air Transportation

Impacts to air transportation resources during Tinian Alternative 2 operations would be the same as those identified for Tinian Alternative 1, discussed in Section 4.13.3.1. Tinian Alternative 2 operations would result in less than significant direct and indirect significant impacts to air transportation resources.

4.13.3.2.2.2 Ground Transportation

Impacts to ground transportation resources during Tinian Alternative 2 operations would be similar to those identified for Tinian Alternative 1, discussed in Section 4.13.3.1.

The planned roadway network and projected roadway use levels within the Military Lease Area under Tinian Alternative 2 would differ from Tinian Alternative 1 as follows:

- **Range Complex C.** The southern Battle Area Complex would exist. Therefore, vehicle travel on roadways between base camp and Range Complex C would increase slightly compared to Tinian Alternative 1. The slight increase in vehicle travel would not adversely affect traffic circulation or roadway Level of Service.
- **Military Lease Area-wide Training Facilities.** The Convoy Course would run along a different alignment that would extend into the International Broadcasting Bureau Area. There would be more engagement areas along the route (11 versus 6) compared to Tinian Alternative 1. The reconfiguration of the Convoy Course would not change projected roadway use levels compared to Tinian Alternative 1.

- **Access.** The International Broadcasting Bureau would not be in operation. Therefore, vehicle travel on roadways between the proposed 8th Avenue gate and the International Broadcasting Bureau would be expected to decrease slightly compared to Tinian Alternative 1.

The minimal incremental increase in traffic associated with transportation of military personnel, the altered circulation patterns resulting from the permanent closure of existing roads within the High Hazard Impact Area, the transportation of hazardous materials, and the temporary road closures and detours under Tinian Alternative 2 would not significantly increase the potential for impacts to traffic circulation or roadway Level of Service for vehicles, public transit, pedestrians, or bicycles, increase the rate of traffic related accidents, or reduce transportation safety.

Therefore, Tinian Alternative 2 operations would result in less than significant direct and indirect impacts to ground transportation resources. In addition, planned roadway improvements would result in beneficial impacts to traffic circulation for vehicles, pedestrians, and bicycles, and would decrease accident rates and increase overall transportation safety on Tinian.

4.13.3.2.2.3 Marine Transportation

Impacts to marine transportation resources during Tinian Alternative 2 operations would be similar to those identified for Alternative 1, discussed in Section 4.13.3.1. The Tinian Alternative 2 danger zones are expanded versus those of Alternative 1, as shown in Chapter 2, *Proposed Action and Alternatives,* Figure 2.4-17. The closure of the larger area as compared to Tinian Alternative 1 would have no additional impact to marine transportation, as vessels would already be re-routed due to the closure.

Therefore, Tinian Alternative 2 operations would result in less than significant direct and indirect impacts to marine transportation resources.

4.13.3.3 Tinian Alternative 3

4.13.3.3.1 Construction Impacts

4.13.3.3.1.1 Air Transportation

The impacts to air transportation resources during Tinian Alternative 3 construction activities would be the same as those identified for Tinian Alternative 1, discussed in Section 4.13.3.1. Through the implementation of resource management measures, including contractor coordination with the Commonwealth Ports Authority and the various air and sea carriers in advance for transportation arrangements during the peak transportation seasons, and adjusting construction timing to accommodate civil and commercial usage of airport facilities, construction activities associated with Tinian Alternative 3 would result in less than significant direct and indirect impacts to air transportation resources.

4.13.3.3.1.2 Ground Transportation

Impacts to ground transportation resources during Tinian Alternative 3 construction activities would be the same as those identified for Tinian Alternative 1, discussed in Section 4.13.3.1.

With implementation of resource management measures which would include a comprehensive Traffic Management Plan and appropriate work zone traffic management strategies, construction associated with Tinian Alternative 3 would not significantly increase the potential for impacts traffic circulation or roadway Level of Service for vehicles, public transit, pedestrians, or bicycles, increase the rate of traffic related accidents, or reduce transportation safety. Therefore, construction activities associated with Tinian Alternative 3 would result in less than significant direct and indirect impacts to ground transportation resources.

4.13.3.3.1.3 Marine Transportation

Impacts to marine transportation resources from Tinian Alternative 3 construction activities would be the same as those identified for Tinian Alternative 1, discussed in Section 4.13.3.1.

Construction activities associated with Tinian Alternative 3 would not affect the port's ability to process vessels transporting personnel and cargo. Therefore, Tinian Alternative 3 construction activities would result in less than significant direct and indirect impacts to marine transportation resources.

4.13.3.3.2 Operation Impacts

4.13.3.3.2.1 Air Transportation

The impacts to air transportation resources resulting from Tinian Alternative 3 operations would be the same as those identified for Tinian Alternative 1, discussed in Section 4.13.3.1. Operation of Tinian Alternative 3 would result in less than significant direct and indirect impacts to air transportation resources.

4.13.3.3.2.2 Ground Transportation

Impacts to ground transportation resources resulting from Tinian Alternative 3 operations would be similar to those identified for Tinian Alternative 1, discussed in Section 4.13.3.1.

The planned roadway network and projected use levels within the Military Lease Area under Tinian Alternative 3 would differ from Tinian Alternative 1 as follows:

- **Range Complex C.** The southern Battle Area Complex would exist. Therefore, vehicle travel on roadways between base camp and Range Complex C would increase slightly compared to Tinian Alternative 1. The slight increase in vehicle travel would not adversely affect roadway Level of Service.
- **Range Complex D.** The northern Battle Area Complex would not exist. Therefore, vehicle travel on roadways between base camp and Range Complex D would be expected to decrease slightly compared to Tinian Alternative 1.
- **Military Lease Area-wide Training Assets.** The Convoy Course would run along a different alignment that would extend into the International Broadcasting Bureau area. There would be more engagement areas along the route (11 versus 6) compared to Tinian Alternative 1. The reconfiguration of the Convoy Course would not change projected roadway use levels compared to Tinian Alternative 1.
- **Access.** The International Broadcasting Bureau would not be in operation. Therefore, vehicle travel on roadways between the proposed 8th Avenue gate and the International Broadcasting Bureau would be expected to decrease slightly compared to Tinian Alternative 1.

The minimal incremental increase in traffic associated with transportation of military personnel, the altered circulation patterns resulting from the permanent closure of existing roads within the High

Hazard Impact Area, the transportation of hazardous materials, and the temporary road closures and detours under Tinian Alternative 3 would not significantly increase the potential for impacts to traffic circulation or roadway Level of Service for vehicles, public transit, pedestrians, or bicycles, increase the rate of traffic related accidents, or reduce transportation safety.

Therefore, Tinian Alternative 3 operations would result in less than significant direct and indirect impacts to ground transportation resources. In addition, planned roadway improvements would result in beneficial impacts to traffic circulation for vehicles, pedestrians, and bicycles, and would decrease accident rates and increase overall transportation safety on Tinian.

4.13.3.3.2.3 Marine Transportation

Impacts to marine transportation resources during Tinian Alternative 3 operations would be the same as those identified for Tinian Alternative 1, discussed in Section 4.13.3.1. The Tinian Alternative 3 danger zones are expanded as compared to those of Tinian Alternative 1, as shown in Chapter 2, *Proposed Action and Alternatives*, Figure 2.4-17. The closure of the larger area as compared to Tinian Alternative 1 would have no additional impact to marine transportation, as vessels would already be re-routed due to the closure.

Therefore, Tinian Alternative 3 operations would result in less than significant direct and indirect impacts to marine transportation resources.

4.13.3.4 Tinian No-Action Alternative

The periodic non-live-fire training that the military has undertaken in the Military Lease Area of Tinian would be expected to continue under the no-action alternative. Constructing and operating the four training ranges on Tinian analyzed in the Guam and CNMI Military Relocation EIS (DoN 2010a) would have less than significant impacts to ground transportation and no impacts to air or sea port transportation (see Table 14.2-4; DoN 2010a). On Tinian, Mariana Islands Range Complex training would not affect transportation resources (DoN 2010b). The no-action alternative, therefore, would have less than significant impacts to transportation resources.

4.13.3.5 Summary of Impacts for Tinian Alternatives

Table 4.13-1 contains a comparison of the potential impacts to transportation resources for the three Tinian alternatives and the no-action alternative.

Table 4.13-1. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Transportation	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Air Transportation	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*
Ground Transportation	*LSI*	*LSI/BI*	*LSI*	*LSI/BI*	*LSI*	*LSI/BI*	*LSI*	*LSI*
Marine Transportation	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*

Legend: *BI* = beneficial impact; *LSI* = less than significant impact; *NI* = no impact.

4.13.4 Pagan

4.13.4.1 Pagan Alternative 1

4.13.4.1.1 Construction Impacts

4.13.4.1.1.1 Air Transportation

Pagan Alternative 1 is designed to use Pagan's terrain features to support the combined level training for the proposed action. The proposed facilities would support an expeditionary base camp. Air transportation during the construction period would be very limited and constrained by the existing Runway 11/29 measuring 1,500 feet (457 meters) long and with a load-bearing capacity of only 4,000 pounds (1,814 kilograms). Some of the construction work would be carried out by the military as part of the training exercises. The primary mode of transportation for construction equipment, materials, and personnel would be by sea. The increase in the number of flights to Pagan during construction would be minimal.

The lava flow from the 1981 volcano eruption covered nearly half of Runway 11/29 on the existing Pagan airfield. The lava flow would be removed under the proposed action and Runway 11/19 would be extended, re-graded, and strengthened. New aircraft parking apron would be provided. There would be temporary closure of the Pagan airfield during the removal of the lava flow and for the improvements on and adjacent to the runway. Upon completion of proposed improvements the airfield would reopen. In view of the very low usage of the existing Pagan airfield, the construction would be carried out with minimal interruption of operations and as part of military training. The impacts to the existing facility during construction would be limited and included in the operation phase impacts. Federal Aviation Administration Form 7460-1, Notice of Proposed Construction or Alternation, would be submitted prior to construction on the Pagan airfield.

Therefore, direct and indirect impacts to air transportation resources from construction activities associated with implementation of Pagan Alternative 1 would be less than significant.

4.13.4.1.1.2 Ground Transportation

Currently there are no roads, transit networks, pedestrian, or bicycle facilities, and no significant vehicular traffic patterns occur on Pagan. Only all-terrain vehicle pathways exist on Pagan and their use is limited. Construction of the expeditionary base camp, supporting facilities, and military training trails on Pagan would require heavy equipment, including, but not limited to: road graders, vibratory compactors, dump trucks, and backhoes.

Construction activities associated implementation of Pagan Alternative 1 would not increase the potential for impacts to traffic circulation or Level of Service for vehicles, public transit, pedestrians, bicycles; increase the rate of traffic related accidents, or reduce transportation safety. Therefore, Pagan Alternative 1 construction activities would result in no direct or indirect impacts to ground transportation resources.

4.13.4.1.1.3 Marine Transportation

There is currently no functional dock or appreciable marine vessel traffic to Pagan. Therefore, Pagan Alternative 1 construction activities would have no impact to marine transportation.

4.13.4.1.2 Operation Impacts

4.13.4.1.2.1 Air Transportation

Based on the airfield demand/capacity analysis, the Pagan airfield would not experience airfield-capacity constraint with the additional air transportation demand under the proposed action. Details of the analysis are given in Appendix O, *Transportation Study* (DoN 2014b). Although the airfield has sufficient capacity for the increased operations, the existing physical constraints at Runway 11/29, such as the lava flow from the 1981 volcano eruption, would limit its usage for the proposed action and improvements would be implemented. During the operation phase of the Pagan alternatives, the lava flow would be removed and Runway 11/29 would be extended, re-graded and strengthened, and a new aircraft parking apron would be provided adjacent to the runway to support the training activities. It is anticipated that the Pagan airfield would be restricted for the exclusive military use during the training period (around 16 weeks per year). Taking into consideration the existing low usage of the Pagan airfield for general aviation only, the direct and indirect impacts to the civilian usage of the Pagan airfield are considered less than significant.

Transportation of personnel and equipment to Pagan by air is only the secondary mode of transportation. Marine transportation is considered the primary mode. If the Pagan airfield would be the first port of entry to the U.S. for any foreign allies or participants from overseas military facilities, coordination among the Department of Defense, Department of Homeland Security, and the CNMI Customs Services would be accomplished. No permanent facility for passenger boarding or processing on the Pagan airfield is anticipated.

The proposed action also includes improvements at the Pagan airfield that would have positive effects to air transportation resources. These improvements include:

- Removal of the lava flow and increase in the capability of the runway in terms of runway length and strength
- Runway turnaround aprons
- Aircraft parking aprons
- Removal of existing obstructions within the runway object free area and trimming trees outside to meet the transition slope and obstacle clearance surfaces

These improvements would enhance the existing facilities at the Pagan airfield.

Therefore, Pagan Alternative 1 operations would have beneficial direct and indirect impacts on air transportation resources.

4.13.4.1.2.2 Ground Transportation

All units would be expected to arrive and depart with their own vehicles and equipment. Similar to Tinian, personnel would arrive and depart via sea transport (e.g., Amphibious Assault Vehicle) and aircraft (CH-53, MV-22, and C-130).

Training activities under Pagan Alternative 1 would require the use of the planned military training trails (see Chapter 2, *Proposed Action and Alternatives,* Figure 2.5-3). About 6 miles (10 kilometers) of the planned 22-mile (35-kilometer) trail system would be on existing all-terrain vehicle pathways or trails and the other 16 miles (25 kilometers) would be over terrain where no pathways or trails currently exist.

Access to all-terrain vehicle pathways or trails and areas within the High Hazard Impact Area would be restricted.

No specific construction activities would occur to support maneuvering operations. Personnel would move along the landscape and train in a manner similar to combat conditions. Vehicles would move along the established military training trails as well as other terrain that they could safely navigate (excluding no maneuver areas).

Pagan Alternative 1 would not increase the potential for impacts to traffic circulation or Level of Service for vehicles, public transit, pedestrians, bicycles; or increase the rate of traffic related accidents; or reduce transportation safety. Therefore, Pagan Alternative 1 operations would result in no direct or indirect impacts to ground transportation resources.

4.13.4.1.2.3 Marine Transportation

During operations, personnel would arrive and depart via air or marine transport at the beginning and end of each training period. The primary mode of marine transportation would be amphibious shipping to beaches of both personnel and equipment, as no docking facilities are proposed at Pagan under any Alternative. All training equipment would arrive with the personnel. There is no current functional dock on Pagan or appreciable vessel traffic in adjacent waters.

The Proposed danger zones associated with Pagan Alternative 1 are described in Chapter 2, *Proposed Action and Alternatives,* Section 2.5, and Figures 2.5-4 and 2.5-6. As stated in 33 CFR Part 334, Navigable Waters (danger zone and restricted area regulations), operation of the Pagan RTA would exclude traffic from these areas of sea space on a full-time or intermittent basis, depending on the requirements of training. Consistent with military safety requirements, danger zones would be open to the public only when hazards are minimized to assure safety of the non-participating public. In addition to the danger zones, adjacent restricted areas may be required to accommodate warning areas that separate military operations from non-participating vessels.

Range control would be conducted to maximize safety for the public and military units. Training schedules would be published through a Notice to Airmen. The range control facility would remotely survey the range and communicate with personnel involved in training to identify conflict prior to and during use. Procedures would be implemented for the immediate cessation of training if a vessel entered the restricted areas.

Therefore, Pagan Alternative 1 operations would have no impact to marine transportation resources.

4.13.4.2 Pagan Alternative 2

4.13.4.2.1 Construction Impacts

4.13.4.2.1.1 Air Transportation

Impacts to air transportation resources during Pagan Alternative 2 construction activities would be the same as those identified for Pagan Alternative 1, discussed in Section 4.13.4.1.

4.13.4.2.1.2 Ground Transportation

Impacts to ground transportation resources during Pagan Alternative 2 construction activities would be the same as those identified for Pagan Alternative 1, discussed in Section 4.13.4.1.

Construction activities associated with Pagan Alternative 2 would not increase the potential for impacts to traffic circulation or Level of Service for vehicles, public transit, pedestrians, bicycles; increase the rate of traffic related accidents; or reduce transportation safety. Therefore, Pagan Alternative 2 construction activities would result in no direct or indirect impacts to ground transportation resources.

4.13.4.2.1.3 Marine Transportation

Impacts to marine transportation resources during Pagan Alternative 2 construction activities would be the same as those identified for Pagan Alternative 1, discussed in Section 4.13.4.1.

Pagan Alternative 2 construction activities would have no impact to marine transportation.

4.13.4.2.2 Operation Impacts

4.13.4.2.2.1 Air Transportation

Impacts to air transportation resources during Pagan Alternative 2 operations would be the same as those identified for Pagan Alternative 1, discussed in Section 4.13.4.1.

4.13.4.2.2.2 Ground Transportation

Impacts to ground transportation resources during Pagan Alternative 2 operations would similar to those identified for Pagan Alternative 1, discussed in Section 4.13.4.1.

Under Pagan Alternative 2, vehicular access to areas of northern Pagan would be slightly less restricted due to the smaller northern High Hazard Impact Area compared to Pagan Alternative 1.

Pagan Alternative 2 would not increase the potential for impacts to traffic circulation or Level of Service for vehicles, public transit, pedestrians, bicycles, increase the rate of traffic related accidents, or reduce transportation safety. Therefore, Pagan Alternative 2 operations would result in no direct or indirect impacts to ground transportation resources.

4.13.4.2.2.3 Marine Transportation

The proposed danger zones associated with Pagan Alternative 2 are described in Chapter 2, *Proposed Action and Alternatives,* Section 2.5, and Figures 2.5-4 and 2.5-6. Impacts to marine transportation resources during Pagan Alternative 2 operations would be the same as those identified for Pagan Alternative 1, discussed in Section 4.13.4.1. Pagan Alternative 2 operations would have no impact to marine transportation resources.

4.13.4.3 Pagan No-Action Alternative

The no-action alternative would include short term and periodic visits to Pagan for eco-tourism, scientific surveys and military training for search and rescue type exercises and would be expected to continue. These temporary activities would have no impacts on transportation resources. Therefore, the no-action alternative would have no impacts ground transportation resources.

4.13.4.4 Summary of Impacts for Pagan Alternatives

Table 4.13-2 contains a comparison of the potential impacts to transportation resources for the two Pagan alternatives and the no-action alternative.

Table 4.13-2. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Transportation	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Air Transportation	*LSI*	*BI*	*LSI*	*BI*	*NI*	*NI*
Ground Transportation	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*
Marine Transportation	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*

Legend: *BI* = beneficial impact; *LSI* = less than significant impact; *NI* = no impact.

4.14 UTILITIES

Section 4.14 describes the potential utility impacts of the proposed action requirements on the existing utility infrastructure on Tinian and Pagan. Impacts such as installation of proposed utilities and construction of facilities that could affect other resources are covered in their respective sections, including: Sections 4.3, *Water Resources*; 4.4, *Air Quality*; 4.5, *Noise*; 4.9, *Terrestrial Biology*; and 4.10, *Marine Biology*. Changes to land uses are presented in Section 4.7, *Land and Submerged Land Use*, and potential soil contamination issues are addressed in Section 4.16, *Hazardous Materials and Waste*.

4.14.1 Approach to Analysis

The impact analysis addresses potential effects to the capacity and/or distribution of the following utilities systems: electrical, potable water, wastewater, stormwater, solid waste, and information technology/communications. The analysis estimates increased requirements due to proposed facilities, infrastructure, personnel, and forecast natural civilian population growth independent of the proposed action. These analyses cover both construction and operation of the proposed action. The *Utilities Study* (Appendix P) used an approximate current population for Tinian of 3,500 including an allowance for tourists (DoN 2014a). The *Socioeconomic Impacts Assessment Study* (Appendix Q) estimated the impact of the proposed action to Tinian's population (not including training units) presented below in Table 4.14-1 (DoN 2014b). Tinian's utility requirements are assessed based on these forecast changes to the island population plus requirements to support the training units.

Table 4.14-1. Total Estimated Change to Tinian Population

Category	*Low*	*Medium*	*High*
Estimated Baseline Population	2,890	3,211	3,532
Population Change – Construction[1, 2]	477	537	596
Population Change – Military Operations[2]	143	192	242
Population with the Proposed Action	3,510	3,940	4,370
Total Population Change	**620**	**729**	**838**
Population Change – Percentage	21.4%	22.7%	23.7%

Notes: [1]Annual average during the 8 to 10 years of construction.
[2]Includes dependents.
Source: Socioeconomic Impacts Assessment Study, Table 5.1-3 (DoN 2014b).

The analysis also compares projections of future utility requirements to the capacity of the utilities. Existing utility requirements attributed to the current Tinian population are considered baseline conditions and are discussed in Section 3.14, *Utilities*.

For the purposes of this analysis, a conservative assumption was made that most of the construction workers would come from off-island locations (i.e., presently not resident on Tinian or Pagan). In addition, for the purposes of this analysis, off-island construction workforce dependents are considered under direct impacts. Therefore, there would be no indirect impacts of the proposed action as it relates to the utility resource.

The projections of future utility requirements account for the following impacts:

- Off-island (i.e., presently not resident on Tinian or Pagan) construction workforce and their dependents
- All proposed U.S. military active duty personnel
- On-base civilian workforce
- Industrial requirements from proposed facilities

The impact analysis considered the capacity of the various utilities and the ability of the utility to properly handle and provide required services to both the military and civilian customers. The analysis also assesses whether the utility is currently operating within design capacity and regulatory requirements, and whether the utility would continue to operate within design capacity and regulatory requirements under the conditions of the proposed action.

As discussed in Chapter 3, data was available for October 2011 through August 2014 pertaining to potable water production and use (Commonwealth Utilities Corporation 2014). Pump rates from Marpi Well #2 are available through 2014. The potable water database supplied by Commonwealth Utilities Corporation, consisting of potable water production rates and metered supply from October 2011 through August 2014, was used to evaluate available potable water to meet the project demands.

The significance of utility-related impacts was determined qualitatively. A significant impact would occur if:

- The projected increase in demand for a utility would exceed the available or proposed planned capacity of that utility, resulting in substandard service to existing or expected future customers of that utility.
- The estimated demands of the proposed action would cause the utility to operate in violation of regulatory requirements.

If a utility obtains (or is expected to obtain) an agreement with regulatory agencies to either exempt certain requirements or extend the due date for regulatory compliance, then that utility would be deemed to be operating within regulatory requirements. This situation would be categorized as a less than significant impact.

4.14.2 Resource Management Measures

- Resource management measures, including best management practices and standard operating procedures, applicable to utilities are provided below and described in Appendix D, *Best Management Practices.* Leadership in Energy and Environmental Design (construction and operations)
- Stormwater Management Plan and Stormwater Pollution Prevention Plan (construction)
- Coordination with the utility providers on planned outages and service disruptions (construction)
- Inventory of spare parts, maintenance equipment, and tools (operation)

Potable Water

- Disposal of hydrotesting and cleaning and flushing water in accordance with the CNMI Bureau of Environmental and Coastal Quality regulations
- Operation, inspection, and maintenance of potable water storage tanks, water production wells, pumps and treatment equipment in accordance with a regularly updated and approved Operations and Maintenance manual to ensure proper function
- Periodic inspection of water transmission, distribution and service lines and repair of any damaged lines to ensure adequate operation and identification of any damage or leaks within the system

Wastewater

- Operation and maintenance of wastewater facilities in accordance with a regularly updated and approved Operations and Maintenance manual
- Inspection of septic tank systems no less than every 3 years and periodic cleaning in accordance with the CNMI regulations
- Prevent trees or shrubs from growing over any septic tank and leaching field components
- Sewer lines and pump station(s) would be inspected and maintained to minimize the risk of sanitary sewer overflows

Stormwater Management

- Compliance with Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects
- Well Head Protection Zones (construction and operations)
- Low Impact Development (construction and operations)

Solid Waste

- Recycling of municipal solid waste, such as glass, paper, and metals
- Reuse of all green waste and 60% of construction and demolition debris, based upon Department of Defense Strategic Sustainability Performance Plan, fiscal year 2012 (dated September 20, 2012)

4.14.3 Tinian

4.14.3.1 Tinian Alternative 1

4.14.3.1.1 Construction Impacts

As described in Section 2.4.1.2.7, *Utility Improvements*, new construction and improvements to the existing utilities infrastructure would occur to provide electrical power, potable water, wastewater management, stormwater management, solid waste, and communications to the base camp, Munitions Storage Area, Port of Tinian support facilities, and the Tinian RTA. There are no permanent electrical power utility, potable water utility, wastewater infrastructure, or information technology/ communications infrastructure associated with the Tinian International Airport Improvements.

Construction of the Tinian RTA would be accomplished over an 8 to 10 year period. During that time, training events could also occur, so there could be an overlap of construction and operation activities. Routinely, construction work would temporarily be impacted during live-fire training events, construction workers would remain on island, and construction would resume after training events have ended. Because construction activities would be impacted during live-fire training events, this overlap would not result in additive impacts to utilities resources. Regardless of when these activities would occur, all construction-related impacts, including impacts associated with workers residing at worker housing, have been assessed within the construction impacts, while all operation-related impacts have been assessed within operation impacts.

During an overlap of construction and operation, not all of the facilities would be completed and in operation. As an example, there would be a reduction in electrical power demand from operation that would compensate for having some construction electrical power demand during that time. The existing power generating capacity has excess capacity to provide for any potential increased electrical power demand during overlap between construction and operation that might occur. Short-term power outages could occur at some of the operational facilities for construction hook ups, which would need to be coordinated between construction and operation. Stormwater management features would be built in phases with the training facilities and be functional during any training exercises occurring during construction.

4.14.3.1.1.1 Electrical Power

As discussed in Section 3.14.4.1, *Electrical Power*, the existing Tinian power plant has an installed generating capacity rated at 17.0 megawatts. One 4.5 megawatt generation unit is kept in reserve for maintenance purposes; therefore, the utility maintains 12.5 megawatts of capacity available to meet expected loads. With an average daily load of 4.5 megawatts, 8 megawatts of reserve power remains available. The power demand required during construction would mainly be met with portable generators in the field, and connections to the existing electrical system would be limited. As a result, the 8 megawatt reserve far exceeds any contemplated demand, and is within the current capability of the existing power plant. Therefore, there would be no impacts to services associated with capacity.

As discussed in the *Utilities* subsection of Section 2.4.1, *Elements Common to All Action Alternatives*, new electrical lines and improvements to existing power distribution lines would be constructed. Impacts to the provision of electrical power during construction of the proposed facilities may include temporary power outages to facilitate hooking up new and rerouted power lines. These would be of short duration, scheduled to allow for advance notification to users, and timed to be least disruptive (e.g., late in the evening), thereby minimizing the effect of any potential outages. Therefore, Tinian Alternative 1 construction activities would result in less than significant impacts to the existing electrical utility.

4.14.3.1.1.2 Potable Water

Construction water use would include dust suppression, concrete mixing, rinsing new water pipes, hydrotesting new water storage tanks, and other typical construction requirements. As discussed in the potable water portion of Section 2.4.1, *Elements Common to All Action Alternatives*, the projected water supply requirements for the proposed action would be mostly met by a new water system and supply wells in the Military Lease Area for military use. The new water system would be completely independent of the existing Commonwealth Utilities Corporation system. The proposed water system would be constructed early in the site development process. The existing Commonwealth Utilities Corporation water system will be able to meet increased demand as a result of construction activities in the early phases of construction due to the limited need for road watering, cement requirements, and other construction water uses. After the proposed military potable water system is installed, construction activities within the Military Lease Area would use minimal water from the existing Commonwealth Utilities Corporation water system. This use would be limited to water use by facilities outside of the Military Lease Area, such as the existing concrete batch plant, if utilized by the construction contractor.

Use of the existing Commonwealth Utilities Corporation potable water system would occur for supplying the proposed military facilities at the Port of Tinian. Thus, construction impacts to the existing Commonwealth Utilities Corporation potable water system would be limited to tie-ins at the Port of Tinian, which could cause short duration local water service outages. The impacts of these outages would be coordinated with the Commonwealth Utilities Commission operators to be during the least disruptive times, and are anticipated to be of short duration.

The majority of the construction workers would reside in a work camp outside the Military Lease Area provided by the construction contractor. With proper negotiation, the existing worker facilities associated with the Tinian Dynasty Hotel and Casino could potentially be utilized as the work camp. Construction managers and their dependents are expected to find housing in existing properties outside of the Military Lease Area on Tinian. The additional work force would increase the demand on the existing Commonwealth Utilities Corporation potable water system by approximately 33,525 gallons (126,906 liters) per day. To evaluate the capacity and ability of the existing Tinian potable water system to meet project needs, production and use data from October 2011 through August 2014 was utilized. The average daily production over this time period was 1,056,553 gallons (3,999,488 liters) per day; average use was 320,384 gallons (1,212,785 liters) per day. The potential water production from Maui Well #2 has been estimated as at least 1 million gallons per day (3.8 million liters) of potable water in the dry season and 1.5 million gallons (5.7 million liters) per day in the wet season (Army Corps of Engineers 2003). Based upon this production range, the maximum production in 2013 of 1,260,000 gallons (4,769,619 liters) per day was selected to represent a new average production rate that could be sustainably pumped. Utilizing this new average pump rate, an additional 203,477 gallons (770,131 liters) per day would be available for the potable water system. After applying the unaccounted for water factor of 75%, 50,862 gallons (192,534 liters) per day (after losses in the distribution system) would be available to the Tinian population.

The existing potable water system would be expected to meet increased water need~~s~~ during construction. Therefore, construction under Tinian Alternative 1 would result in less than significant impacts to the existing potable water utility.

4.14.3.1.1.3 Wastewater

The existing U.S. military septic tank and leaching field system on Tinian is not currently being used due to poor condition of the leaching field. Currently, Joint Region Marianas has plans to rehabilitate this system in order to support current military training exercises not associated with the proposed action on Tinian. Use of this existing system during construction for the proposed action may require the rehabilitation of the septic tank or leaching field depending on its condition at the time of the construction. The use of the existing system for the proposed action would also require inspection and permit compliance verification prior to use. Wastewater generated around construction sites by construction workers and managers would be collected at temporary toilet facilities that would be emptied periodically using a vacuum truck, and then transported to the existing U.S. military septic tank and leaching field system for treatment and disposal. The estimated average daily wastewater flow rate is 1,370 gallons (5,190 liters). The existing system is permitted for an average daily flow of 6,640 gallons (25,000 liters), thus there is a 5,270 gallons (19,950 liters) per day excess capacity. The estimated wastewater flow generated during construction is anticipated to be within the excess capacity of the U.S. military septic tank and leaching field system. Should this existing U.S. military septic tank and leaching field system become unavailable, a potential alternate approach may be to pursue the existing wastewater system at the Tinian Dynasty Hotel and Casino to treat and dispose of wastewater. This option would require proper negotiation with the Tinian Dynasty Hotel and Casino and regulatory approval.

It is anticipated that construction managers and their dependents would reside in existing housing outside the Military Lease Area. The individual septic tank and leaching field systems associated with these housing units are typically sized for small families. Consequently, there should be no additional capacity required. A majority of the construction workforce will reside in a work camp located outside the Military Lease Area provided by the construction contractor. With proper negotiation and rehabilitation, existing worker facilities associated with the Tinian Dynasty Hotel and Casino could potentially be utilized as the work camp. According to recent discharge monitoring reports in 2014, the Dynasty Hotel and Casino's wastewater treatment plant has an average daily flow up to 150,000 gallons (568,000 liters). The permitted discharge limit of the plant is a monthly average flow of 240,000 gallons (908,000 liters), thus there is 90,000 gallons (341,000 liters) per day of excess capacity. The estimated increase in wastewater flow generated by the construction workforce is an average daily flow of 27,400 gallons (104,000 liters) and is well within the 90,000 gallons (341,000 liters) per day of excess capacity at the plant. As such, the existing plant is anticipated to have adequate capacity to treat and dispose of the additional wastewater flow generated by the construction workforce. It is not anticipated that upgrades to the wastewater treatment plant would be required if the work camp is utilized.

Because the existing wastewater infrastructure could handle the projected wastewater increase associated with the construction and construction worker housing, it is not anticipated that the wastewater generated during construction would cause existing wastewater systems to operate in violation of their regulatory requirements. Therefore, Tinian Alternative 1 construction activities would result in less than significant impacts to the existing wastewater infrastructure.

4.14.3.1.1.4 Stormwater Management

Drainage and Low Impact Development is described in Section 4.3, *Water Resources*. Stormwater management infrastructure would be constructed in accordance with local and federal regulations and guiding documents that take into account both quantity and quality. During construction stormwater management facilities would be strategically placed throughout the base camp, the Port of Tinian improvement area, the Tinian International Airport, along road improvements, and within the Tinian RTA. These improvements would be located adjacent to and downstream of the proposed site improvements, to capture, detain, and treat any increases in stormwater runoff volume, rate, and pollutants, as applicable. Temporary stormwater control facilities would be, where possible, located in areas that will ultimately be developed such that surface disturbances would be minimized. In locations where the temporary facilities would not have additional construction on the disturbed area, the site would be re-graded, seeded and mulched to minimize stormwater erosion impacts.

Proposed stormwater retention ponds and other infiltration devices would be located outside of existing water wellhead protection zones, in accordance with the CNMI Well Drilling and Well Operations Regulations. Other environmental and operational constraints, such as Federal Aviation Administration mitigation areas for ecological/species protection, would also be applied when siting proposed stormwater management improvements to prevent and/or minimize the potential for any adverse impacts.

The primary stormwater improvements would consist of temporary surface conveyance and control via vegetated swales, pipe culverts, and retention ponds. The majority of roadways would be rural road sections (no curb and gutter) and thus stormwater would be controlled using roadside swales. Urban road sections with curb, gutter, and drainage inlets would only be used when necessary and in limited quantity, as applicable, for water quality treatment, and improve conveyance of large volumes of stormwater, and to minimize associated construction, operation, and maintenance costs.

Construction of permanent stormwater management facilities would occur at the base camp, training areas, Munitions Storage Area, the Port of Tinian, the Tinian International Airport, and at other areas with proposed site improvements. An effort would be made during construction to reduce areas disturbed to only those areas required to construct each facility or improvement. The stormwater management facilities would be modified, as needed, to accommodate construction phasing.

Based on the stormwater management treatment systems described above and the implementation of best management practices in Appendix D, *Best Management Practices*, Tinian Alternative 1 would result in less than significant impacts to stormwater management.

4.14.3.1.1.5 Solid Waste

Solid waste generated during the construction phase would primarily consist of green waste resulting from the clearing and grubbing of the base camp, Munitions Storage Area, roadways, and training facility footprints. The solid waste streams anticipated to be generated during the construction phase are summarized in Table 4.14-2.

Construction and demolition waste would be sampled if reviews of existing reports indicate that lead-based paint or asbestos could be present. If required, waste would be treated and disposed of appropriately (see Section 4.16, *Hazardous Materials and Waste*). Green waste can be beneficially reused as compost, cover material, animal food, and other alternative uses. To the extent possible, beneficial reuse and recycling of construction and demolition waste would occur. Other construction and demolition waste would be transported off-island for recycling at facilities with capacity to receive the material and proper permitting, in accordance with construction and demolition waste disposal regulations.

Table 4.14-2. Tinian Alternative 1 Projected Construction Waste

	Waste Description	*Waste in Tons (metric tons)*
Green Waste		
Tinian Base Camp	Vegetation Clearance	60,984 tons (55,324 metric tons)
Training Range Alternative 1	Range Clearance	378,824 tons (343,667 metric tons)
Construction and Demolition Waste		
Base Camp	Construction and demolition waste from construction of base camp facilities (3.89 pounds per square foot of facility space)	766 tons (695 metric tons)
Base Camp Road Demolition	Asphalt waste from planned demolition of 8,563 feet of existing roads located within the base camp	6,668 tons (6,049 metric tons)
Munitions Storage Area	Construction and demolition waste from planned construction of Munitions Storage Area facilities (3.89 pounds per square foot of facility space)	168.2 tons (152.6 metric tons)
Tinian International Airport Improvements	Construction and demolition waste from planned construction of Tinian Airport Improvements (3.89 pounds per square foot of facility space)	468.4 tons (425.8 metric tons)
Port of Tinian	Construction and demolition waste from planned construction of Port of Tinian facilities (3.89 pounds per square foot of facility space)	29.7 tons (26.9 metric tons)

**Source:* Appendix A, Version 4, CJMT Solid Waste Study, August 2014.

Other municipal solid waste generated by the construction contractors would be disposed of at a regulatory compliant facility. The existing solid waste facilities on Tinian are not in compliance with regulatory requirements, and therefore solid waste generated would have to be transferred off-island to a compliant landfill.

Based on the previous analysis, Tinian Alternative 1 construction activities would result in less than significant impacts to the solid waste management.

4.14.3.1.1.6 Information Technology/Communications

The proposed telecommunications system would consist of a combination of overhead pole-mounted cabling and underground conduits, manholes/handholes, and pull-boxes that would provide the site infrastructure to support government communications systems (e.g., government telephone, government data, security, and closed circuit television), as well as commercial utility services, including commercial telephone, internet, and cable television. New distribution infrastructure originating at the base camp area distribution node would distribute telecommunications services to end-user buildings and facilities in the base camp, ranges, and other facilities. Proposed core information technology/communications cable connections would connect the area distribution node to end user buildings and facilities at the base camp through overhead pole-supported cabling. Proposed core information technology/communications cable connections would connect the area distribution node in the base camp to range entrances through overhead pole supported cabling and underground concrete encased duct banks and cabling.

Commercial telephone, internet, and cable television services would be provided to the base camp through infrastructure provided by the commercial utility providers. The cables are anticipated to be installed mostly overhead except for routing that crosses the runway clear zone, which would be installed underground. Inside the base camp, the cables for commercial telephone, internet, and cable television service would be distributed around the base camp through overhead pole-supported cabling.

Commercial telephone, internet, and cable television services would be provided to the construction work camp through infrastructure provided by the commercial utility providers. Inside the work camp, the cables for commercial telephone, internet, and cable television service is anticipated to be distributed through overhead pole-supported cabling. Commercial telephone, internet, and cable television services to the work camp would be minimal and have limited impact to the existing commercial provider infrastructure. Impact to existing commercial telephone, television, and internet services during construction would be limited to potential short outages that would be necessary to facilitate new connections to the existing systems. As with other utilities, such outages would be of short duration and would be scheduled to cause the least disruption. Therefore, Tinian Alternative 1 construction activities would result in less than significant impacts to the existing information technology/communications utilities.

4.14.3.1.2 Operation Impacts

4.14.3.1.2.1 Electrical Power

The electrical load increase due to the population change for operation workers and training personnel is included in the facility demand calculations, which is calculated on a watts per square foot basis and included in the total maximum demand shown in Table 4.14-3. The electrical load increase could be less than the calculated load due to implementation of Leadership in Energy and Environmental Design Certification and the Energy Policy Act of 2005, and best management practices listed in Appendix D, *Best Management Practices*. However, even without such savings, the total power demand for the Tinian Alternative 1 shown in Table 4.14-3 is 6.03 megawatts, which is less than the current excess capacity of the existing power plant. The existing island-wide power generation facility is capable of meeting the increased power demand during operation.

A study of the existing electrical utility infrastructure was performed and documents that both Tinian's generating system and distribution system are reliable and in good condition. Details of this study are provided in Volume II of Appendix P, *Utilities Study*. Therefore, Tinian Alternative 1 operations would result in less than significant impacts to the existing electric utility generation capability and electrical distribution system.

Table 4.14-3. Tinian Future Proposed Plan Electrical Power Demand Forecast

Item	Description	Megawatts
1	Existing Peak Demand (see note below)	4.5
2	Base Camp	1.17
3	Training Facilities	0.21
4	Munition Storage Area	0.12
5	Biosecurity facility and Port of Tinian Bulk Fuel Storage Tanks	0.03
Total Increase		**1.53**
Percent Increase from Existing Peak Demand		**34%**
Total Tinian Demand		**6.03**
Tinian Power Plant Capacity		**12.5**
Available Remaining Power Capacity		**6.47**

Note: The existing peak demand includes the future anticipated load for the existing International Broadcasting Bureau facility. The International Broadcasting Bureau facility would remain on Tinian in Tinian Alternative 1. The International Broadcasting Bureau load is included for all three proposed alternatives, because it would continue to operate for a period of time before it is relocated.

Source: DoN 2014a.

4.14.3.1.2.2 Potable Water

There is currently no existing potable water system to, or within, the Military Lease Area. Under Tinian Alternative 1, the base camp, Munitions Storage Area, and proposed facility improvements at the Port of Tinian would require potable water and fire protection systems. The estimated average and maximum demands for the proposed facilities are provided in Table 4.14-4.

Table 4.14-4. Estimated Potable Water Demand for Proposed Tinian Range Training Area System

Description	Average Demand	Maximum Demand
Base Camp (Including Munitions Storage Area)	240,013 gallons per day (908,548 liters per day)	459,758 gallons per day (1,740,374 liters per day)
Port facilities (Military Biosecurity & Vehicle Wash Down Facilities)	22,181 gallons per day (83,965 liters per day)	22,581 gallons per day (85,479 liters per day)
Total Tinian Demand for Proposed Action	262,194 gallons per day (992,513 liters per day)	482,339 gallons per day (1,825,853 liters per day)

Source: DoN 2014a.

Under Tinian Alternative 1, operation of the potable water system serving the proposed military facilities, except the proposed Port of Tinian facilities, would be independent of the Commonwealth Utilities Corporation's water system. Approximately three to six new supply wells, plus one backup, located to the north and east of the Tinian International Airport within the Military Lease Area would be installed to support the proposed action. The operation and maintenance of this new system, including supply, transmission, and distribution, would be independent of the Commonwealth's Utilities Corporation's water system. Fire suppression services for the expeditionary airport facilities would be provided by standard expeditionary procedures such as using stand-by fire water trucks as no permanent utility infrastructure will be installed.

Due to the distance between the proposed facilities at the Port of Tinian (in the village of San Jose) and the proposed military potable water system (in the Military Lease Area), the Commonwealth Utilities Corporation's potable water system would need to be used to supply water to the proposed facilities at the Port of Tinian. The proposed facilities at the Port of Tinian would require an average demand of 12,675 gallons (47,980 liters) per day.

The potable water demand from operation personnel and their dependents would average 30,250 gallons (114,509 liters) per day. The operation personnel and their dependents would reside in the public areas and increase the demand on the Commonwealth Utilities Corporations' potable water system. The total average demand of 12,675 gallons (47,980 liters) per day for personnel and industrial use at the proposed facilities at the Port of Tinian and operation personnel and their dependents living outside the Military Lease Area result in a total demand of 42,925 gallons (162,489 liters) per day. As described in the Construction section, the Tinian potable water system has a potential to produce and deliver an additional 50,862 gallons (192,534 liters) per day. Therefore, Tinian Alternative 1 operations would result in less than significant impacts to the Tinian potable water system.

4.14.3.1.2.3 Wastewater

The areas requiring wastewater infrastructure on Tinian under the proposed action include the base camp, Munitions Storage Area, and proposed facilities at the Port of Tinian. The largest wastewater needs for the proposed action come from the base camp. The estimated wastewater flows for the proposed base camp are shown in Table 4.14-5, and include domestic and industrial wastewater sources. Due to the magnitude of the estimated flows associated with the proposed action, the existing U.S. military septic tank and leaching field system would not have adequate capacity. A new wastewater collection and treatment system is required to support the proposed action and would be located at the base camp. Due to the transient nature of the population, the wastewater system would need to be able to handle a wide range of flow conditions.

Table 4.14-5. Estimated Wastewater Flows generated by Military Personnel

Wastewater Flow	***Flow Conditions***		
	No Training	***For Basic Max Training Population***	***For Surge Training Population***
Average Day	47,052 gallons per day (178,111 liters per day)	122,052 gallons per day (462,016 liters per day)	197,052 gallons per day (745,922 liters per day)
Peak Day	51,327 gallons per day (194,293 liters per day)	238,827 gallons per day (904,058 liters per day)	426,327 gallons per day (1,613,823 liters per day)
Peak Hour*	58,452 gallons per day (221,264 liters per day)	402,312 gallons per day (1,522,916 liters per day)	655,602 gallons per day (2,481,723 liters per day)

Source: DoN 2014a. * Peak Hour is the peak hour flow rate given as a daily rate.
Note: The "no training" scenario accounts for the operation and maintenance of the base camp by the operations personnel when no training military personnel are present. The "training population" scenario would include wastewater generated by up to 1,500 military training personnel. The "surge training population" scenario addresses the potential for up to 3,000 military training personnel for several weeks, several times per year inclusive within the proposed action for 20 weeks per year of training.

Per discussions with the CNMI Bureau of Environmental and Coastal Quality, Tinian is a Class I Aquifer Recharge Area, which, by the CNMI regulations, requires that projects with an average daily flow greater than 5,000 gallons (18,927 liters) per day utilize technology other than a septic tank and leaching field system. The CNMI regulations would also require that the system be capable of producing secondary treated effluent. As shown in Table 4.14-5, the average daily flow could vary from 47,052 gallons (178,111 liters) per day to 197,052 gallons (745,922 liters) per day. Therefore, the wastewater treatment system would require a minimum of secondary level of treatment, as defined by CNMI regulations. The CNMI secondary treated effluent regulatory requirements are summarized in Table 4.14-6.

Table 4.14-6. CNMI Secondary Treated Effluent Requirements (Base Camp)

Effluent Characteristic	***Maximum Discharge Limits***	
	Average Monthly	***Maximum Daily***
Biochemical Oxygen Demand, 5-day	20 mg/L	40 mg/L
Total Suspended Solids	20 mg/L	40 mg/L
Total Nitrogen	1.0 mg/L	2.0 mg/L
Fecal Coliform	23 cfu/100 mL	23 cfu/100 mL
pH	Between 6.5 and 8.6	

Legend: cfu = colony forming unit; mg/L = milligram per liter; mL = milliliter.
Source: Northern Mariana Islands Administrative Code 2004.

A critical issue with the regulatory effluent limits is the total nitrogen parameter. The limits for secondary treated effluents include a total nitrogen concentration of 1.0 milligram per liter. This regulatory limit is lower than what is attainable using currently best available control technology for total nitrogen, wherein total nitrogen is the sum of the organic nitrogen, ammonia, nitrite, and nitrate concentrations. The CNMI Bureau of Environmental and Coastal Quality, Division of Environmental Quality is aware of this issue and evaluates this requirement on a case-by-case basis. According to the CNMI Bureau of Environmental and Coastal Quality, Division of Environmental Quality, other systems required to meet this nitrogen limit measure nitrate as nitrogen.

The estimated wastewater characteristics for the base camp are summarized in Table 4.14-7, see Volume IV of Appendix P, *Utilities Study*.

Table 4.14-7. Estimated Influent Loading (Base Camp)

Training Scenario	***Biological Oxygen Demand (5-day)***		***Total Suspended Solids***	
	(pounds/day)	***(milligrams/liter)***	***(pounds/day)***	***(milligrams/liter)***
No Training	16	679	19	799*
Typical Training	271	418	319	491
Training Surge	526	413	619	486

Note: * Higher concentration is due to a lower flow rate with fewer personnel; more personnel result in additional flows
Source: DoN 2014a.

As discussed in the *Utilities* subsection of Section 2.4.1, *Elements Common to All Alternatives,* a new wastewater collection, treatment, and disposal system would be provided at the base camp. This system would include sewage receiving and solids management. The wastewater treatment system at the base camp would be designed, permitted, constructed, certified for use, operated, and maintained in accordance with the CNMI regulations and be capable of meeting the CNMI's secondary treated effluent requirements. Industrial wastewater sources at the base camp such as the dining facility, fuel loading, vehicle wash platforms, vehicle grease racks, and vehicle maintenance shops would have their wastewater flow directed through grease traps or oil/water separators prior to flowing downstream to the wastewater treatment system. Secondary treated effluent would be disposed of through a subsurface disposal area consisting of sub-leaching fields.

The Munitions Storage Area would be located outside of the base camp area and would have lower wastewater needs that would be served by individual sewage disposal systems, including a septic tank and leach field. The estimated average daily wastewater flow for the Munitions Storage Area is 3,880 gallons (14,687 liters) per day. The individual wastewater disposal systems for the Munitions Storage Area would be designed, permitted, constructed, certified for use, operated, and maintained in accordance with the CNMI regulations. Where site limitations of area and/or soil type are such that methods of individual wastewater disposal system cannot be utilized, wastewater would be stored in water-tight holding tanks and periodically pumped by a licensed contractor and taken to the base camp wastewater treatment plant for treatment and disposal.

The proposed facilities at the Port of Tinian would require treatment of industrial wastewater generated from the wash-down of vehicles, which is estimated to be up to 12,000 gallons (45,000 liters) per day when the facility is in use. This wastewater from the vehicle wash-down area would be treated by a sedimentation basin followed by an intermittent sand filtration system prior to discharge to an adjacent stormwater retention pond. The proposed biosecurity facility at the Port of Tinian is estimated to generate an average daily wastewater flow of 576 gallons (2,180 liters) per day. Due to the biosecurity facility's proximity to the coastline, it is anticipated that the domestic wastewater would be stored in a holding tank that would be periodically emptied and contents transferred to the base camp wastewater treatment plant for treatment and disposal.

Wastewater generated on the ranges would be collected in portable toilets and emptied at the base camp wastewater treatment and disposal system periodically by a licensed contractor. The proposed independent military wastewater infrastructure would be designed and constructed to handle the projected increase in wastewater generated during operation. Therefore, Tinian Alternative 1 operations would result in less than significant impacts to the existing wastewater infrastructure.

4.14.3.1.2.4 Stormwater Management

Tinian Alternative 1 would result in newly created impervious surfaces including roads, airport improvements, base camp facilities, port improvements, and minor structures associated with training facilities, as described in Section 2.4.1.1, *Construction and Improvements*. In accordance with local and federal guidance on water quality, a Low Impact Development approach to stormwater management would be utilized to maintain existing hydrology conditions to the maximum extent technically feasible. The Low Impact Development strategies include detailed modeling and design alternative analyses to both maximize infiltration of treated stormwater for groundwater recharge and prevent the transportation of pollutants resulting from proposed facilities or operations. Low Impact Development devices and other structural and non-structural best management practices would be selected and sited based on specific land use activities, anticipated pollutant characteristics, and pollutant treatment capabilities.

Stormwater management systems require regular maintenance to ensure the systems operate as designed and continue to provide adequate storage capacity, conveyance, and treatment. The use of a Low Impact Development approach requires additional maintenance specific to water quality and the operation of the Low Impact Development devices. A Stormwater Management Plan would be developed taking into consideration the climate, site conditions, operations, pollutant generation, and specific Low Impact Development devices such as vegetated swales and bioretention and nonstructural best management practices such as range clearance procedures. Therefore, Tinian Alternative 1 operations would result in less than significant impacts to stormwater management. Drainage and Low Impact Development is described in Section 4.3, *Water Resources*.

4.14.3.1.2.5 Solid Waste

There are currently no permanently established U.S. military solid waste facilities on Tinian. The existing solid waste facility on Tinian consists of a non-compliant open disposal site that is operated under a the CNMI Bureau of Environmental and Coastal Quality, Division of Environmental Quality Administrative Order dictating specific operation and maintenance measures. The estimated total solid waste demand for operation of the proposed action is shown below in Table 4.14-8.

Table 4.14-8. Estimated Total Solid Waste Generation

Waste Stream	*Estimated Percent*	*Projected Waste Amount*[1]
Paper and Cardboard	28.5%	6,185 pounds per day (2,811 kilograms per day)
Glass	4%	868 pounds per day (395 kilograms per day)
Plastics and Polystyrene	19.5%	4,232 pounds per day (1,924 kilograms per day)
Metal (including aluminum and expended brass cartridges estimated at 300 pounds per day)	6%	1,302 pounds per day (592 kilograms per day)
Organics	34.5%	7,487 pounds per day (3,403 kilograms per day)
Construction and Demolition from operations and maintenance	5%	1,085 pounds per day (493 kilograms per day)
Electronics	1%	217 pounds per day (99 kilograms per day)
Remaining/Composite MSW	1.3%	282 pounds per day (128 kilograms per day)
Household Hazardous Waste	0.2%	43 pounds per day (20 kilograms per day)
Total Solid Waste Generation		**21,700 pounds per day (9,864 kilograms per day)**
40% Recycle Rate		**8,680 pounds per day (3,946 kilograms per day)**
Remaining Solid Waste Disposal		**13,020 pounds per day (5,918 kilograms per day)**

Note: *Based on 7.0 pounds per person per day generation rate and 40% of the generated waste would be recycled (7.0 pounds per day X 3,100 X 0.60 = 13,020 pounds per day disposal requirement). The requirement is based on the peak number of personnel supported during the CJMT training cycle.

The disposal requirements for the projected solid waste generated as a result of the proposed action would initially be met by establishment of a solid waste transfer station, recycling center, and associated open storage areas within the base camp area. The municipal solid waste would be collected in dumpsters and recycling containers located throughout the base camp and training areas. Solid waste container trucks would transport the waste containers to the transfer station and recycling center at the base camp, where the municipal solid waste would be separated, shredded, compacted, baled, and stored in holding areas. The processed waste would then be shipped to a facility in compliance with U.S. Environmental Protection Agency/Resource Conservation and Recovery Act requirements. Therefore, Tinian Alternative 1 operations would result in less than significant impacts to solid waste management.

4.14.3.1.2.6 Information Technology/Communications

The current commercial information technology/communications facilities have adequate capacity to serve the proposed new facilities. The island's telephone and internet provider, IT&E, and the island's television provider, Docomo Pacific, have stated that there are sufficient capacities to provide commercial telephone and internet to the new planned facilities. New service lines to the new facilities would be routed via a combination of aerial cables and underground cables in concrete encased duct banks.

Military use of the existing information technology infrastructure would be limited to a leased line (for security) or Satellite connection to Guam. Since the high security connections to the fiber optics system would be a line lease, capacity of the existing civilian portion of that cable is not expected to be significantly impacted. The Tinian information technology infrastructure in the Military Lease Area would not be connected to the commercial services. Therefore, Tinian Alternative 1 operations would result in less than significant impacts to the current information technology/communications utilities.

4.14.3.2 Tinian Alternative 2

4.14.3.2.1 Construction Impacts

The impacts to the electrical power, potable water, wastewater, and information technology/ communications utilities and stormwater management resulting from Tinian Alternative 2 construction activities are nearly the same as those described for Tinian Alternative 1. See Section 4.14.3.1, *Tinian Alternative 1*, for a discussion of impacts.

The overall impacts to solid waste management during construction of Tinian Alternative 2 would be similar to those described in Section 4.14.3.1, *Tinian Alternative 1*, with the difference being the quantity of green waste produced (an additional 32,382 tons [29,377 metric tons]), which is a result of differences between the footprint of the training facilities under Tinian Alternative 2 as compared to Tinian Alternative 1, and the future relocation of the International Broadcasting Bureau facilities, which would generate increased construction and demolition waste. Construction and demolition waste would be generated during the construction phase in the quantities summarized in Table 4.14-9.

The differences in the quantity of green waste (439,808 tons [398,991 metric tons] versus 472,190 tons [428,368 metric tons]) and construction and demolition waste (8,100 tons [7,349 metric tons] versus 8,649 tons [7,847 metric tons]) would not have a notable effect on the impact to the solid waste management. For the reasons discussed above, Tinian Alternative 2 construction activities would result in less than significant impacts to the existing electrical, potable water, wastewater, and information technology/communications utility and less than significant impacts to stormwater management and solid waste management.

Table 4.14-9. Tinian Alternative 2 Projected Construction Waste

	Waste Description	*Waste in Tons (metric tons)*
Green Waste		
Tinian Base Camp	Vegetation Clearance	60,984 tons (55,324 metric tons)
Training Range Alternative 2	Range Clearance	411,206 tons (373,044 metric tons)
Construction and Demolition Waste		
Base Camp	Construction and demolition waste from construction of base camp facilities (3.89 pounds per square foot of facility space)	766 tons (695 metric tons)
Base Camp Road Demolition	Asphalt waste from planned demolition of 8,563 feet of existing roads located within the base camp	6,668 tons (6,049 metric tons)
Munitions Storage Area	Construction and demolition waste from planned construction of MSA facilities (3.89 pounds per square foot of facility space)	168.2 tons (152.6 metric tons)
Tinian International Airport Improvements	Construction and demolition waste from planned construction of Tinian Airport Improvements (3.89 pounds per square foot of facility space)	468.4 tons (425.8 metric tons)
Port of Tinian	Construction and demolition waste from planned construction of Port of Tinian facilities (3.89 pounds per square foot of facility space)	29.7 tons (26.9 metric tons)
International Broadcasting Bureau Fuel Tank Demolition		
Steel Debris	Scrap metal debris generated by the planned demolition of the two existing above ground storage tanks in the International Broadcasting Bureau compound	92.7 tons (84.1 metric tons)
Concrete Debris	Concrete debris generated by the planned demolition of the above storage tank foundations in the International Broadcasting Bureau	455.6 tons (413.3 metric tons)

**Source:* Appendix A, Version 4, CJMT Solid Waste Study, August 2014.

4.14.3.2.2 Operation Impacts

The total power demand for the Tinian Alternative 2 associated with the base camp, Munitions Storage Area, and proposed facilities at the Port of Tinian, along with the projected potable water demand, proposed water distribution system, projected wastewater flows, proposed wastewater collection and treatment system, and the information technology/ communications infrastructure would be almost identical to that described in Section 4.14.3.1, *Tinian Alternative 1*.

Tinian Alternative 2 would result in impervious surfaces including roads, airport improvements, base camp facilities, port improvements, and minor structures associated with training facilities, as described in Section 2.4.1.2, *Construction and Improvements*. The stormwater management system for Tinian Alternative 2 would utilize the same approach as described in Section 4.14.3.1, *Tinian Alternative 1*.

Specific drainage elements including Low Impact Development device selection and best management practice sizing and locations would be modified to accommodate the proposed site improvements within Tinian Alternative 2. As with Tinian Alternative 1, Tinian Alternative 2 would follow strict operation and maintenance protocols to ensure the stormwater management system functions as designed and that the system does not create any adverse effects to downstream or off-site facilities.

The planned solid waste transfer station, recycling center, off-island shipment, and open storage areas planned in Tinian Alternative 1 would also be planned in Tinian Alternative 2. Therefore, the impacts during Tinian Alternative 2 operations would be nearly the same as presented in Section 4.14.3.1, *Tinian Alternative 1*.

As such, operation of Tinian Alternative 2 would result in less than significant impacts to the existing electrical power, potable water, wastewater, and information technology/communications utilities and less than significant impacts to stormwater management and solid waste management.

4.14.3.3 Tinian Alternative 3

4.14.3.3.1 Construction Impacts

The impacts to the electrical power, potable water, wastewater, and information technology/ communications utilities and stormwater management resulting from Tinian Alternative 3 construction activities are nearly the same as those described for Tinian Alternative 1. See Section 4.14.3.1, *Tinian Alternative 1*, for a discussion of impacts.

The overall impacts to the solid waste management during Tinian Alternative 3 construction activities would be similar to those described in Section 4.14.3.1, *Tinian Alternative 1*, with the difference being the quantity of green waste produced (an additional 24,789 tons [22,481 metric tons]), which is a result of differences between the footprint of the base camp area and the training facilities, and the future relocation of the International Broadcasting Bureau facilities, which would generate increased construction and demolition waste. Construction and demolition waste would be generated during the construction phase in the quantities summarized in Table 4.14-10.

The differences in the quantity of green waste (439,800 tons [398,991 metric tons] versus 464,589 tons [421,472 metric tons]) and construction and demolition waste (8,100 tons [7,349 metric tons] versus 8,649 tons [7,847 metric tons]) would not have a notable effect on the impact to the solid waste management. Therefore, Tinian Alternative 3 construction activities would result in less than significant impacts to the existing electrical, potable water, wastewater, and information technology/ communications utility and less than significant impacts to stormwater management solid waste management.

Table 4.14-10. Tinian Alternative 3 Projected Construction Waste

	Waste Description	*Waste in Tons (metric tons)*
Green Waste		
Tinian Base Camp	Vegetation Clearance	60,984 tons (55,324 metric tons)
Training Range Alternative 3	Range Clearance	403,605 tons (366,148 metric tons)
Construction and Demolition Waste		
Base Camp	Construction and demolition waste from construction of base camp facilities (3.89 pounds per square foot of facility space)	766 tons (695 metric tons)
Base Camp Road Demolition	Asphalt waste from planned demolition of 8,563 feet of existing roads located within the base camp	6,668 tons (6,049 metric tons)
Munitions Storage Area	Construction and demolition waste from planned construction of Munitions Storage Area facilities (3.89 pounds per square foot of facility space)	168.2 tons (152.6 metric tons)
Tinian International Airport Improvements	Construction and demolition waste from planned construction of Tinian Airport Improvements (3.89 pounds per square foot of facility space)	468.4 tons (425.8 metric tons)
Port of Tinian	Construction and demolition waste from planned construction of Port of Tinian facilities (3.89 pounds per square foot of facility space)	29.7 tons (26.9 metric tons)
International Broadcasting Bureau Fuel Tank Demolition		
Steel Debris	Scrap metal debris generated by the planned demolition of the two existing above ground storage tanks in the International Broadcasting Bureau compound	92.7 tons (84.1 metric tons)
Concrete Debris	Concrete debris generated by the planned demolition of the AST foundations in the International Broadcasting Bureau	455.6 tons (413.3 metric tons)

**Source:* Appendix A, Version 4, CJMT Solid Waste Study, August 2014.

4.14.3.3.2 Operation Impacts

The total power demand for the Tinian Alternative 3 associated with the base camp, Munitions Storage Area, and proposed facilities at the Port of Tinian, along with the projected potable water demand, proposed water distribution system, projected wastewater flows, proposed wastewater collection and treatment system, and the information technology/ communications infrastructure would be almost identical to that described in Section 4.14.3.1, *Tinian Alternative 1*.

Tinian Alternative 3 would result in newly created impervious surfaces including roads, airport improvements, base camp facilities, port improvements, and minor structures associated with training facilities, as described in Section 2.4.1.2, *Construction and Improvements*. The stormwater management system for Tinian Alternative 3 would utilize the same approach as described above in Tinian Alternative 1. Specific drainage elements including Low Impact Development device selection and best management practice sizing and location would be modified to accommodate the proposed site improvements within Tinian Alternative 3. As with Tinian Alternative 1, Tinian Alternative 3 would follow strict operation and maintenance protocols to ensure the stormwater management system functions as designed and that the system does not create any adverse effects to downstream or off-site facilities.

The planned solid waste transfer station, recycling center, open storage areas, and off-island shipment and disposal in Tinian Alternative 1 would also be planned for Tinian Alternative 3. Therefore, the impacts during Tinian Alternative 3 operations would be the same as presented in Section 4.14.3.1, *Tinian Alternative 1*. Tinian Alternative 3 operations would result in less than significant impacts to the existing electrical power, potable water, wastewater, and information technology/communications utilities and less than significant impacts to stormwater management and solid waste management.

4.14.3.4 Tinian No-Action Alternative

The periodic non-live-fire military training exercises that occur in the Military Lease Area on Tinian consist of troop maneuvering, ground vehicle movements, and helicopter and fixed-wing aircraft operations. The training exercises that have occurred in the Military Lease Area on Tinian during the 2012 to 2014 timeframe were of short duration and had minimal needs for utility support. In addition, there would be less than significant impacts to wastewater and potable water and no impacts to power and solid waste when establishing and using the four live-fire training ranges on Tinian (see Table 15.2-4, DoN 2014b). No impacts to utilities would be anticipated due to the Mariana Islands Range Complex training. Therefore, the no-action alternative would have less than significant impacts on utilities.

4.14.3.5 Summary of Impacts for Tinian Alternatives

Table 4.14-11 provides a comparison of the potential impacts to utilities for the three Tinian alternatives and the no-action alternative.

Table 4.14-11. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Utilities	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Electrical Power	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Potable Water	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Wastewater	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Stormwater Management	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Solid Waste	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Information Technology/ Communications	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*

Legend: *LSI* = less than significant impact.

4.14.4 Pagan

4.14.4.1 Pagan Alternative 1

4.14.4.1.1 Construction Impacts

There is no current electrical power utility, potable water utility, wastewater infrastructure, or information technology/communications infrastructure on Pagan. All requirements for these utilities during construction would be provided by temporary camp style systems (generators, alternative energy devices, etc.). Since there are currently no utilities on Pagan, there would be no impact to existing utilities.

No permanent wastewater infrastructure exists or is being proposed for Pagan. It is anticipated that wastewater generated on Pagan would be managed with field sanitation devices and expeditionary procedures would be followed. Field sanitation devices would include toilets with collection bags or burn-out latrines and field urinals. It is anticipated that the ash produced by the burn-out latrines would be collected in containers and shipped to an approved disposal facility.

The stormwater management system for Pagan would be consistent with the level of site improvements. The majority of stormwater system improvements would consist of vegetated swales for conveyance and control of stormwater, gravel low water crossings along dirt trails, and detention ponds where increased imperviousness occurs, such as at the airfield. The proposed airfield improvements on Pagan would impact infiltration rate due to the compaction associated with the proposed training activity and may contribute to increased stormwater flows. Phasing of these stormwater improvements would follow the phasing of site improvements to ensure continued control of stormwater and would mimic pre-development hydrology to the maximum extent technically feasible. Construction activities would require a Stormwater Pollution Prevention Plan and appropriate use of erosion control procedures to protect downstream water resources.

The primary solid waste impact would consist of green waste generated during the clearing and grubbing phase. Green waste would be managed on site through size reduction and through the use of chipping. Any waste generated during construction that cannot be processed and reused on Pagan would be shipped to an acceptable off-island location for proper handling and disposal or reuse. Therefore, construction of Pagan Alternative 1 would result in no impacts to the electrical power utility, potable water utility, wastewater infrastructure, or information technology/communications infrastructure and less than significant impacts to stormwater management and solid waste management.

4.14.4.1.2 Operation Impacts

Requirements for electrical power during operation would be provided by temporary camp style systems (generators, alternative energy devices, etc.). No permanent potable water infrastructure is being proposed for Pagan. It is anticipated that potable water would be provided by the use of portable de-salinization units, water totes brought to Pagan, or other portable devices. No information technology/communications utility is being proposed besides portable devices that do not require infrastructure.

It is anticipated that wastewater generated on Pagan would be managed with field sanitation devices and expeditionary procedures would be followed. Field sanitation devices would include toilets with collection bags or burn-out latrines and field urinals. It is anticipated the ash produced by the burn-out latrines would be collected in containers and shipped to an approved facility.

The stormwater management system for Pagan would be consistent with the level of site improvements. The majority of stormwater system improvements would consist of vegetated swales for conveyance and control of stormwater, gravel low water crossings along dirt trails, and detention ponds where increased imperviousness occurs, such as at the airfield.

The solid waste generated during training operations on Pagan would be minimal. The waste would be collected in containers and shipped to an approved facility. Therefore, Pagan Alternative 1 operations would result in no impacts to the electrical power, potable water, wastewater, or information technology/communications utilities and less than significant impacts to stormwater management and solid waste management.

4.14.4.2 Pagan Alternative 2

4.14.4.2.1 Construction Impacts

The potential construction impacts to all utilities for Pagan Alternative 2 would be nearly the same as for those discussed in Section 4.14.4.1, *Pagan Alternative 1*. Therefore, Pagan Alternative 2 construction activities would result in no impacts to the electrical power, potable water, wastewater, and information technology/communications utilities and less than significant impacts to stormwater management and solid waste management.

4.14.4.2.2 Operation Impacts

The potential impacts to all utilities resulting from Pagan Alternative 2 operations would be the same as for those discussed in Section 4.14.4.1, *Pagan Alternative 1*. Therefore, Pagan Alternative 2 operations would result in no impacts to electrical power, potable water, wastewater, and information technology/communications utilities and less than significant impacts to stormwater management and solid waste management.

4.14.4.3 Pagan No-Action Alternative

Only periodic low impact visits for eco-tourism, scientific surveys, and military training for search and rescue are anticipated to occur on Pagan. There are currently no existing utilities on Pagan, and no impacts to wastewater, potable water, power, stormwater and solid waste would occur under the no-action alternative. Therefore, the no-action alternative would have no impacts on utilities.

4.14.4.4 Summary of Impacts for Pagan Alternatives

Table 4.14-12 provides a comparison of the potential impacts to utilities for the two Pagan alternatives and the no-action alternative.

Table 4.14-12. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Utilities	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Electrical Power	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
Potable Water	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
Wastewater	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
Stormwater Management	*LSI*	*LSI*	*LSI*	*LSI*	*Not applicable*	*Not applicable*
Solid Waste	*LSI*	*LSI*	*LSI*	*LSI*	*Not applicable*	*Not applicable*
Information Technology/ Communications	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*

Legend: *LSI* = less than significant impact.

4.15 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Section 4.15 evaluates the effects of the proposed action on the general socioeconomic conditions in the CNMI, with concentration on socioeconomic impacts to Tinian and Pagan. Appendix Q, *Socioeconomic Impact Assessment Study*, provides detailed analysis conducted in determining the socioeconomic impacts described in this section.

In compliance with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations and Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks, this section also identifies and evaluates impacts that could disproportionately and adversely affect minority and low-income populations and have the potential to expose children to adverse health and/or safety risks.

4.15.1 Approach to Analysis

Methodologies for focused topics are identified and described below; see Appendix Q, *Socioeconomic Impact Assessment Study* (specifically Chapter 2 and Appendix A of the study), for more detailed information on approach to analysis, methodologies and intermediate calculations made for quantified estimates.

Impacts are quantified and compared to estimates of expected future baseline conditions, and presented as percentage changes compared to the expected future baseline conditions (e.g., employment if the proposed action were implemented versus baseline employment, and the percent difference between the two is identified as the impact). The expected future baseline represents projected socioeconomic conditions from 2016, when the Record of Decision would be signed, to 2025, when construction related to the proposed action would be complete. While the expected future baseline is not the no-action alternative for the proposed action, it does not take potential effects from the proposed action into consideration. The expected future baseline was established because establishing a baseline that accounted for no change in economic activity over time would likely lead to incorrect results (U.S. Environmental Protection Agency 2010).

Impacts that are quantified were calculated as direct impacts; some potential indirect impacts would also be anticipated to occur due to multiplier effects associated with financial activity and, as such, would primarily be associated with economic impacts. Public service and sociocultural impacts are presented qualitatively, though some quantitative data are used to provide a basis for conclusions.

Data for environmental justice and protection of children analyses were gathered from the U.S. Census Bureau and the U.S. military. Additionally, in February 2014, a series of project specific interviews were conducted to obtain more detailed information about the socioeconomic conditions on Tinian and community sentiment about Pagan (see Appendix Q, *Socioeconomic Impact Assessment Study,* Appendix B, January-February 2014 Site Visit Meeting Records).

There is military-specific legislation (Public Law 110-17, 10 U.S. Code 2391: *Military Base Reuse Studies and Community Planning Assistance*) and implementing Department of Defense Directives (3030.01 and 5410.12) that address the issue of what is a significant impact to communities due to changes in military programs.

The price of pozzolan in 2012 was lower than the cost would be to ship pozzolan to market (U.S. Geological Survey 2013, Saipan Shipping Company 2014). This indicates that, while a permit to mine pozzolan was provided by the CNMI Department of Public Lands to a private mining company, a pozzolan mine on Pagan may not be economically feasible and pozzolan mining activities are not expected to take place (see Appendix Q, *Socioeconomic Impact Assessment Study*, Section 4.2.10 for more information). Therefore, impacts to pozzolan mining are not analyzed.

Impacts are analyzed separately for the construction and operations phases of the proposed action. For additional information on methods of analysis, see Chapter 2 and Appendix A of Appendix Q, *Socioeconomic Impact Assessment Study*.

4.15.1.1 Population

Population change was determined based on changes in the number of people who would be on Tinian as a result of the proposed action. Sources of additional population that would be related to the proposed action include construction workers, operations personnel, and training personnel, along with dependents of construction workers and operations personnel. Estimates of the change in population were divided by the estimated baseline population to determine the percentage change in population relative to baseline levels. See Sections 1.1.1 and 1.2.1 of Appendix A of the *Socioeconomic Impact Assessment Study* for additional details on these estimates.

Construction of training ranges and support facilities on Tinian would occur for 8 to 10 years. It is anticipated that the construction work force would be rotational, i.e., the same construction workers would not be on Tinian the entire 8 to 10 year period. While Tinian residents would be eligible to work on project-related construction, Tinian has a very small construction workforce, so the vast majority of construction workers were anticipated to come from off-Tinian and temporarily add to the population. While it is possible that some portion of the construction workforce could be from other the CNMI islands, and travel to Tinian for work on a daily basis, for purposes of analysis, in order to assess maximum potential impacts, all workers from off-island are assumed to reside on Tinian and add to the existing population. Additional assumptions used in the process of estimating population change led to an assessment of maximum potential impacts. For instance, construction phase population was estimated using data on construction cost to construction worker ratios that were based on numerous smaller CNMI construction projects that would not achieve the same efficiencies of scale and utilization of equipment over manpower that would likely be realized with this proposed construction effort.

Department of Defense-specific legislation (Public Law 110-17 10 U.S. Code 2391: Military base reuse studies and community planning assistance) and Directives (Department of Defense 3030.01 and 5410.12) address the issue of what is a significant impact on communities due to changes in population related to Department of Defense programs, such as a base realignment or expansion. Collectively, these documents establish “thresholds” that allow the Department of Defense’s Office of Economic Adjustment to provide communities with technical and financial assistance for organizing and planning for Department of Defense program impacts. To qualify for financial assistance, the magnitude of Department of Defense personnel increases must meet the following statutory thresholds:

- More than 2,000 direct military, civilian, and contractor personnel (i.e., net addition); or

- More military, civilian, and contractor personnel than 10% of persons employed in the counties or independent municipalities within 15 miles (24 kilometers) of the installation, whichever is less.

Additionally, the Office of Economic Adjustment must make a finding that the affected community would experience a “direct and significantly adverse consequence” based on the Department of Defense impacts in light of community-specific needs and resources (Office of Economic Adjustment, Department of Defense n.d.).

Impacts related to population change on Pagan are not assessed because there is no existing permanent population or socioeconomic infrastructure, although visitors do travel to the island.

A change in population is not considered an impact itself. However, population change has the potential to drive positive or negative impacts to other socioeconomic factors discussed in the following subsections.

4.15.1.2 Economic Conditions

Economic conditions that are assessed include tourism, gross domestic product, employment and income, government revenues, housing, agriculture, fishing and aquaculture, airports and sea ports, and power utility rates.

Increases in quantifiable impacts related to jobs and dollars – the usual measures of economic prosperity – were considered “beneficial” impacts. Impacts that were either qualitative or where precise numbers could not be estimated, were given significance ratings on a judgment basis, considering the overall information available from surveys or interviews conducted for this EIS/OEIS (see Appendix Q, *Socioeconomic Impact Assessment Study,* Appendix B, January-February 2014 Site Visit Meeting Records).

4.15.1.2.1 Tourism

Estimates of potential changes in the number of visitors to Tinian and the CNMI, which may result from the proposed action, were developed in Appendix Q, *Socioeconomic Impact Assessment Study.* These estimates were compared to baseline estimates of visitors in order to establish the percentage change in number of visitors to the CNMI that would result from the proposed action. See Sections 1.1.2.1 and 1.2.2.1 of Appendix A of the *Socioeconomic Impact Assessment Study* (Appendix Q)*,* for additional details on these estimates.

Potential changes in number of visitors resulting from the proposed action were estimated for the following scenarios: (1) impacts could occur by altering commercial and civil aircraft flight paths and increasing the distance flown and associated fuel costs resulting in a potential rise in ticket prices, which could lead to reduced demand for visits to Tinian; and (2) access restrictions to tourist sites in the Military Lease Area potentially resulting in a decrease in tourism visitors.

4.15.1.2.2 Gross Domestic Product

Estimates of changes to gross domestic product that would result from the proposed action were developed in Appendix Q, *Socioeconomic Impact Assessment Study.* These estimates were compared to baseline estimates of gross domestic product in order to establish the percentage change in the CNMI gross domestic product that would result from the proposed action. See Sections 1.1.2.2 and 1.2.2.2 of Appendix A of the *Socioeconomic Impact Assessment Study* (Appendix Q) for details on these estimates.

Contributions to gross domestic product were estimated in association with potential changes in tourism visitor expenditures, construction expenditures, operations employment, and spending by military personnel while on Tinian. Each contribution was determined separately and then summed to calculate the total change to gross domestic product.

4.15.1.2.3 Employment and Income

Estimates of changes to employment and income that would result from the proposed action were developed in Appendix Q, *Socioeconomic Impact Assessment Study.* These estimates were compared to baseline estimates of employment and income in order to establish the percentage change in Tinian employment and income that would result from the proposed action. Total employment and income associated with the proposed action were estimated based on planned construction spending and estimates of operations employment. See Sections 1.1.2.3 and 1.2.2.3 of Appendix A of the *Socioeconomic Impact Assessment Study* for information on these estimates.

4.15.1.2.4 Government Revenues

Estimates of changes to government revenues that would result from the proposed action were developed in Appendix Q, *Socioeconomic Impact Assessment Study.* These estimates were compared to baseline estimates of government revenues in order to establish the percentage change in the CNMI government revenues that would result from the proposed action. Changes in government revenues were estimated based on estimated changes in gross domestic product associated with the proposed action using the historical relationship between gross domestic product and government revenues of 20% (i.e., government revenues have historically equaled 20% of gross domestic product). See Sections 1.1.2.4 and 1.2.2.4 of Appendix A of the *Socioeconomic Impact Assessment Study* for information on these estimates. Qualitative assessments related to payments for use of the CNMI land were also made, under the assumption that these payments would be positive and contribute to the CNMI government revenues.

4.15.1.2.5 Housing

Estimates of changes to housing demand on Tinian that would result from the proposed action were developed in Appendix Q, *Socioeconomic Impact Assessment Study.* These estimates were compared to broad estimates of baseline housing supply on Tinian in order to determine whether demand could be met by supply. Based on the existing supply of potential construction workforce housing located behind the Tinian Dynasty, construction contractor-provided housing was assumed to accommodate the vast majority of construction workers (all non-managers). See Section 1.2.2.5 of Appendix A of the *Socioeconomic Impact Assessment Study* for information on approach to housing analysis.

4.15.1.2.6 Agriculture

Impacts to agriculture were assessed in terms of potential reductions of land available for grazing in the Military Lease Area. The amount of land currently used for cattle grazing was considered as was a range of estimates of grazing area required per head of cattle in the Tinian herd (of various potential sizes) that were developed in Appendix Q, *Socioeconomic Impact Assessment Study.* Estimates were compared to the land that would potentially be available for grazing with the proposed action, in order to determine whether there would be adequate space for the herd. See Sections 1.1.2.5 and 1.2.2.6 of Appendix A of the *Socioeconomic Impact Assessment Study* for information on these estimates.

Additional discussion regarding growing agricultural products for subsistence purposes is provided with respect to community and social topics in Section 4.15.1.4.

4.15.1.2.7 Fishing and Aquaculture

Marine areas that would potentially have access restricted as a result of the proposed action were reviewed in comparison with areas that are used for commercial fishing to determine whether areas that are important to commercial fishing would be affected by the proposed action. Similarly, potential affects that the proposed action may have on open-ocean aquaculture were reviewed in terms of whether open-ocean aquaculture and the proposed action would be compatible given potential access restrictions. See Sections 1.1.2.6 and 1.2.2.7 of Appendix A of the *Socioeconomic Impact Assessment Study* for information on the approach to analysis for fishing and aquaculture.

4.15.1.2.8 Airport and Sea Ports

Estimates of changes to sea port freight that would result from the proposed action were developed in Appendix Q, *Socioeconomic Impact Assessment Study.* These estimates were compared to baseline estimates in order to establish the percentage change that would result from the proposed action. Potential changes in the level of airport freight were addressed qualitatively. See Sections 1.1.2.7 and 1.2.2.8 of Appendix A of the *Socioeconomic Impact Assessment Study* for information on the approach to analysis for airports and sea ports.

4.15.1.2.9 Power Utility Rates

The potential for changes to utility rates was based on whether the proposed action would lead to a change in demand for power and thus result in a change in costs to residents of Tinian. The general framework of analysis considered that a reduction in overall power demand on Tinian would lead to the same cost of power generation being shared by fewer customers, and thus lead to higher per-customer power utility rates (and vice versa). Additional information on this topic is provided in Appendix Q, the *Socioeconomic Impact Assessment Study*.

4.15.1.3 Public Services

Impacts to public services (i.e., education, emergency services, and health) were assessed primarily in relation to changes in population. Increases in population tend to drive up the demand for public services as well as the level of services required to be provided by public service agencies. Additional demands, generated by additional population, were evaluated and compared to the ability of existing facilities and services to meet these demands. Impacts to public services were considered significant if they would lead to a condition where demand on public services would exceed existing capacity of Tinian public services agencies to provide services. Additional information on this topic is provided in Appendix Q, the *Socioeconomic Impact Assessment Study* and detail on estimates is provided in Sections 1.1.3 and 1.2.4 of Appendix A of the study.

4.15.1.4 Community and Social Topics

Community and social topics were identified, discussed, and summarized in the context of both community character and community cohesion. Community character is the distinctive identity of a particular place that results from the interaction of many factors—built form, landscape, history, people, and their activities (American Planning Association 2011). Community character impacts occur when ties with particular places are degraded or eliminated. Community cohesion is the social ties and community commitments that bind people together or a community with strong relationships between people from diverse backgrounds. A deterioration of community cohesion occurs when there are increased divisions between social groups in a community (Holdsworth 2009). Additional information on this topic is provided in Appendix Q, the *Socioeconomic Impact Assessment Study* and detail is provided in Sections 1.1.4 and 1.2.5 of Appendix A of the study.

4.15.1.5 Environmental Justice and Protection of Children

The Council on Environmental Quality suggests several principles in its *Environmental Justice Guidance Under the National Environmental Policy Act* (1997), to guide agencies in identifying environmental justice issues. These guidelines and the following steps were used to assess potential environmental justice impacts. First, minority and/or low-income populations affected by the proposed action within the region of influence were identified. Second, if these population groups were present, they were specifically identified as to where they were located. Third, it was determined whether these populations were exposed to health or environmental impacts caused by the proposed action. If so, then these impacts were evaluated to determine whether the effects were disproportionally high and adverse to human health or to the natural and physical environment of low-income and/or minority populations. The guidance further states that, "when determining whether environmental effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable:

(a) Whether there is or will be an impact on the natural or physical environment that significantly (as employed by NEPA) and adversely affects a minority population, low-income, or Indian tribe;

(b) Whether environmental effects are significant (as employed by NEPA) and are or may be having an adverse impact on minority populations, low-income population, or Indian tribe that appreciably exceeds or is likely to appreciably exceed those on general population or other appropriate comparison group; and

(c) Whether the environmental effects occur or would occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards."

Health and safety impacts to children were identified by consulting U.S. Environmental Protection Agency's memorandum *Addressing Children's Health through Reviews Conducted Pursuant to the National Environmental Policy Act and Section 309 of the Clean Air Act* (U.S. Environmental Protection Agency 2012). The memorandum suggests that proposed activities that impact air quality, water quality, floodplains, noise, and traffic and/or produce hazardous/poisonous materials, introduce toxic chemicals, or use radiation have the potential to adversely affect the health and safety of children. Therefore, the analysis herein considered where children live, go to school, and play to determine whether children would be affected by proposed RTA construction and operational activities. Analysis then identified if any adverse health or safety risks for children would be introduced.

If disproportionately high and adverse impacts to low-income and/or minority populations were identified, then they would be considered significant; however, analysis of proportionality (the possibility that impacts would have greater effects on certain locations than other locations) did not apply because the only locations that could be affected by the proposed action are in the CNMI. If children were exposed to adverse health and safety risks, then impacts would be considered significant.

4.15.2 Resource Management Measures

There are no resource management measures that were specifically developed for socioeconomics. In many cases; however, there are incidental environmental, socioeconomic, and cultural benefits resulting from standard operating procedures and best management practices. As detailed in Appendix D, *Best Management Practices*, the following resource management measures are standard operating procedures and best management practices that have incidental benefits relating to socioeconomics:

- Dust Control Measures
- Water Quality Monitoring
- Design individual projects using Leadership in Energy and Environmental Design Certification standards
- Design projects with Water Conservation measures
- Spill Prevention, Control and Countermeasures Plans and Facility Response Plans
- Biosecurity Outreach and Education
- Implement Traffic Management Plan and Work Zone Traffic Management
- Noise Abatement
- Notice to Mariners
- Notice to Air Traffic
- Utility Services
- Cultural Resources
- Range Environmental Vulnerability Assessments

4.15.3 Tinian

Please refer to Appendix Q, *Socioeconomic Impact Assessment Study, Chapter 5, Impacts of the Proposed Action,* for supporting documentation of the socioeconomic impact conclusions. Assessments of potential environmental justice impacts and potential impacts to children's health and safety follow the socioeconomic analysis.

4.15.3.1 Tinian Alternative 1

4.15.3.1.1 Construction Impacts

4.15.3.1.1.1 Population

The construction phase of the proposed action, for Tinian Alternative 1, would be anticipated to increase Tinian's population by between 477 and 596 (including between 456 and 571 construction workers and between 21 and 26 construction worker dependents), on average, each year for an 8 to 10 year period. Tinian's baseline population over the time period was estimated to be between 2,890 and 3,532. Given projected baseline population and projected population increase, the population increase would be between 14% and 21%.

Since the population increase is estimated to be greater than 10%, in order for the CNMI to qualify for financial assistance to help manage this growth, the Office of Economic Adjustment must make a finding that Tinian would experience a "direct and significantly adverse consequence" based on the Department of Defense impacts in light of community-specific needs and resources (Office of Economic Adjustment, Department of Defense n.d.). As noted above in Section 4.15.1.1, a change in population is not considered an impact itself. However, population change has the potential to drive positive or negative impacts to other socioeconomic factors discussed in the following subsections.

4.15.3.1.1.2 Economic Conditions

Tourism

The number of tourism visitors to some tourism areas on Tinian may decline modestly relative to baseline conditions during the construction period due to temporary access restrictions (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.2.1). Because the impact of the construction phase would be small relative to the overall number of visitors, Tinian Alternative 1 construction activities to tourism is considered less than significant.

Gross Domestic Product

Construction activities associated with Tinian Alternative 1 are anticipated to lead to increases in the CNMI gross domestic product. Increases to the gross domestic product would be an estimated $29 to $36 million, annually, over the 8 to 10 year construction period (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.2.2). This represents an annual increase of between 2.7% and 4.1% over baseline levels, which were estimated to be between $878 million and $1.09 billion. Because gross domestic product would increase, Tinian Alternative 1 construction activities would result in beneficial impacts.

Employment and Income

Construction activities associated with Tinian Alternative 1 would result in employment increases of between 456 and 571 annual construction jobs on Tinian during the construction period; this would represent between a 19% and 30% increase in employment over baseline levels (see Appendix Q, Socioeconomic Impact Assessment Study, Section 5.2.3), which were estimated to be between 1,899 and 2,378 jobs. Income related to the additional jobs is estimated to be between $5.9 and $7.4 million annually (between 13% and 21% above baseline levels, which were estimated to be between $35.8 million and $44.6 million). Since employment and income would increase, Tinian Alternative 1 construction activities would result in beneficial economic impacts.

Government Revenues

The CNMI government revenues under Tinian Alternative 1 would increase by between $6.5 million and $7.9 million, annually, over the course of the 8 to 10 year construction period (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.2.4). About 90% of this (between $5.9 million and

$7.1 million) would be associated with construction activities (e.g., taxes on income and businesses, fees). Estimated baseline CNMI government revenues were estimated to be between $176 million and $219 million, indicating that the annual increase in government revenues associated with construction would be between 3% and 4% above estimated baseline levels. Since government revenues would increase, Tinian Alternative 1 construction activities would result in beneficial impacts to the CNMI government revenues.

Housing

There are existing underutilized dwelling units including those associated with and adjacent to the Dynasty Hotel. It is understood that the dwelling units associated with the Dynasty could be available to construction workers and could house in excess of 1,500 people, many more than would potentially be needed for the high-end estimate of 571 construction workers. Given this apparent availability of existing workforce housing, it is likely that construction contractors would make this housing available for their employees and that no new workforce housing would need to be constructed to implement the proposed action.

For construction managers, who are not anticipated to reside in workforce housing, between 18 and 23 housing units would be needed in the Tinian community (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.2.5*)*. As of the 2010 Census, there were 101 housing units for rent and additional housing is currently being built. Thus demand for housing related to construction, under Tinian Alternative 1, would not exceed the number of units available during construction. There may be some potentially beneficial impacts related to growth in the housing/rental markets. Overall, Tinian Alternative 1 construction activities would result in less than significant impacts on housing.

Agriculture

Commercial agriculture, which only occurs outside of Military Lease Area boundaries, would not be affected by Tinian Alternative 1 construction activities.

As of 2014, the Lease Back Area (i.e., southern portion of the Military Lease Area) supported approximately 2,375 acres (961 hectares) of agricultural grazing permits. An estimated approximation of 1,010 acres (409 hectares) of that was being used for cattle grazing. Under Tinian Alternative 1, land within the Lease Back Area, which has been used for cattle grazing, would be removed from cattle grazing use. However, the DoN has identified and proposed a total of 2,554 acres (1,034 hectares) of land for cattle grazing areas throughout the Military Lease Area. Of this total 1,010 acres (409 hectares) would be unencumbered by surface danger zones and 1,544 acres (625 hectares) would be encumbered. The unencumbered portion is approximately the same amount of land that is currently used for cattle grazing and the approximate amount of land needed for the current herd under the ideal herd size to utilized acreage ratio (see Appendix Q, *Socioeconomic Impact Assessment Study,* Sections 4.2.6 and 5.2.6*).* The proposed action would require that some cattle be relocated; however, since the amount of land currently used for cattle grazing would be made available for cattle grazing under Tinian Alternative 1, impacts to cattle grazing are considered less than significant.

Commercial Fishing and Aquaculture

There would be limited access restrictions to nearshore waters at Unai Chulu due to construction of an amphibious landing. Access to commercial fishing or potential open-ocean aquaculture activities would not be affected. Therefore, there would be no impacts related to Tinian Alternative 1 construction activities.

Airports and Sea Ports

At Tinian International Airport, there is the potential for increased revenue from freight deliveries during construction. For inbound sea port freight, measured in revenue tons, short-term increases of between 8% and 12% are anticipated during the construction period under Tinian Alternative 1 (as annual revenue tons would increase by between 50,573 and 61,076 above estimated baseline levels which were estimated to be between 516,443 and 642,966 revenue tons) (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.2.8). Since capacity would not be exceeded and revenues would increase, Tinian Alternative 1 construction activities would result in increased revenues to the Commonwealth Ports Authority and beneficial economic impacts.

Additionally, infrastructure improvements, including additional lighting, would be made to the Tinian seaport that would benefit the public.

Power Utility Rates

Construction activities under Alternative 1 would not displace any utility users. And there would be no reduction in demand for electricity consumption on Tinian. Therefore, Tinian Alternative 1 construction activities would result in no impact to Tinian resident utility rates.

4.15.3.1.1.3 Public Services

Education

An increase in the number of students of between 29 and 59 is anticipated during Tinian Alternative 1 construction and operations activities (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.3.1*)*, with between 8 and 10 students per year associated with construction related population. The addition of between 8 and 10 students per year would be between a 1.5% and 2.3% increase above baseline levels, which were estimated to be between 451 and 551 students. The total number of students associated with the proposed construction (between 459 and 561) would be fewer than recent (2007-2008 school year) enrollment of 615 students. Since enrollment would not exceed recent levels, it is not anticipated that the construction phase would lead to capacity issues at Tinian schools. Because issues of excess capacity are not anticipated, impacts are considered less than significant.

Emergency Services

Under Tinian Alternative 1, emergency services agencies (police and fire departments) would have a short-term added burden due to increased construction-related population. Existing staffing to service population ratios greatly exceed U.S. averages (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 3.4.2.2). With the projected population increase associated with proposed construction, it is estimated that staffing to service population ratios would continue to exceed U.S. averages. Since Tinian agencies would continue to exceed U.S. averages for level of service, it is anticipated that emergency services agencies would have sufficient capacity to meet the anticipated increased demands without exceeding capacity. Since capacity would not be exceeded, Tinian Alternative 1 construction activities would result in less than significant impacts to Tinian's emergency services agencies.

Public Health

Off-island construction workers associated with the proposed action would increase the service population of the Tinian Health Center; however, construction worker population would not exceed the past population during the late 1990s, when the Tinian Dynasty was under construction, when an estimated 1,800 non-resident construction workers were on Tinian (DoN 2010a).

No existing deficits were noted by Tinian Health Center officials, and given recent facility upgrades (DoN 2014), the additional service population would not be anticipated to necessitate the construction of a new facility or initiate demand for additional services that are not currently provided on Tinian (major health issue would continue to be serviced off-island). Since construction contractors would cover construction worker healthcare expenses, such as by providing health insurance and covering workers compensation expenses, Tinian Health Center revenues would be anticipated to increase in conjunction with the level of services provided, allowing for the hiring of staff or purchasing of equipment and supplies needed to meet additional demands. Because it is not anticipated that an additional medical facility would be required as a result of the proposed action and because providing services in relation to additional demands would be funded by patient fees, Tinian Alternative 1 construction activities would result in less than significant direct impacts to Tinian's public health.

4.15.3.1.1.4 Community and Social Topics

More detailed information on Community and Social Topics can be found in Appendix Q, *Socioeconomic Impact Assessment Study,* Sections 3.5, 4.4, and 5.4.

Community character on Tinian may change due to factors associated with construction activities related to the proposed action. Access restrictions in areas where construction would take place (see Section 2.4.1.2.6, *Fence Lines and Gates*) could shift the relationship between some community members and certain areas/landscapes of the island by reducing opportunities for using the land for subsistence, income earning, practicing traditional skills, or any other place-based relationship. However, since construction activities would restrict access to only discreet portions of the island, there would be considerable alternative areas and locations available that would provide opportunities for using the land, and effects on place-based relationships for the vast majority of the population would likely not occur.

Community cohesion on Tinian may also change due to construction activities associated with the proposed action. Community or social cohesion measures the levels of "relationship between individuals, groups and organizations within a community" (Holdsworth 2009), a concept that is closely tied with the Chamorro concept of "inafa'maolek" (a core Chamorro value that refers to the "interdependence within the kinship group," literally translated as "making it good for each other" or "getting along"). The potential decreases in opportunities to access resources in areas where construction would take place could reduce opportunities for some to provide "chenchule" (gifting or donation, which preserves and strengthens networks), thus disrupting his/her ability to maintain and strengthen the social cohesion within their network. In addition, a potential decrease in the opportunity to practice cultural activities such as fishing, hunting, and gathering among the community on Tinian could lessen the opportunities that the community could engage in activities together and build and maintain social cohesion. However, because construction activities would restrict access to only discreet portions of the island, there would be considerable alternative areas and locations available that would provide opportunities for using the land, and effects on personal relationships driven by changes in opportunities to access resources, for the vast majority of the population, would likely not occur.

Finally, a lack of community cohesion occurs when there are "divisions between groups, individuals and systems" (Stone and Hughes 2002); such divisions could be possible if the current Tinian population were to come into conflict with the incoming construction worker population. The introduction of some construction workers from outside of the CNMI would increase the number of people present in the community that have no social ties to the community or commitments that bind them to the community. However, foreign workers regularly operate on Tinian and in the past have not been prone to conflict.

Because only discreet portions of the island would be affected, and because major community conflict with construction workers is not anticipated, the potential changes to community character and cohesion caused by Tinian Alternative 1 construction activities would result in less than significant impacts to the overall community. However, these changes may significantly impact the perceptions that some Tinian residents have of the place they live.

4.15.3.1.1.5 Environmental Justice and Protection of Children

Data from the 2010 Census indicate that 98.2% of Tinian's population was comprised of minorities (see Table 3.15-8) and 44.6% of the population was low income (see Table 3.15-9) (U.S. Census Bureau 2010). On Tinian, these populations predominantly reside in San Jose and Marpo Heights (see Figures 3.15-6 and 3.15-7). Children age 18 and younger comprise to approximately 30% of the total population of Tinian (see Table 3.15-10); attend the Tinian elementary school, junior/senior high school, or the Head Start program in San Jose; and reside in San Jose and Marpo Heights areas (see Figure 3.15-7).

The resources that could impact environmental justice populations disproportionately would be air quality, noise, public health and safety, and hazardous materials and waste. Air pollutant emissions would not degrade the regional air quality, noise during construction would not extend outside Military Lease Area boundaries, the public would be prohibited from entering construction zones to protect their health and safety, and any hazardous materials used or waste generated would be stored and disposed of according to federal and CNMI regulations. Therefore, Tinian Alternative 1 construction activities would have no significant impacts that would be considered adverse or disproportionate to the health and safety of environmental justice populations.

4.15.3.1.2 Operation Impacts

4.15.3.1.2.1 Population

The number of military personnel training is variable and fluctuates annually across 20 non-consecutive weeks of live-fire training. During weeks when there would be live-fire training, there may be as few as 30 and as many as 3,000 personnel (assumes a maximum of 2,200 training personnel and the potential for overlap of pre- or post-training parties) in the Military Lease Area. On average, over the course of a year, 771 training personnel would be on Tinian.

Additional population to Tinian, consisting of base operation and support employees and their dependents, is estimated to be between 143 and 242 (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.1.1). Estimated baseline Tinian population ranges from 2,890 to 3,532 indicating that non-military operations-related population increase would be between 4% and 8.4% over baseline levels.

Since the population increase would be variable in size and, in part transient in duration, in order for the CNMI to qualify for financial assistance to help manage this growth, the Office of Economic Adjustment must make a finding that Tinian would experience a "direct and significantly adverse consequence" based on the Department of Defense impacts in light of community-specific needs and resources (Office of Economic Adjustment, Department of Defense n.d.). A change in population is not considered an impact itself. However, population change has the potential to drive positive or negative impacts to other socioeconomic factors discussed in the following subsections.

4.15.3.1.2.2 Economic Conditions

Tourism

Tinian Alternative 1 operational activities may result in a decline in tourism relative to estimated baseline levels. Flights to and from Saipan and Tinian may need to be diverted from overflying the Military Lease Area during training, which would potentially result in increased ticket costs (by an estimated 0.26% while training would be occurring) and a decrease in overall demand for travel to Tinian (by and estimated 0.12% to 0.15%). This effect would lead to an estimated decline in visitors of between 68 and 123 (-0.08% and -0.22%) annually, compared to baseline levels (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.2.1).

In addition, access to certain natural/historic attractions in the Military Lease Area would be reduced during training, potentially leading to decreases in projected growth in visitor numbers. This reduction in visitors is estimated to be between 578 and 788 annually, representing between a 0.7% and 1.38% reduction from estimated baseline levels (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.2.1).

In total, it is estimated that Tinian Alternative 1 operations would reduce tourism visitors to Tinian by between 647 and 912 annually, from baseline levels which were estimated to be between 57,046 and 82,565 annually, constituting a decline of between 0.8% and 1.6%.

Despite the small reduction potentially associated with the proposed action, it is estimated that, while the proposed action would be occurring, there would be more visitors to Tinian than there are currently, due to market expansion in China and Korea (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 1.1.2.1 of Appendix A). Because the impact of the proposed action is expected to be small in percentage terms, and because it is expected that the Tinian tourism market will grow from current levels (indicating that the proposed action would not hinder overall growth in the industry), impacts to tourism are considered less than significant.

Gross Domestic Product

The CNMI gross domestic product would see an estimated net increase of between $3.7 million and $4.2 million per year considering the following operations-related factors: combined income earned by RTA employees (estimated to be $3.4 million per year), the spending of training personnel at Tinian business establishments (estimated to be $2 million per year), and the estimated decrease in visitor expenditures (between -$1.2 million and -$1.7 million) due to decreased visitor numbers. The increase of between $3.7 and $4.2 million per year would represent an increase of between 0.3% and 0.5% compared to baseline levels which were estimated to be between $878 and $1,093 million (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.2.2*).*

Additional growth in gross domestic product would result from operational expenditures, which would include payments to the Commonwealth Utilities Corporation for utilities service, the purchase of fuel from local distributors, and other purchases. The increase in gross domestic product brought about by Tinian Alternative 1 operations is considered a beneficial impact.

Employment and Income

It is estimated that the employment increase associated with Tinian Alternative 1 operations would be 95 full-time positions, an increase of between 4% and 5% compared to baseline employment levels, which were estimated to range from 1,899 to 2,378 jobs. Combined, these positions would earn approximately $2.2 million annually, between a 4.9% to 6.1% increase in income relative to baseline levels, which were estimated to be between $35.8 and $46.7 million. Additional employment and income would be generated at businesses that provide goods and services to RTA employees and visiting trainees. Increases in employment and income as a result of Tinian Alternative 1 operations would result in beneficial impacts (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.2.3).

Government Revenues

The CNMI government revenues under Tinian Alternative 1 would increase by between $650,000 and $790,000, annually, in association with RTA operations. These increases would be from revenues related to income and business taxes associated with employment. Estimated baseline CNMI government revenues are between $176 million and $219 million indicating that the increase in government revenues associated with RTA operations would be between 0.3% and 0.4% over baseline levels (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.2.1).

In addition to those estimated revenues, payments associated with any additional acquisition of land on Tinian, taxes associated with local operations expenditures, and other payments and fees (such as port charges) would contribute to increases in government revenues. The increase in government revenues associated with Tinian Alternative 1 operations would result in beneficial impacts.

Housing

Between 57 and 87 housing units would be required for operations-related residents of Tinian (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.2.5). As of the 2010 Census, there were 101 housing units for rent and additional housing is currently being built. Additional demand for housing under Tinian Alternative 1 likely would not exceed the number of units available.

For the 8 to 10 year period when construction and operations overlap, the required 57 to 87 operations-related units and 18 to 23 construction-related units would, combined, generate a requirement for between 75 and 110 units. The high end of the range (110 units) would exceed the number of existing available rental units, which as of the 2010 Census was 101.

While demand generated by the proposed action may exceed existing supply, other factors would likely relieve potential conditions of excess demand. As noted in Section 3.15, additional housing units are being developed, as homestead property; while these units would not be available to incoming populations, the occupants of these units would conceivably exit the housing units that they currently occupy, which would increase the number of rental units available for incoming population. It is also possible that some construction managers may share housing units amongst themselves, which would lead to a reduction in the number of estimated units demanded. Furthermore, additional demand for housing may lead to private sector housing development, with the additional housing supply considered a beneficial economic outcome. Overall, impacts of the proposed action on Tinian housing are considered less than significant.

Agriculture

Commercial agriculture, which only occurs outside of Military Lease Area boundaries, would not be affected by Tinian Alternative 1 operations.

As of 2014, the Lease Back Area (i.e., southern portion of the Military Lease Area) supported approximately 2,375 acres (961 hectares) of agricultural grazing permits. An estimated approximation of 1,010 acres (409 hectares) of that was being used for cattle grazing. Under Tinian Alternative 1, land within the Lease Back Area, which has been used for cattle grazing, would be removed from cattle grazing use. However, the DoN has identified and proposed a total of 2,554 acres (1,034 hectares) of land for cattle grazing areas throughout the Military Lease Area. Of this total 1,010 acres (409 hectares) would be unencumbered by surface danger zones and 1,544 acres (625 hectares) would be encumbered. The unencumbered portion is approximately the same amount of land that is currently used for cattle grazing and the approximate amount of land needed for the current herd under the ideal herd size to utilized acreage ratio (see Appendix Q, *Socioeconomic Impact Assessment Study,* Sections 4.2.6 and 5.2.6). The proposed action would require that some cattle be relocated; however, since the amount of land currently used for cattle grazing would be made available for cattle grazing under Tinian Alternative 1, impacts to cattle grazing are considered less than significant.

Commercial Fishing and Aquaculture

Tinian does not have a commercial fishing fleet so there would be no impacts from that perspective. However, the waters on the west side of the Military Lease Area are prime locations for net casting from boats, which is a method applied in commercial fishing, so commercial fishers from Saipan may be affected. Once the RTA is operational, access to adjacent waters, during some of the 20 weeks of training, would be restricted, including access to some areas used for net-cast fishing. Since these restrictions would not be permanent and other areas would be available for net-cast fishing during times when access is temporarily restricted, impacts to on-shore or open-ocean fishing activities from Tinian Alternative 1 operations would be less than significant.

There are no current open-ocean aquaculture operations in Tinian waters. Because there is a large amount of open-ocean area around Tinian that would not be affected by the proposed action, it is anticipated that any potential future open-ocean aquaculture operation would be compatible with the proposed action, and no impacts would be anticipated.

Airports and Sea Ports

Once the RTA is operational, airport and sea port freight would increase negligibly leading to small increases in port fees. There would also be airport and sea port infrastructure improvements and road upgrades that would benefit the public. Increased freight activity, port fees, and infrastructure improvements would result in beneficial impacts on the Tinian airport and sea port.

Power Utility Rates

Under Tinian Alternative 1, the International Broadcasting Bureau would remain in place. Power utility rates could potentially decrease for Tinian residents because of increased demand for power from the RTA and associated reduced cost per unit of electricity sold by the Commonwealth Utilities Corporation. Potentially reduced electricity rates under Tinian Alternative 1 would have beneficial impacts to Tinian ratepayers.

4.15.3.1.2.3 Public Services

Education

An increase in the number of students of between 29 and 59 is anticipated during Tinian Alternative 1 construction and operation activities. After construction is complete, considering only operations related increases, the increase in number of students would be between about 21 and 48 (see Appendix Q, *Socioeconomic Impact Assessment Study,* Section 5.3.1), and increase over baseline enrollment levels of between 3.8% and 10.7%.

Considering both construction and operations, given an estimated baseline number of students ranging from 451 to 551, the high estimate for total number of students with the proposed action (609) is lower than the number of students that attended Tinian schools during the 2007 to 2008 school year (615 students). Since even the highest estimates of student population with the proposed action would be less than levels seen in the recent past, it is not likely that the proposed action would lead to Tinian schools exceeding existing capacity. Since it is not likely that capacity would be exceeded, impacts are considered less than significant.

Emergency Services

During Tinian Alternative 1 operations, military police would accompany the military units when training personnel are in town. A fire-response facility would be added to respond to emergencies within the Military Lease Area, as well as assist the community when needed. Therefore, Tinian Alternative 1 operations would result in beneficial impacts to emergency services.

Public Health

The military units undertaking training come with their own medical and first aid capabilities and the addition of personnel could be accommodated by the existing health agencies on Tinian. Therefore Tinian Alternative 1 operations would result in less than significant impacts to Tinian's public health services.

4.15.3.1.2.4 Community and Social Topics

More detailed information on Community and Social Topics can be found in Appendix Q *Socioeconomic Impact Assessment Study,* Sections 3.5, 4.4, and 5.4.

Decreased opportunities to access fresh locally grown and gathered food, decreased income for those that participate in subsistence and commercial gathering activity, decreased access to recreational and cultural activity areas, and potential conflict with incoming populations can all impact community character and cohesion.

Community character on Tinian may change due restricted access to certain areas that are used for agriculture, hunting, fishing, and gathering (see Section 2.4.1.4.1 for information on access restrictions). The potential decrease in access to these food sources and the associated subsistence, recreational, and cultural activities could change the nature of everyday activities for the population on Tinian. This could accelerate the trend of the Tinian community moving away from these activities to a more modern community with different cultural practices and reduced practice of traditional skills. In addition, the access restrictions themselves, by restricting access to areas that have been known to be accessible, could shift the perception of the relationship between the community and the place they live.

Community cohesion on Tinian may also change due to the proposed action. Community or social cohesion measures the levels of "relationship between individuals, groups and organizations within a community" (Holdsworth 2009), a concept that is closely tied with the Chamorro concept of "inafa'maolek". The potential decreases in opportunities for access to resources in the Military Lease Area could reduce a person's ability to provide "chenchule," thus disrupting his/her ability to maintain and strengthen the social cohesion within their network. In addition, a potential decrease in the practice of cultural activity among the Chamorro community on Tinian could lessen the opportunities that the community could engage in activity together and build and maintain social cohesion. Finally, a lack of community cohesion occurs when there are "divisions between groups, individuals and systems" (Stone and Hughes 2002); such divisions could be possible if the current Tinian population were to come into conflict with incoming populations. The introduction of military training personnel would increase the number of people present in the community that have no social ties to the community or commitments that bind them to the community. However, military personnel tend to be respected by the local population on Tinian and there is not a history of conflict.

The potential changes to community character and cohesion that could occur from Tinian Alternative 1 operations would result in less than significant impacts to the overall community. However, these changes may significantly impact the perceptions that some Tinian residents have of the place they live.

4.15.3.1.2.5 Environmental Justice and Protection of Children

Environmental Justice

Under Tinian Alternative 1, there would be no geological or soil impacts (see Section 4.2.3.1) that would affect environmental justice populations. Impacts to water (see Section 4.3.3.1) from munitions expenditure and constituents would introduce less than significant impacts, and air quality (see Section 4.4.3.1) would not be adversely affected as a consequence of RTA operations. Therefore, no disproportionately high and adverse human health effects from geology and soils, water, and air quality to low-income and minority populations would occur.

Noise levels from small caliber munitions expenditures would also not generally extend beyond the Military Lease Area boundaries. However, as depicted in Section 4.5, *Noise*, Table 4.5-13, estimated day-night average ambient noise levels from aircraft operations would increase four-fold (20 decibels) throughout much of Tinian. This large rate of increase reflects both the level of anticipated aircraft operations involved in the proposed action and the relative quiet existing conditions of Tinian. During these airspace training operations, noise generated by aircraft overflights would expose 10 homes in Marpo Valley, east of Marpo Heights, to noise levels over 65 A-weighted day-night average sound levels and therefore, would be considered incompatible with residential land use. It is estimated that about 40 people (slightly more than 1% of Tinian's population) live in the 10 houses that would be exposed to these noise levels from aircraft operations. Impacts to the 10 residences would occur as often as 15% of the time during operations, or about 3 weeks per year. This incompatibility would be considered significant to the residents of 10 houses, but since the affected individuals account for approximately 1% of Tinian's total population, the affect would be less than significant. The impact would not be considered disproportional as all of Tinian is considered a minority and low-income area.

Peak noise levels would be significant during training with large caliber weapons and artillery blasts. As noted in Section 4.5, *Noise,* 80 people on Tinian and over 1,000 people on Saipan would be exposed to Peak noise levels of 115 decibels during certain training events under unfavorable weather conditions (wind directions and cloud cover). This Peak noise level of 115 decibels compares with hearing a siren of an emergency vehicle (Noise Help 2014) or proximate to other common noise events like fireworks or being near a rock band playing music. There are approximately 13,596 large caliber expenditures from 155 millimeters high explosive weapons per year under the proposed action that would produce the Peak noise levels of 115 decibels (see Chapter 2, Table 2.4-5). Best management practices addressed in Section 4.5, *Noise*, and Appendix D, would limit nighttime training with large caliber weapons. In addition, these peak noise levels would only be experienced during unfavorable weather conditions. Unfavorable weather conditions occur when the wind blows in the opposite direction of normal trade winds. It was estimated that this condition would occur a maximum of 10-15% of the total training time. Therefore, there is the potential on Saipan to hear Peak noise of 115 decibels from certain large caliber weapon training about 2,040 times (15% of 13,596) during the times while weather conditions were unfavorable. The residents of Tinian and Saipan that would be the receptors of these periodic Peak noise levels live in a minority and low-income area. However, the impact would not be considered disproportional as all of the CNMI is considered a minority and low-income area.

There would be impacts to land use (see Section 4.7.3.1), recreation (see Section 4.8.3.1), and visual resources (see Section 4.12.3.1) from the operations of proposed Tinian Alternative 1. Residents of Tinian, most of who are minority and low-income populations, would be affected by access restrictions to the Military Lease Area during active training events. However, access would still be granted during the 32 weeks when there would be no training and intermittently during the 20 weeks when training would occur. Effects from access restrictions would be shared equally throughout the island and would not be considered disproportionately high and adverse to minority and low-income populations.

Economic impacts would tend to be beneficial and public service agencies would have sufficient capacity to meet the needs of the proposed action leading to no adverse impacts on the health or environment of populations. A potentially significant impact on community character and community cohesion was identified but this would affect all residents similarly and so would not be a disproportionate impact.

There would be no significant impacts that would be adverse or disproportionate to affect environmental justice populations resulting from Tinian Alternative 1 operations.

Protection of Children

Noise exposure at schools on both Tinian and Saipan was evaluated (see Section 4.5.2.1). The modeling results illustrated that on average, noise generated by aircraft would not exceed levels considered detrimental to human hearing, either for adults or children in these school areas. However, to the northeast of Marpo Heights, 10 homes in which children may live would be exposed to incompatible levels (65 decibels) from the aircraft operations of the proposed action. There are schools, particularly in Saipan, located in the areas identified as receptors of significant Peak noise levels of 115 decibels from the planned expenditures of large caliber weapons during training events. While these Peak noise levels would be significant, they would be short-term and intermittent impacts when weather conditions are unfavorable. Reactions to these Peak noise events could affect children in a range from no reaction, to minor annoyance, activity interference or stress. However, these noise levels would be short-term in duration, occur infrequently during the 20 weeks of live-fire training. These noise events and other activities associated with the proposed training ranges on Tinian would not disproportionally present environmental health or safety risks to children on Tinian or Saipan. In accordance with the Executive Order, the anticipated noise level and frequency would not likely result in health risks to children Therefore, Tinian Alternative 1 operations would result in less than significant impacts to children under Tinian Alternative 1.

4.15.3.2 Tinian Alternative 2

4.15.3.2.1 Construction Impacts

Construction impacts for Tinian Alternative 2 are similar to those for Alternative 1 (see Section 4.15.3.1.1). There would be no disproportionate or adverse health risks to affect environmental justice populations and children would not be exposed to increased health and safety issues.

Tinian Alternative 2 construction activities would result in an increase in population; less than significant or beneficial impacts to economic conditions; less than significant impacts to public services; there could be the potential for significant impacts to community character and cohesion; and there would be less than significant impacts to environmental justice populations and children.

4.15.3.2.2 Operation Impacts

Operation impacts for Tinian Alternative 2 are similar to those for Alternative 1 (see Section 4.15.3.1.2). The only difference that would affect socioeconomics is the relocation of the International Broadcasting Bureau; however, there would be no net reduction in electricity consumption due to the proposed action, and therefore no adverse impacts are anticipated in relation to the proposed action. There would be no disproportionate or adverse health risks to affect environmental justice populations and children would not be exposed to increased health and safety issues.

Tinian Alternative 2 operations would lead to an increase in population; less than significant or beneficial impacts to economic conditions; less than significant impacts to public services; there could be the potential for significant impacts to community character and cohesion; and there would be less than significant impacts to environmental justice populations and children.

4.15.3.3 Tinian Alternative 3

4.15.3.3.1 Construction Impacts

Construction impacts for Tinian Alternative 3 are similar to those for Alternative 1 (see Section 4.15.3.1.1). There would be no disproportionate or adverse health risks to affect environmental justice populations and children would not be exposed to increased health and safety issues.

Tinian Alternative 3 construction activities would lead to an increase in population; less than significant or beneficial impacts to economic conditions; less than significant impacts to public services; there could be the potential for significant impacts to community character and cohesion; and there would be less than significant impacts to environmental justice populations and children.

4.15.3.3.2 Operation Impacts

Operation impacts for Tinian Alternative 3 are similar to those for Alternative 1 (see Section 4.15.3.1.2). The only difference that would affect socioeconomics is the relocation of the International Broadcasting Bureau; however there would be no net reduction in electricity consumption due to the proposed action and therefore no adverse impacts are anticipated in relation to the relocation. There would be no disproportionate or adverse health risks to affect environmental justice populations and children would not be exposed to increased health and safety issues.

Tinian Alternative 3 operations would result in an increase in population; less than significant or beneficial impacts to economic conditions; less than significant impacts to public services; there could be the potential for significant impacts to community character and cohesion; and there would be less than significant impacts to environmental justice populations and children.

4.15.3.4 Tinian No-Action Alternative

The periodic military non-live-fire training exercises that have occurred in the Military Lease Area of Tinian are expected to continue. These activities are short term events that would produce minimal impacts to the socioeconomic conditions of the island. In addition, the impacts from the four proposed live-fire training ranges, described in the September 2010 Record of Decision in the Guam and CNMI Military Relocation EIS (DoN and Department of the Army 2010) span from beneficial, to less than significant, and significant (see Table 16.2-1; DoN 2010a). More jobs would be created during construction creating beneficial impacts; however, fewer agricultural leases would be available and reduce revenues. Less than significant impacts would occur to tourism revenues. Under Mariana Islands Range Complex training, no impacts to Tinian's economy would occur (see Table 3.16-4; DoN 2010b). The no-action alternative, therefore, would introduce mixed, but generally less than significant, impacts.

For environmental justice, establishing the four ranges would remove the availability of conducting agricultural activities for some who are low income and leasing land; however, while this could be considered significant unless other lands were made available, it would not be disproportionate. No significant impacts to children would occur by operating the four ranges (see Table 19.2-4; DoN 2010a). In terms of the Mariana Islands Range Complex training, no disproportionate health and safety impacts to low-income, minority, and children populations (see Table 3.18-1; DoN 2010b). Therefore, less than significant impacts would be expected from the no-action alternative.

4.15.3.5 Summary of Impacts for Tinian Alternatives

Table 4.15-1 provides a comparison of the potential impacts to socioeconomics and environmental justice resources for the three Tinian alternatives and the no-action alternative.

Table 4.15-1. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No Action Alternative***	
Socioeconomic and Environmental Justice	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Population[1]	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*
Economic Conditions								
Tourism	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Gross Domestic Product	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*	*LSI*	*LSI*
Employment and Income	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*
Government Revenues	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*	*LSI*	*LSI*
Housing	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Agriculture	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Commercial Fishing and Aquaculture	*NI*	*LSI*	*NI*	*LSI*	*NI*	*LSI*	*LSI*	*LSI*
Airports and Sea Ports	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*	*LSI*	*LSI*
Power Utility Rates	*NI*	*BI*	*NI*	*BI*	*NI*	*BI*	*LSI*	*LSI*
Public Services								
Education	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Emergency Services	*LSI*	*BI*	*LSI*	*BI*	*LSI*	*BI*	*LSI*	*LSI*
Public Health	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Community and Social Topics	*LSI/SI*	*LSI/SI*	*LSI/SI*	*LSI/SI*	*LSI/SI*	*LSI/SI*	*LSI*	*LSI*
Environmental Justice and Protection of Children	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*	*LSI*	*LSI*

Legend: *BI* = beneficial impact; *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts.
Note[1]: A change in population is not considered an impact itself. However, population change has the potential to drive positive or negative impacts to other socioeconomic factors.

4.15.4 Pagan

Economic conditions (i.e., tourism, gross domestic product, employment and income, government revenues, housing, agriculture, airport and sea port, and power utility rates) and public services are non-existent on Pagan. Because there are no residents on Pagan, Executive Orders for Environmental Justice and the Protection of Children are not relevant and no analyses of these issues were provided in this EIS/OEIS. The following discusses only those aspects of socioeconomics impacts anticipated on Pagan.

4.15.4.1 Pagan Alternative 1

4.15.4.1.1 Construction Impacts

Because the island is currently undeveloped and unpopulated, there would be no impacts related to population change, public services, or community character and cohesion associated with Pagan Alternative 1 construction activities. Pagan Alternative 1 construction activities would result in beneficial economic impacts due to construction-related economic activity and revenues provided to the CNMI government.

4.15.4.1.2 Operation Impacts

There would be no impacts related to population change associated with Pagan Alternative 1 operational activities because the island is currently unpopulated, with no socioeconomic infrastructure. However, any potential future settlement may be smaller with the proposed action than without it. Appendix Q, *Socioeconomic Impact Assessment Study*, indicates that there is potential for existing transitory economic activities that occur on Pagan to continue and for new ones to be developed. These activities include the continuance of very limited ecotourism and potential open-ocean aquaculture operations. Given the existing level of these activities, and accounting for some expansion, assuming appropriate planning takes place, while there may be a reduced land area available, these activities could take place either concurrent with training activities or during times when training would not be occurring on Pagan. Since ecotourism and aquaculture activities could take place at similar magnitudes, with or without the proposed action, the proposed action is not anticipated to have an effect on these activities.

The CNMI government would see an increase in revenues from payments made by the U.S. federal government associated with military use of Pagan. Because the increased revenue would improve the CNMI government's financial position, the increased revenues would constitute a beneficial impact to the CNMI.

4.15.4.1.2.1 Community and Social Topics

More detailed information on Community and Social Topics can be found in Appendix Q, *Socioeconomic Impact Assessment Study,* Sections 3.5, 4.4, and 5.4.

Potential impacts to Pagan include decreased access to recreational and cultural opportunities (see Section 2.5.1.4.1.2, *Public Access,* for information on access restrictions), and decreased the opportunity for former Pagan residents or their descendants to be able to re-settle or homestead the island. Pagan Alternative 1 operations could affect community character by replacing some recreational and cultural opportunities on Pagan with military training. Pagan Alternative 1 operations would convert land that could be used for subsistence activities and farming into lands sustaining active live-fire military training, thereby affecting the place-based relationship that communities are able to have with their ancestral homeland. Access restrictions associated with Pagan Alternative 1 operations would also affect the opportunity for those with ties to the island to practice and pass down knowledge of cultural activities while on the island.

These localized changes may impact the perceptions that some former residents and their descendants have of Pagan. Therefore, there is a potential for changes to community character and cohesion to occur as a result of Pagan Alternative 1 operations.

4.15.4.2 Pagan Alternative 2

The only differences between Pagan Alternatives 1 and 2 are that the southern High Hazard Impact Area would not be established and the northern impact area would decrease in size. These changes would not affect the analysis presented for Alternative 1. Therefore, socioeconomic impacts associated with Pagan Alternative 2 would be the same as those presented for Pagan Alternative 1.

4.15.4.2.1 Construction Impacts

There would be no population, public services, or community character and cohesion impacts associated with Pagan Alternative 2 construction activities. There would be beneficial economic impacts due to construction-related revenues provided to the CNMI government.

4.15.4.2.2 Operation Impacts

Pagan Alternative 2 operations would result in less than significant impacts to the population and beneficial impacts to economic conditions from U.S. federal land acquisition. However, there is a potential for direct significant impacts to community character and cohesion resulting from Pagan Alternative 2 operations.

4.15.4.3 Pagan No-Action Alternative

There would be no live-fire training on Pagan under the no-action alternative. There would continue to be periodic visits to Pagan for eco-tourism, scientific surveys and military training for search and rescue. These activities would be short term and have less than significant impacts on the socioeconomic conditions of Pagan.

4.15.4.4 Summary of Impacts for Pagan Alternatives

Table 4.15-2 provides a comparison of the potential impacts to socioeconomics and environmental justice resources for the two Pagan alternatives and the no-action alternative.

Table 4.15-2. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Socioeconomics and Environmental Justice	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Population	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*
Economic Conditions	*BI*	*BI*	*BI*	*BI*	*NI*	*LSI*
Public Services	*NI*	*LSI*	*NI*	*LSI*	*NI*	*NI*
Community and Social Topics	*NI*	*Potential for SI*	*NI*	*Potential for SI*	*NI*	*LSI*

Legend: *BI* = beneficial impact; *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts.
Note[1]: A change in population is not considered an impact itself. Population change has the potential to drive positive or negative impacts to other socioeconomic factors; however, Pagan has no socioeconomic infrastructure that could be impacted by population change.

4.16 HAZARDOUS MATERIALS AND WASTE

Section 4.16 evaluates potential direct and indirect impacts resulting from hazardous materials, toxic substances, hazardous waste, and contaminated sites associated with the proposed action. Section 3.16, *Hazardous Materials and Waste* and Appendix R, *Hazardous Materials and Waste Technical Memo,* provide definitions for the terms used in this section (e.g., hazardous materials, hazardous waste, toxic substances) and general background information on the hazardous materials and waste resource category. Information from this section is also used in the impact analysis in Section 4.3, *Water Resources*; Section 4.9, *Terrestrial Biology*; Section 4.10, *Marine Biology*; Section 4.13, *Transportation*; and Section 4.17, *Public Health and Safety*.

4.16.1 Approach to Analysis

The methodology for identifying and evaluating impacts to hazardous materials and waste as they relate to the proposed action and alternatives includes the assessment of transport, storage, dispensing, handling, and disposal of hazardous materials, toxic substances, and/or hazardous waste (i.e., hazardous substances) on and to and from Tinian and Pagan and the potential for increased human health risk or environmental exposure, as well as changes in the quantity and types of hazardous substances transported, stored, used, and disposed of during construction and operation. Existing contaminated sites were also identified and the locations of these sites were compared with the locations of the proposed construction and operation activities associated with the proposed action, and the existing and proposed avoidance measures.

Knowledge of existing processes and available data were used to predict the type and quantity of hazardous materials, toxic substances, and hazardous waste that would likely be used, encountered, or generated through implementation of the proposed action. These estimates were compared with current usage and generation rates, waste types, and the capability for managing hazardous materials, toxic substances, and hazardous waste. Quantitative impact criteria are not available, so the significance of impacts is determined qualitatively based on the degree of change as well as compliance with regulatory standards, where applicable.

The Comprehensive Environmental Response, Compensation, and Liability Act and CNMI regulations establish the process for responding to releases of hazardous materials. Toxic substances are regulated by the Toxic Substances Control Act. The Resource Conservation and Recovery Act and CNMI regulations establish a process for storage, handing, and disposal of hazardous waste as well as requirements for underground storage tanks. Pesticide application and handling requirements are established under the Federal Insecticide, Fungicide, and Rodenticide Act and the Federal Environmental Pesticide Control Act. U.S. Department of Transportation regulations establish the requirements for transporting hazardous substances. The CNMI has adopted rules of the Military Munitions Program. See Appendix R, *Hazardous Materials and Waste Technical Memo,* for an in-depth description of applicable federal and CNMI specific regulations on Tinian and Pagan.

4.16.2 Resource Management Measures

Resource management measures that are applicable to hazardous materials and waste include the following:

4.16.2.1 Avoidance and Minimization Measures

- As part of the planning process, hazardous materials and waste storage facilities were specifically sited away from areas prone to flooding or geological hazards. In addition, encroachment and intersection with known contaminated sites was minimized to the maximum extent practicable.

4.16.2.2 Best Management Practices and Standard Operating Procedures

Best management practices and standard operating procedures that are applicable for hazardous materials and waste are listed below and described in Appendix D, *Best Management Practices*.

- Erosion Control Measures. The erosion control measures such as retention ponds, swales, silt fences, fiber rolls, gravel bag berms, mulch, and erosion control blankets would be implemented during construction and operations to eliminate and/or minimize nonpoint source pollution in surface waters due to sediment.
- Spill Prevention, Control, and Countermeasures. Spill Prevention, Control, and Countermeasures such as the preparation of a Spill Prevention Control and Countermeasure Plan would be implemented to ensure that personnel are trained as to proper labeling, container, storage, staging, and transportation requirements for hazardous substances and to ensure personnel are properly trained with regards to spill prevention, control, and cleanup methods.
- Facility Response Programs. Facility Responses Programs such as the preparation of a Facility Response Plan would be implemented to outline the procedures to assess, respond, and report releases, leaks, or spills of hazardous substances.
- Hazardous Waste Management Programs. Hazardous Waste Management Programs would include waste minimization plans that provide protocols designed to encourage and promote the efficient use of hazardous waste, substitute products that are less toxic whenever feasible, minimize their use, and promote recycling and reuse of hazardous waste.
- Hazardous Materials Management Programs. Hazardous Material Management Programs would implement procedures for the transportation, storage, use, and disposal of hazardous materials. Procedures would also include waste minimization plans that provide protocols designed to encourage and promote the efficient use of hazardous materials, substitute products that are less toxic whenever feasible, minimization of their use, and promote recycling and reuse of hazardous materials.
- Occupational Health and Safety Administration Compliance. Occupational Health and Safety Administration Compliance would include the preparation and implementation of a construction health and safety program that complies with federal and local health and safety regulations.
- Pest Control Measures. Pest Control Measures would include the development and implementation of a comprehensive Integrated Pest Management Plan. This Plan would

encompass all activities regarding the importation, handling, storage, use, and application of pesticides.

- Munitions and Explosives of Concern Protocol, Procedures, and Guidance. Munitions and Explosives of Concern Protocol, Procedures, and Guidance would include compliance with Naval Ordnance Safety and Security Activity Instruction 8020.15D Explosives Safety Review, Oversight, and Verification of Munitions Responses and other directives to reduce the potential exposure to unexploded ordnance; implement routine firing range clearance operations; implement all applicable U.S. military munitions and explosives of concern operations guidance to minimize or eliminate potential hazards; implement land use controls, and provide training on identifying and responding to munitions and explosives of concern.
- Range Management Measures: Range management measures may include the use of impoundments, traps, or other structures to catch lead particles in sediments transported away from objective or target areas and engagement zones by runoff and the application of buffering agents such as limestone, gypsum, and dolomite to maintain a more neutral pH in areas where lead may come in contact with rainwater (e.g., berms in static ranges).
- Radon Control Measures. Radon Control Measures include radon resistant construction methods, installation of radon abatement systems, and periodic radon monitoring.
- Range Environmental Vulnerability Assessment Program as described below.

As discussed in Section 4.3.2, *Resource Management Measures* (for Water Resources), the Range Environmental Vulnerability Assessment program was developed to understand the current environmental conditions at all operational ranges and ensure range activities are not causing an adverse impact to human health and/or the environment. The Range Environmental Vulnerability Assessment program assesses the potential environmental impacts of military munitions use on existing operational ranges and determines whether there has been a release or a substantial threat of a release of munitions constituents to an off-range area. The primary pathways evaluated under the Range Environmental Vulnerability Assessment program include surface water, groundwater and sediment transport.

Operational ranges that are addressed under the Range Environmental Vulnerability Assessment program include target/impact areas, firing positions, small arms ranges, and training and maneuver areas. The Range Environmental Vulnerability Assessment program also assesses areas with historical training munitions use within operational range boundaries. The Range Environmental Vulnerability Assessment program does not evaluate future ranges or ranges that are covered under a separate program (e.g., cleanup of closed ranges under the Munitions Response Program, permitted Open Burning/Open Detonation sites under the Resource Conservation and Recovery Act). The Range Environmental Vulnerability Assessment program provides a snapshot of the current environmental conditions of operational ranges across the Marine Corps and a detailed assessment of potential munitions constituent migration from operational ranges to off-range areas. The Range Environmental Vulnerability Assessment program uses munitions expenditures data, sampling information, any changes to range use or operations along with data from previous assessments to conduct the analysis. Reevaluations occur at a minimum of every 5 years.

See Section 4.3, *Water Resources*, for discussion of impacts associated with hazardous materials to these resources.

4.16.3 Tinian

4.16.3.1 Tinian Alternative 1

4.16.3.1.1 Construction Impacts

4.16.3.1.1.1 Hazardous Materials

The majority of construction activities, including vegetation removal, grading, excavation, and construction, would take place in the Military Lease Area. There would also be construction activity at the Tinian International Airport, the Port of Tinian, and the proposed Primary Military Munitions Supply Route (Supply Route) from the Port of Tinian to the Munitions Storage Area on the northwestern end of Tinian International Airport (see Figures 4.16-1 and 4.16-2).

Construction activities would cause a short-term increase in the use of hazardous materials that would end when the construction is finished. Most of the hazardous materials expected to be used are common to construction (e.g., diesel fuel, gasoline, and propane; hydraulic fluids, oils, and lubricants; welding gases; paints and solvents; adhesives; and batteries). The increased volume and use of hazardous materials during the construction period would present a potential for increased accidental spills and releases of hazardous materials, resulting in potential impacts to human health and the environment. The hazardous materials would be handled, stored, and disposed according to applicable best management practices; standard operating procedures; and federal and CNMI regulations.

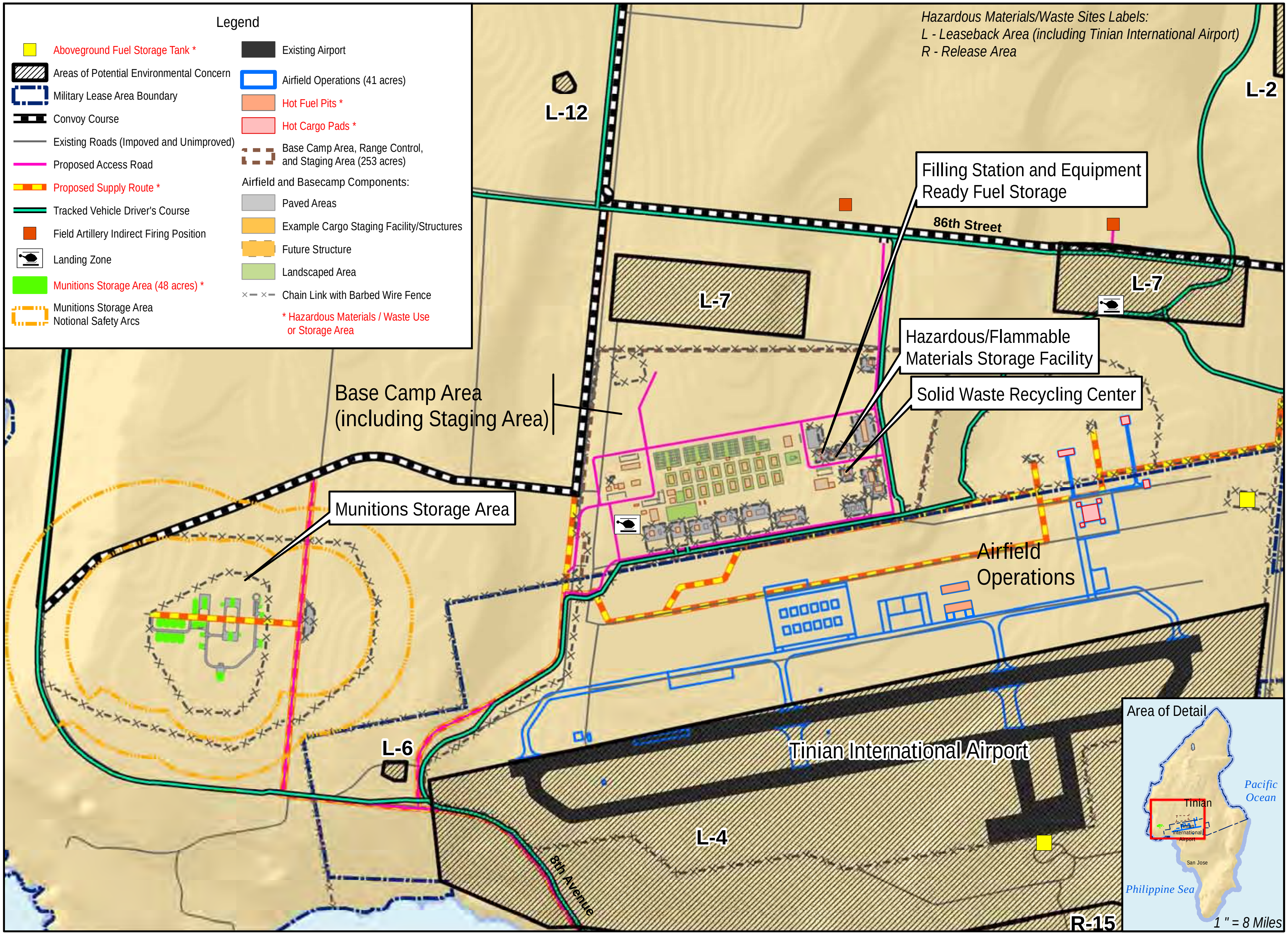
Hazardous materials would be brought to construction sites using existing or proposed public transportation routes. Transportation of all materials would be conducted in compliance with the U.S. Department of Transportation regulations and CFR Title 49. Following the best management practices and standard operating procedures and compliance with federal and CNMI regulations would reduce the likelihood and volume of accidental releases, allow for faster spill response times, and enable timely cleanup.

Construction of the amphibious landing area at Unai Chulu and Bulk Fuel Storage Facility at the Port of Tinian would have the potential for accidental fuel spills in marine and nearshore waters. However, best management practices and standard operating procedures to manage and minimize potential accidental releases of fuel, petroleum, oils, and lubricants would be followed.

The proposed Supply Route leading from the Port of Tinian to the Military Lease Area would not overlap sections of an above ground and underground pipeline that carries diesel from the Mobil bulk fuel storage tank at the Port of Tinian to the Commonwealth Utility Corporation Tinian power plant (Figure 4.16-3); therefore, there would be no impacts to the existing diesel pipeline.

Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, construction activities associated with Tinian Alternative 1 would not significantly increase the potential for impacts from hazardous materials. Therefore, Tinian Alternative 1 construction would result in less than significant direct and indirect impacts with respect to hazardous materials.

Figure 4.16-1
Tinian All Action Alternatives Hazardous Materials / Waste Use, Storage Areas and Contaminated Sites for Range Training Area



0 500 1,000 2,000 Feet

0 100 200 400 Meters

Figure 4.16-2
Tinian All Action Alternatives Hazardous Materials/Waste Use and Storage Areas Base Camp, Munitions Storage, and Airport Improvements

NORTH

Source: NAVFAC Pacific 2013

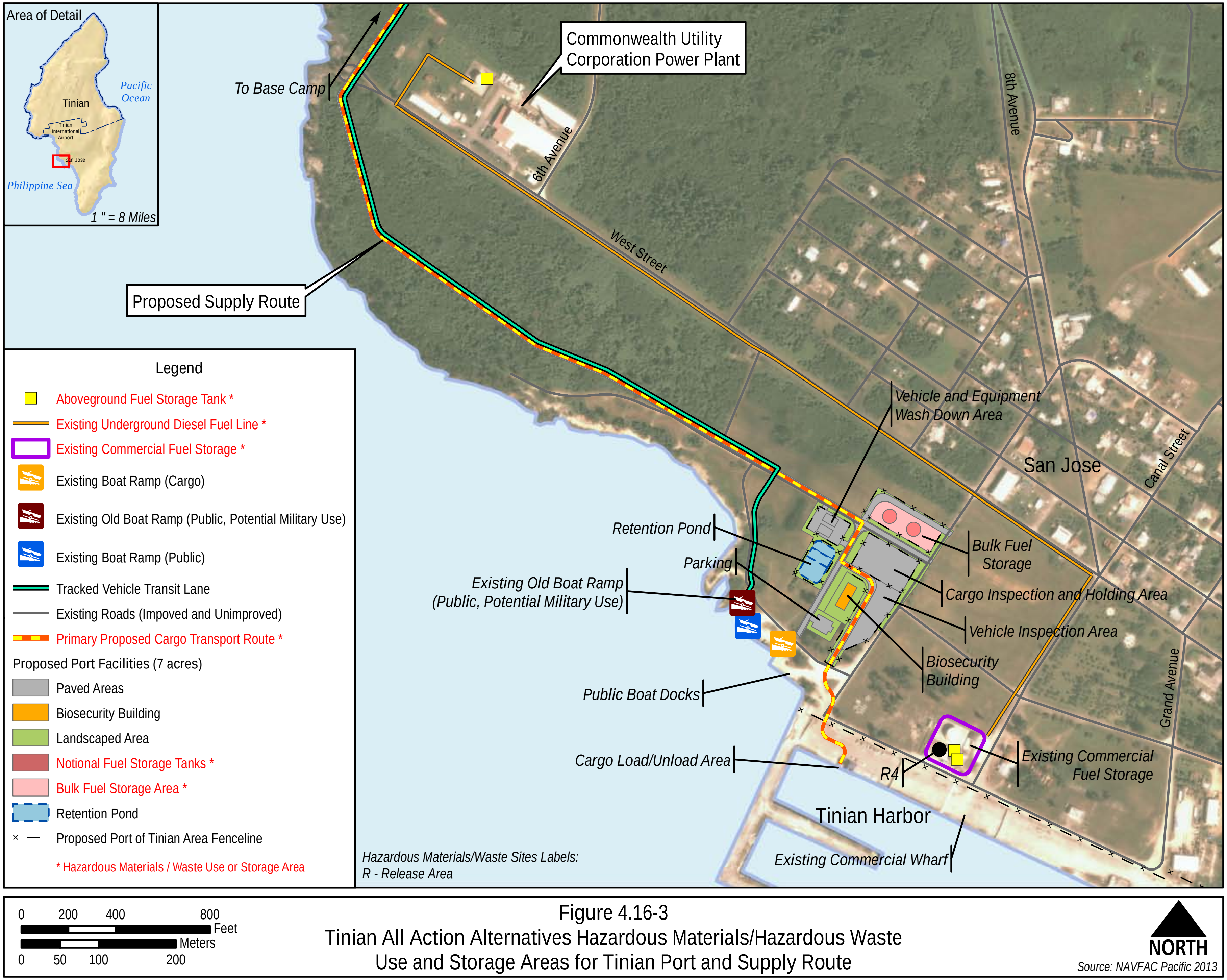


Figure 4.16-3
Tinian All Action Alternatives Hazardous Materials/Hazardous Waste Use and Storage Areas for Tinian Port and Supply Route

4.16.3.1.1.2 Toxic Substances

Although unlikely, construction and demolition may reveal asbestos-containing materials, lead-based paint, or polychlorinated biphenyls that were used in building materials or electrical equipment at the time of original construction. If any of these toxic substances are encountered, properly trained and licensed contractors would be used to ensure that all U.S. military, federal, and CNMI hazardous waste testing, handling, and disposal procedures and requirements are followed for their collection and disposal. Because the U.S. Environmental Protection Agency banned lead-based paint in 1978, and banned most uses of polychlorinated biphenyls in 1979, these toxic substances would not be used to construct the proposed new facilities on Tinian; nor would asbestos-containing materials be used.

Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, construction activities associated with Tinian Alternative 1 would not significantly increase the potential for impacts from toxic substances. Therefore, Tinian Alternative 1 construction would result in less than significant direct and indirect impacts with respect to toxic substances.

4.16.3.1.1.3 Hazardous Waste

Construction activities would result in a short-term increase in the generation of hazardous waste that would end when construction is finished. Hazardous waste generated from construction activities includes pesticides, herbicides, solvents, adhesives, lubricants, corrosive liquids, batteries, and aerosols. Due to the projected increase in generation of hazardous waste, this alternative would have the potential to result in adverse impacts to human health and the environment (i.e., soils, surface water, groundwater, air, and biota). However, the hazardous waste would be handled and disposed per applicable best management practices and standard operating procedures (see Appendix D, *Best Management Practices*). Construction contractors would be required to comply with all applicable requirements concerning handling, storage, and disposal of construction-related hazardous waste. All hazardous waste would be shipped off the island to the appropriate disposal facility site. Existing public transportation routes, including shipping by commercial carrier, would be utilized for the conveyance of hazardous waste to the disposal facility site. Transportation of all hazardous waste would be conducted in compliance with U.S. Department of Transportation regulations and CFR Title 49.

Based upon the above analysis and through implementation of resource management measures described in Section 4.16.2, the temporary increase in the generation, transport, storage, and handling of hazardous waste during construction activities associated with Tinian Alternative 1 would not significantly increase the potential for impacts from hazardous waste. Therefore, Tinian Alternative 1 construction would result in less than significant direct and indirect impacts with respect to hazardous waste.

4.16.3.1.1.4 Contaminated Sites

As shown in Figure 4.16-1, several contaminated sites have been identified within or near the proposed Tinian Alternative 1 construction areas. Consideration and careful attention during project design phases would be given prior to construction to either avoid these sites as much as practicable. Proposed RTA facilities and infrastructure would exclude the Tinian Mortar Range (also called Chiget Mortar Range) (see Figure 4.16-1). If proposed construction projects cannot be designed to avoid these contaminated sites, then various best management practices and construction operational protocols would be followed to protect human health and the environment.

In addition, best management practices that would be used include, but are not limited to, development of site-specific health and safety plans; the use of engineering controls (e.g., dust suppression) and administrative controls; and the use of personal protective equipment (see Appendix D, *Best Management Practices*, for a discussion of proposed best management practices).

Explosives safety documentation would be prepared and would outline specific measures that would be implemented to ensure the safety of workers and the public. This would reduce the potential hazards related to the exposure to unexploded ordnance. It would also be in accordance with Department of Defense Instruction 3200.16, Operational Range Clearance (Department of Defense 2005), Department of Defense Instruction 4140.62, Material Potentially Presenting and Explosive Hazard (Department of Defense 2014), Department of Defense Directive 6055.9, Department of Defense Ammunition and Explosive Safety Submission (DoN 2010a), and Naval Ordnance and Safety and Security Activity Instruction 8020.15D (DoN 2011). Best management practices that would be implemented include having qualified operational range clearance or unexploded ordnance personnel perform surveys to identify and remove potential unexploded ordnance before the start of ground-disturbing activities to minimize potential impacts. However, additional safety precautions could include operational range clearance or unexploded ordnance personnel supervision during earth moving and providing a safety awareness/hazardous assessment brief to construction contractors and equipment operators to train them to identify whether materials are unexploded ordnance that potentially present an explosive hazard. Any unexploded ordnance identified during construction would be disposed of in accordance with applicable regulations.

The design of Tinian Alternative 1 would either avoid the disturbance and dispersion of soil and groundwater at contaminated sites, or use of best management practices to minimize impacts. Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, construction activities associated with Tinian Alternative 1 would not significantly increase the potential for impacts to contaminated sites. Therefore, Tinian Alternative 1 construction would result in less than significant direct and indirect impacts with respect to contaminated sites.

4.16.3.1.2 Operation Impacts

4.16.3.1.2.1 Hazardous Materials

Munitions and Explosives of Concern

Figure 4.16-1 shows the locations of live-fire range complexes and the Convoy Course associated with Tinian Alternative 1. Activities associated with live-fire range operations would result in increased hazardous materials in the form of munitions and explosives of concern and heavy metals. This is because unexploded ordnance, military munitions, and munitions constituents (i.e., chemical components of munitions) have the potential to contain high explosives, explosives constituents, and potentially leachable compounds (i.e., heavy metals that dissolve in water). Training ranges within Range Complexes A, B, C, and D as well as the Convoy Course objective areas would receive spent munitions (e.g., bullets, grenades, rockets, mortars). The High Hazard Impact Area (within Range

Complex A) would receive high explosive munitions such as grenades, mortars, and rockets, as well as inert aviation ordnance.

In general, when munitions are fired, the explosives constituents are consumed in the explosion. Trace amounts of explosives may be detectable on remaining metal components, such as small arms projectiles and hand grenade and mortar fragments. Inert aviation ordnance used on Tinian would be filled with materials such as concrete that do not contain any hazardous constituents. Spotting charges in the inert aviation ordnance and explosives in flares would also be almost entirely consumed in firing the munition except for the dudded munitions and fusing failures.

With the implementation of resource management measures described in Section 4.16.2, the negligible amounts of explosives constituents remaining on projectiles and fragments would not be a source of potential contamination to surface water or groundwater. Munitions constituents, in particular heavy metals (i.e., lead, nickel, chromium, cadmium, and copper), do not break down easily and tend to build up in surface soils. They may rust or otherwise react with natural substances, but do not break down like organic compounds. Therefore, the volume of expended material within the training areas would gradually increase over time (DoN 2010b). As discussed in Section 4.3, *Water Resources*, Low Impact Development features would be utilized to control stormwater runoff from the ranges. Range management activities may include the use of impoundments, traps, or other structures to catch lead particles in sediments transported away from objective or target areas and engagement zones by runoff and the application of buffering agents such as limestone, gypsum, and dolomite to maintain a more neutral pH in areas where lead may come in contact with rainwater (e.g., berms in static ranges). These, range management activities would minimize the accumulations of munitions constituents.

The majority of munitions constituents released to the environment originate from munitions that either partially detonate or do not detonate at all (DoN 2010b). Munitions constituents in partially or unexploded ordnance are contained within the munition itself and release of munitions constituents due to corrosion of the casing may take a long time to occur, although salt spray and humidity may accelerate deterioration of the casing (DoN 2010b). Unexploded ordnance would occur in Range Complex A (High Hazard Impact Area).

The RTA would be managed in accordance with current Marine Corps range management policies and procedures, which are designed to ensure the safe, efficient, effective, and environmentally sustainable use of the ranges. To minimize potential impacts of munitions constituents accumulating and/or migrating in soil and surface water/groundwater, routine range clearance operations would be scheduled and conducted, as needed. Munitions that fail to function as intended during the training activity would be tracked by the Range Control Facility and rendered safe by Explosive Ordnance Disposal Technicians. Applicable U.S. military munitions and explosives of concern operations guidance protocols would also be implemented to mitigate adverse impacts from munitions and explosives of concern, including deposits that have the potential to leach into the subsurface. Best management practices would be implemented to minimize or eliminate direct runoff of munitions and explosives of concern and surficial soil into adjacent areas. Live-fire training would produce ammunition shell casings that would be collected and sent to an authorized recycling center.

All surface danger zone boundaries for munitions impacts extend over much of the Military Lease Area and portions of the adjacent open ocean, so it is unlikely that munitions would land outside the Military

Lease Area. However, it is possible that munitions could fall into ocean waters (i.e., due to ricochet or breakup of munitions after detonation). In the unlikely event that a fragment should land in the ocean, concentrations of munitions constituents would be very low due to the dilution from seawater.

Fuels, Petroleum, Oils, and Lubricants

Training and maintenance activities would require the use of vehicles that would result in an increase in the amount of fuel, petroleum, oils, and lubricants used. During training exercises, the Forward Arming and Refueling Point would be staged on existing pavement at North Field, within berms containing impervious liners or secondary containment. The Forward Arming and Refueling Point for North Field would be a temporary, mobile field facility that would be set up and broken down in the Drop Zone as part of the training exercise, so it would not have a designated permanent location (see Figure 4.16-1).

Beach and amphibious training maneuvers and the use of Amphibious Assault Vehicles would have the potential for accidental fuel spills in marine and nearshore waters. However, best management practices and standard operating procedures would be used to manage and minimize potential accidental releases of fuel, petroleum, oils, and lubricants (see Appendix D, *Best Management Practices*).

Used military vehicles with potential contaminants would not be used as targets at any of the training ranges. All targets would be three dimensional representations constructed of sheet metal.

Figure 4.16-2 shows the locations of hazardous materials and hazardous waste use/storage areas that would be constructed for all alternatives. Hazards materials storage facilities on Tinian would be constructed using best management practices for construction in any unavoidable areas that are known to have seismic and tsunami hazards to minimize potential impacts from geologic hazards. A fueling station would be constructed at the Tinian base camp and two military bulk fuel storage areas (with a 30-day fuel capacity of 500,000 gallons [1,900,000 liters]) would be established at the port (see Figure 4.16-3). The operation of the Bulk Fuel Storage facility and off-load terminal would require an Oil Pollution Act of 1990 permit. Fuel would be delivered by military or civilian vessels to the military bulk fuel facility at the port then trucked to the expeditionary airfield-base for storage in a smaller aboveground storage tank. Air resupply may also be used to deliver bulk fuel to the expeditionary bulk fuel storage facility at the airfield base camp. The transport and transfer of fuel has the potential to result in accidental releases from spills. The military fuel storage facilities would be constructed with secondary containment and other controls to prevent and minimize leaks and spills (e.g., pumps with fuel-level sensors and controls with automatic shut-off capability) (Department of Defense 2013). Fuels would be handled according to permit requirements, best management practices and standard operating procedures designed to prevent and minimize leaks and spills. Personnel working in the fuel facilities would be trained in spill response procedures in accordance with the installations Facility Response Plan and Spill Prevention, Control, and Countermeasures Plan to minimize impacts to the environment in the event of an accidental release.

Tinian Alternative 1 operations would result in an increase to the disposal rate for spent petroleum products. All fuels, petroleum, oils, and lubricants would be stored, handled, transported, and disposed according to existing best management practices, standard operating procedures, and applicable federal and CNMI regulations and permit requirements, as well as U.S. military requirements.

Other Hazardous Materials

Training and maintenance would also involve the use of batteries, pesticides, herbicides, paints, solvents, fluorescent light fixtures, and flameless ration heaters for meals ready to eat. Most hazardous materials (such as paints, solvents, pesticides and herbicides) would be used up and thus not require disposal. Pesticides and herbicides would be used as part of range and facility management to control nuisance species and would be applied and managed in accordance with applicable regulations and manufacturer instructions. For those hazardous materials that do require disposal, a hazardous materials storage facility would be constructed at the base camp, where hazardous materials would be properly managed and stored in accordance with federal and CNMI regulations and U.S. military requirements. The storage facility would be constructed using best management practices for construction in unavoidable areas with seismic and tsunamic hazards to minimize potential impacts from geologic hazards. Batteries would be treated as recyclables. Fluorescent light fixtures would be containerized and shipped off-island. Human health, welfare, and the environment would be protected through the use of proven and effective best management practices and standard operating procedures to:

- Prevent, contain, and/or clean up spills and leaks
- Provide personnel training and operational protocol and procedures, including segregation of unused flameless ration heaters from solid waste for proper reuse or hazardous waste disposal (Breeh 2004)
- Ensure Defense Marketing and Reutilization Office's ability to properly arrange for and coordinate the disposal of anticipated hazardous materials
- Ensure all U.S. military personnel and contractors are trained in accordance with the CNMI pesticide management regulations (Rabauliman 2013) regarding the importation, handling, use, and application of pesticides

Due to the projected increase in the use of hazardous materials, Tinian Alternative 1 operations would have the potential to result in direct and indirect impacts to human health and the natural environment (i.e., soils, surface water, groundwater, air, plants, and animals). Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, direct and indirect impacts from hazardous materials would be reduced to less than significant.

4.16.3.1.2.2 Toxic Substances

Toxic substances, including depleted uranium or radioactive munitions, would not be used as part of operations. Facilities use and maintenance would not require the use or disposal of lead based paint, asbestos containing materials, or polychlorinated biphenyls as these substances have been banned from use.

Radon hazards on Tinian have not been identified; however, radon is known to exceed U.S. Environmental Protection Agency action levels in areas on Guam which has similar geologic formations (e.g., Mariana Limestone). Radon testing on Guam resulted in a definite correlation between the type of surficial geology and radon concentrations. In almost all cases, elevated radon concentrations were found in buildings located above Barrigada Limestone and Mariana Limestone but not in those located above alluvial clay deposits, beach deposits, and volcanic rocks (Burkhart et al. 1993). A large portion of the geology of Tinian consists of Mariana Limestone, and therefore, there is a potential for radon intrusion into structures constructed on the island where this geology is present.

To minimize this potential impact, radon control measures such as using resistant construction techniques and abatement systems would be incorporated into building/facility designs. In addition, the U.S. military would periodically test facilities constructed in known radon zones in accordance with Office of the Chief of Naval Operations Instruction 5090.1D, Chapter 25-3.2, once determined, to verify that no unacceptable radon gas buildup occurs, and would install radon abatement systems as appropriate.

Tinian Alternative 1 would have potential adverse impacts from toxic substances as a result of radon gas. Based upon the above analysis and through implementation of resource management measures described in Section 4.16.2, *Resource Management Measures*, operational activities under Tinian Alternative 1 result in less than significant direct or indirect impacts to radon. In addition, there would not be direct or indirect impacts associated with other toxic substances.

4.16.3.1.2.3 Hazardous Waste

Spent Munitions

Military munitions that are used for their "intended purposes" are not considered waste per the Military Munitions Rule (40 CFR 266.202). In general, military munitions become subject to Resource Conservation and Recovery Act hazardous waste transportation, storage, and disposal requirements (i.e., judged not to have been used for their "intended purposes") when:

- Transported off-range for storage
- Reclaimed and/or treated for disposal
- Buried or land filled on- or off-range
- Munitions land off-range and are not immediately rendered safe or retrieved

With careful management of range clearance and maintenance, and the recovery and recycling of range related scrap metal range operations would not result in increases in hazardous waste volumes on Tinian.

Other Hazardous Waste

There could be increased generation of hazardous waste as a result of operational activities associated with Tinian Alternative 1. Specific increases in hazardous waste generated could include: off-specification pesticides and herbicides; spent or off-specification solvents; corrosive or toxic liquids; and spent or off-specification aerosols. These materials would primarily be generated as a result of firing range maintenance, vehicle maintenance, and aircraft maintenance.

Tinian Alternative 1 operations would result in an increase to the Tinian hazardous waste disposal rate. To accommodate the increase in hazardous waste generation, a satellite hazardous waste accumulation site would be constructed at the Tinian base camp. Hazards waste storage facilities on Tinian would be constructed using best management practices in unavoidable areas with seismic and tsunamic hazards to minimize potential impacts from geologic hazards. The satellite accumulation area would be managed in accordance with applicable regulations and the facility Hazardous Waste Management Program to minimize the likelihood of accidental releases and resulting impacts. Waste collected at the satellite accumulation area would be transported to Guam for recycling/disposal through the Defense Reutilization and Marketing Office in accordance with federal, Guam, and CNMI regulations and U.S. military requirements. There would be sufficient capability at Guam facilities to accommodate recycling and disposal of hazardous waste generated under Tinian Alternative 1.

Tinian Alternative 1 would generate increased volumes of hazardous wastes on Tinian. However, hazardous waste would be managed (stored, transported, disposed) according to best management practices and standard operating procedures that would minimize the potential for accidental spills and releases that could expose people and the environment to hazardous waste.

Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, Tinian Alternative 1 operations would not significantly increase the potential for impacts from hazardous waste. Therefore, Tinian Alternative 1 operations would result in less than significant direct and indirect impacts with respect to hazardous waste.

4.16.3.1.2.4 Contaminated Sites

Contaminated sites have been identified within or near the proposed RTA and Supply Route (Table 4.16-1). If contaminated soil, groundwater, or munitions and explosives of concern are encountered or disturbed during training activities, there could be potential direct and indirect impacts to human health to the natural environment (i.e., soils, surface water, groundwater, air, plants, and animals). These impacts would be minimized through avoidance and the use of appropriate best management practices and standard operating procedures. These may include redesigning or re-routing the proposed training area to avoid a contaminated site and/or having qualified unexploded ordnance personnel perform surveys to identify and remove potential munitions and explosives of concern before training activities begin. Where appropriate, limited testing of soils and groundwater may also occur to identify potential health risks where hazardous wastes are suspected to be present. Additional precautions, such as unexploded ordnance personnel supervision during training activities, and/or providing munitions and explosives of concern awareness training to personnel before training activities begin could also be taken.

Disturbance of contaminated sites would be avoided to the maximum extent practicable. Where contaminated sites cannot be avoided, the use of best management practices and standard operation procedures regarding munitions and explosives of concern and hazardous waste management would minimize potential impacts.

Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, Tinian Alternative 1 operations would not increase the potential for impacts to contaminated sites. Therefore, Tinian Alternative 1 operations would result in less than significant direct and indirect impacts with respect to contaminated sites.

Table 4.16-1. Potentially Contaminated Sites Within or Near Training Areas Under Alternative 1

Training Area	***Contaminated Site***	***Potential Hazard***	***Applicable Resource Management Measures***
Range Complex A	E-2	Petroleum residues, small ordnance	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational Safety and Health Administration Compliance
	E-11	Petroleum residues	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational safety and Health Administration Compliance
	E-12	Ordnance	Munitions and Explosives of Concern Protocol, Procedures, and Guidance
	E-18	Agricultural chemical residues	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
Range Complex B	L-2	Petroleum residues	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	L-5	Petroleum residues, Asbestos; Unidentified chemical hazards	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
Range Complex C	L-7	Petroleum	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	L-12	Petroleum, Metals, Ordnance	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational Safety and Health Administration Compliance
Tracked Vehicle Drivers Course	E-1	Petroleum residues, small ordnance	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational Safety and Health Administration Compliance
	E-17	Agricultural chemical residues	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	L-2	Petroleum residues, Asbestos	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	L-4	Petroleum Residues	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	L-5	Petroleum residues, Asbestos; Unidentified chemical hazards	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	L-8	Ordnance	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance;

Table 4.16-1. Potentially Contaminated Sites Within or Near Training Areas Under Alternative 1

Training Area	Contaminated Site	Potential Hazard	Applicable Resource Management Measures
			Occupational Safety and Health Administration Compliance
	R-1	Petroleum Residues	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	R-15	Agricultural chemical residues	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	Masalog Ridge Area Site	Ordnance	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational Safety and Health Administration Compliance
Convoy Course	E-1	Petroleum residues, small ordnance	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational Safety and Health Administration Compliance
	E-13	Ordnance	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational Safety and Health Administration Compliance
	E-17	Agricultural chemical residues	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	E-18	Agricultural chemical residues	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	E-29	Unidentified chemical hazards	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	L-2	Petroleum residues, Ordnance	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational Safety and Health Administration Compliance
	L-5	Petroleum residues, Asbestos	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	L-7	Petroleum	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance

Table 4.16-1. Potentially Contaminated Sites Within or Near Training Areas Under Alternative 1

Training Area	*Contaminated Site*	*Potential Hazard*	*Applicable Resource Management Measures*
Proposed Supply Route	R-1	Petroleum, Ordnance	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational Safety and Health Administration Compliance
	R-4	Petroleum	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	R-6	Petroleum residues, Unidentified chemical hazards	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	R-15	Agricultural chemical residues	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	L-4	Petroleum	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	L-6	Petroleum	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	L-7	Petroleum	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
All training areas	Site Wide	Munitions and Explosives of Concern; Sodium arsenate, Petroleum	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational Safety and Health Administration Compliance

Sources: GMP Associates, Inc. 1997; CNMI Bureau of Environmental and Coastal Quality 2014.

4.16.3.2 Tinian Alternative 2

4.16.3.2.1 Construction Impacts

Tinian Alternative 2 would use similar construction materials and methods as described in Section 4.16.3.1 for Tinian Alternative 1. Alternative 2 would also follow the same best management practices, standard operating procedures, and regulatory compliance which would minimize the potential impacts associated with hazardous materials, toxic substances, hazardous waste, and contaminated sites as described in Section 4.16.3.1 for Tinian Alternative 1. The primary difference related to hazardous materials and waste is that a larger construction footprint would be created under Tinian Alternative 2 due to the addition of a Battle Area Complex and associated Urban Assault Course at the International Broadcasting Bureau (Range Complex C) and the addition of five more Convoy Course engagement areas. Within Range Complex C, the International Broadcasting Bureau would no longer be operational. Its buildings would be stripped and the antennae removed. These actions would result in a temporary increase in hazardous materials and waste being used/generated on Tinian. The potential for construction activities to encroach or intersect with contaminated sites would be the same as described under Alternative 1 for all RTAs except Range Complex C and the Convoy Course. The increased area of this range would potentially encounter seven additional contaminated sites, as summarized in Table 4.16-2. The difference in the amount of construction or number of contaminated sites within the Alternative 2 footprint would not change the effectiveness of the best management practices and standard operating procedures in preventing and minimizing adverse environmental impacts.

Based upon the above analysis and the implementation of the resource management measures described in Section 4.16.2, activities associated with Tinian Alternative 2 would not significantly increase the potential for impacts from hazardous materials, toxic substances, hazardous waste, and contaminated sites. Therefore, Tinian Alternative 2 construction would result in less than significant direct and indirect impacts with respect to hazardous materials, toxic substances, hazardous waste, and contaminated sites.

4.16.3.2.2 Operation Impacts

Tinian Alternative 2 training and maintenance activities would be similar to those described in Section 4.16.3.1 for Tinian Alternative 1 with regards to hazardous materials, toxic substances, hazardous wastes, and contaminated sites. Tinian Alternative 2 would also follow the same best management practices, standard operating procedures, and regulatory compliance which would minimize the potential impacts associated with hazardous materials, toxic substances, hazardous waste, and contaminated sites as described in Section 4.16.3.1 for Tinian Alternative 1. The only difference is that maneuver activities would take place over a larger area for Tinian Alternative 2 as compared with Tinian Alternative 1, because Alternative 2 would include the southern Battle Area Complex, and six additional engagement zones associated with the Convoy Course. Due to the larger Battle Area Complex and Convoy Course, Tinian Alternative 2 would likely use more petroleum based hazardous materials and generate more non-petroleum-based hazardous waste (e.g., pesticides) than Tinian Alternative 1.

Disturbance of contaminated sites would be avoided to the maximum extent practicable. Where contaminated sites cannot be avoided, the use of resource management measures identified in Section 4.16.2 would minimize potential impacts to contaminated sites.

The differences in the size of the training area, hazardous materials and waste volumes, and number of contaminated sites would not change the effectiveness of the best management practices and standard operating procedures in preventing and minimizing adverse environmental impacts.

Based upon the above analysis and the implementation of the resource management measures described in Section 4.16.2, Tinian Alternative 2 operations would not significantly increase the potential for impacts from hazardous materials, toxic substances, hazardous waste, and contaminated sites. Therefore, Tinian Alternative 2 operations would result in less than significant direct and indirect impacts with respect to hazardous materials, toxic substances, hazardous waste, and contaminated sites.

Table 4.16-2. Potentially Contaminated Sites Within or Near Training Areas Under Alternative 2

Training Area	*Contaminated Site*	*Potential Hazard*	*Applicable Resource Management Measures*
Range Complex C	E-6	Asphalt plant release area, hazardous substances	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	E-15	Medical waste	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	E-17	Agricultural chemical residues	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance
	E-22	Metals, toxic substances, petroleum residues, ordnance, hazardous materials and wastes	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational Safety and Health Administration Compliance
	E-25	Metals, ordnance	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational Safety and Health Administration Compliance
	E-26	Petroleum residues, ordnance	Erosion control measures; Hazardous Waste Management Program; Munitions and Explosives of Concern Protocol, Procedures, and Guidance; Occupational Safety and Health Administration Compliance
Convoy Course	E-20	Petroleum	Erosion control measures; Hazardous Waste Management Program; Occupational Safety and Health Administration Compliance

Sources: GMP Associates, Inc. 1997; CNMI Bureau of Environmental and Coastal Quality 2014.

4.16.3.3 Tinian Alternative 3

4.16.3.3.1 Construction Impacts

Tinian Alternative 3 would use similar construction materials and methods as described in Section 4.16.3.1 for Tinian Alternative 1. Alternative 3 would also follow the same best management practices, standard operating procedures, and regulatory compliance to minimize potential impacts associated with hazardous materials, toxic substances, hazardous waste, and contaminated sites as described in Section 4.16.3.1 for Tinian Alternative 1. Differences would include slightly less construction within Range Complex D as there would be no northern Battle Area Complex and associated Urban Assault Course under Tinian Alternative 3; increased construction for six additional engagement zones associated with the Convoy Course; and increased construction associated with the southern Battle Area Complex and associated Urban Assault Course (Range Complex C). Within Range Complex C, the International Broadcasting Bureau would no longer be operational. Its buildings would be stripped and the antennae removed. The potential for construction activities to encroach or intersect with contaminated sites would be the same as described under Tinian Alternative 2 and summarized in Tables 4.16-1 and 4.16-2. These actions would result in a temporary increase in hazardous materials and waste being used/generated on Tinian. The difference in the amount of construction for Tinian Alternative 3 would not change the effectiveness of the resource management measures identified in Section 4.16.2 in preventing or minimizing adverse environmental impacts.

Based upon the above analysis and the implementation of the resource management measures described in Section 4.16.2, construction activities associated with Tinian Alternative 3 would not significantly increase the potential for impacts from hazardous materials, toxic substances, hazardous waste, and contaminated sites. Therefore, Tinian Alternative 3 construction would result in less than significant direct and indirect impacts with respect to hazardous materials, toxic substances, hazardous waste, and contaminated sites.

4.16.3.3.2 Operation Impacts

Tinian Alternative 3 training and maintenance activities would be similar to those described in Section 4.16.3.1 for Tinian Alternative 1 with regard to hazardous materials, toxic substances, hazardous wastes and contaminated sites. Tinian Alternative 3 would also follow the same best management practices and standard operating procedures to minimize potential impacts associated with hazardous materials, toxic substances, hazardous waste, and contaminated sites as described in Section 4.16.3.1 for Tinian Alternative 1. The only difference is that training activities would take place over a slightly larger area for Tinian Alternative 3 as compared with Tinian Alternative 1, because Alternative 3 would not have the northern Battle Area Complex and associated Urban Assault Course (Range Complex D) but it would have the larger southern Battle Area Complex and associated Urban Assault Course at the International Broadcasting Bureau (Range Complex C). Tinian Alternative 3 would also have six additional engagement zones associated with the Convoy Course. Due to the larger training area, Alternative 3 would likely use slightly more petroleum based hazardous materials and generate slightly more non-petroleum based hazardous waste (e.g., pesticides) than Tinian Alternative 1. The differences in the size of the maneuver area and hazardous materials and waste volumes would not change the effectiveness of the best management practices and standard operating procedures in preventing or minimizing adverse environmental impacts.

The potential for training operations to encroach or intersect with contaminated sites would be the same as described under Tinian Alternative 2 and summarized in Tables 4.16-1 and 4.16-2. Disturbance of contaminated sites would be avoided to the maximum extent practicable. Where contaminated sites cannot be avoided, the use of resource management measures identified in Section 4.16.2 would minimize potential impacts to contaminated sites.

Based upon the above analysis and the implementation of the resource management measures described in Section 4.16.2, Tinian Alternative 3 operations would not significantly increase the potential for impacts from hazardous materials, toxic substances, hazardous waste, and contaminated sites. Therefore, Tinian Alternative 3 operations would result in less than significant direct and indirect impacts with respect to hazardous materials, toxic substances, hazardous waste, and contaminated sites.

4.16.3.4 Tinian No-Action Alternative

Hazardous materials used in the periodic non-live-fire training exercises that have and would continue to occur on Tinian and any hazardous waste generated during these brief exercises would be managed properly through use of best management practices and in compliance with all applicable regulations. The four planned live-fire training ranges included in the Guam and CNMI Military Relocation Final EIS (DoN 2010c) would result in less than significant impacts with respect to hazardous materials, toxic substances, hazardous waste, and contaminated sites (see Table 17.2-12; DoN 2010c). On Tinian, Mariana Islands Range Complex operations would not incur any impacts to hazardous materials and waste (DoN 2010b). Existing hazardous materials, toxic substances, hazardous wastes and contaminated sites in the proposed action areas on Tinian would remain in their current conditions. Therefore, the no-action alternative would result in less than significant impacts on Tinian with respect to hazardous materials and waste.

4.16.3.5 Summary of Impacts for Tinian Alternatives

Table 4.16-3 provides a comparison of the potential impacts to hazardous materials and waste resources for the three Tinian alternatives and the no-action alternative.

Table 4.16-3. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Hazardous Materials and Waste	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Hazardous Materials	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Toxic Substances	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Hazardous Waste	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Contaminated Sites	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*

Legend: *LSI* = less than significant impact.

4.16.4 Pagan

4.16.4.1 Pagan Alternative 1

4.16.4.1.1 Construction Impacts

4.16.4.1.1.1 Hazardous Materials

The development and construction of Pagan Alternative 1 facilities would take place entirely within the North Range Complex. Construction activities would cause a short-term increase in the use of hazardous materials that would end when the construction is finished. Most of the hazardous materials expected to be used are common to construction (e.g., diesel fuel, gasoline, and propane; hydraulic fluids, oils, and lubricants; welding gases; paints and solvents; adhesives; and batteries). The increased volume and use of hazardous materials during the construction period would present a potential for increased accidental spills and releases of hazardous materials, resulting in potential impacts to human health and the environment. The hazardous materials would be handled, stored, and disposed according to applicable best management practices; standard operating procedures; and federal and CNMI regulations.

The best management practices and standard operating procedures described in Section 4.16.2 would be followed to minimize or prevent accidental releases of hazardous materials during construction on Pagan. Storage of construction related hazards materials on Pagan would occur using best management practices and in accordance with applicable standards to minimize risks and potential impacts from seismic and volcanic hazards. The use, transport, storage, and handling of hazardous materials would be in accordance with applicable federal and CNMI regulations and U.S. military requirements. Laguna Sanhalom, a surface water, is surrounded by but not included in the northern High Hazard Impact Area. Laguna Sanhalom and Laguna Sanhiyon and surrounding areas have been designated “No Maneuver Areas” where no construction activities are proposed and no direct or indirect construction impacts are anticipated.

Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, the construction activities associated with Pagan Alternative 1 would not significantly increase the potential for impacts from hazardous materials. Therefore, Pagan Alternative 1 construction would result in less than significant direct and indirect impacts with respect to hazardous materials.

4.16.4.1.1.2 Toxic Substances

No demolition would take place under Pagan Alternative 1 construction activities, so it is unlikely that toxic substances in materials from existing buildings would be encountered. In the event that asbestos-containing materials, lead-containing paint, or polychlorinated biphenyls are discovered, these materials would be managed by properly trained and licensed personnel to ensure that applicable hazardous waste testing, handling, and disposal procedures and requirements are followed. No toxic-substance building materials would be used in the construction of facilities under Pagan Alternative 1.

Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, the construction activities associated with Pagan Alternative 1 would not significantly increase the potential for impacts from toxic substances. Therefore, Pagan Alternative 1 construction would result in less than significant direct and indirect impacts with respect to toxic substances.

4.16.4.1.1.3 Hazardous Waste

Construction activities would result in a short-term increase in the generation of hazardous waste that would end when construction is finished. Hazardous waste generated from construction activities includes pesticides, herbicides, solvents, adhesives, lubricants, corrosive liquids, batteries, and aerosols. Due to the projected increase in generation of hazardous waste, this alternative would have the potential to result in adverse impacts to human health and the environment (i.e., soils, surface water, groundwater, air, and biota). However, the hazardous waste would be handled and disposed per applicable best management practices and standard operating procedures (see Appendix D, *Best Management Practices*) to reduce the likelihood and volume of accidental releases, allow for accelerated spill response times, and allow for the timely implementation of cleanup measures. Hazardous waste generated during construction on Pagan would be temporarily stored on the island to minimize risks from seismic and volcanic hazards. Long-term storage of hazardous wastes would not occur on Pagan. The generation, transport, storage, and handling of hazardous waste would be in accordance with applicable federal and CNMI regulations and U.S. military requirements. All hazardous waste would be shipped off the island to the appropriate disposal facility site. Transport of hazardous wastes from Pagan, including shipping by commercial carrier, would utilize existing transportation routes to the maximum extent practicable, for the conveyance of hazardous waste to a licensed disposal facility site. Currently, there are no existing commercial carrier transportation routes to Pagan. Transportation of all hazardous waste would be conducted in compliance with U.S. Department of Transportation regulations and CFR Title 49.

The temporary increase in the generation, transport, storage, and handling of hazardous waste during construction activities associated with Pagan Alternative 1 would not significantly increase the potential for impacts from hazardous waste. Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, Pagan Alternative 1 construction would result in less than significant direct and indirect impacts with respect to hazardous waste.

4.16.4.1.1.4 Contaminated Sites

Contaminated sites on Pagan have not been well documented but are likely to be present as a result activities conducted during World War II (Figure 4.16-4). Construction activities at proposed tactical amphibious landing beaches are likely to encroach or intersect with contaminated sites and these areas are co-located with Japanese defense positions. In addition, erosion may have transported contaminated soil from upward defense positions to these low lying, coastal areas. The Japanese airfield is also likely to be contaminated with petroleum products and munitions and explosives of concern as a result of its use during World War II. Several firing positions and helicopter landing sites may also encroach on or intersect with Japanese defense positions and that may be contaminated with munitions and explosives of concern. If Pagan Alternative 1 cannot be constructed without avoiding contaminated sites, then the same resource management measures as described in Section 4.16.2 would be followed. Through the use of the identified resource management measures, impacts resulting from the disturbance of contaminated sites would be minimized.

Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, the construction activities associated with Pagan Alternative 1 would not significantly increase the potential for impacts from contaminated sites. Therefore, Pagan Alternative 1 construction would result in less than significant direct and indirect impacts with respect to contaminated sites.

4.16.4.1.2 Operation Impacts

4.16.4.1.2.1 Hazardous Materials

Munitions and Explosives of Concern

Figure 4.16-4 shows the locations of live-firing positions and High Hazard Impact Areas associated with Pagan Alternative 1. Activities associated with live-fire range operations would result in increased hazardous materials in the form of munitions and explosives of concern and heavy metals. This is because unexploded ordnance, military munitions, and munitions constituents (i.e., chemical components of munitions) have the potential to contain high explosives, explosives constituents, and potentially leachable compounds (i.e., heavy metals that dissolve in water). Pagan Alternative 1 would have two High Hazard Impact Areas (Figure 4.16-4). As described in Section 2.5.2, the High Hazard Impact Areas on Pagan would receive artillery, mortars, inert aviation ordnance, 5-inch naval machine gun rounds, and rifle fire. Live-fire weapons such as artillery and mortars and small-caliber munitions would be used in the Live-Fire Maneuver Area in the North Range Complex, where they would be fired at temporary objectives in the High Hazard Impact Areas (non-maneuver area). No weapons would be used in the Non-Live-Fire Maneuver Area in the South Range Complex.

In general, when munitions are fired, the explosives constituents are consumed in the explosion. Trace amounts of explosives may be detectable on remaining metal components, such as small arms projectiles and hand grenade and mortar fragments.

With the implementation of resource management measures identified in Section 4.16.2, the negligible amounts of explosives constituents remaining on projectiles and fragments would not be a source of potential contamination to surface water or groundwater. Munitions constituents, in particular heavy metals (i.e., lead, nickel, chromium, cadmium, and copper), do not break down easily and tend to build up in surface soils. They may rust or otherwise react with natural substances, but do not break down like organic compounds. Therefore, the volume of expended material within the training areas would gradually increase over time (DoN 2010b). As discussed in Section 4.3, *Water Resources*, Low Impact Development features would be utilized to control stormwater runoff from the ranges. Additional range management activities may also include the use of impoundments, traps, or other structures to catch lead particles in sediment transported away from the range area by runoff and the application of buffering agents such as limestone, gypsum, and dolomite to maintain a more neutral pH in areas where lead may come in contact with water. These, range management activities would minimize the accumulations of munitions constituents.

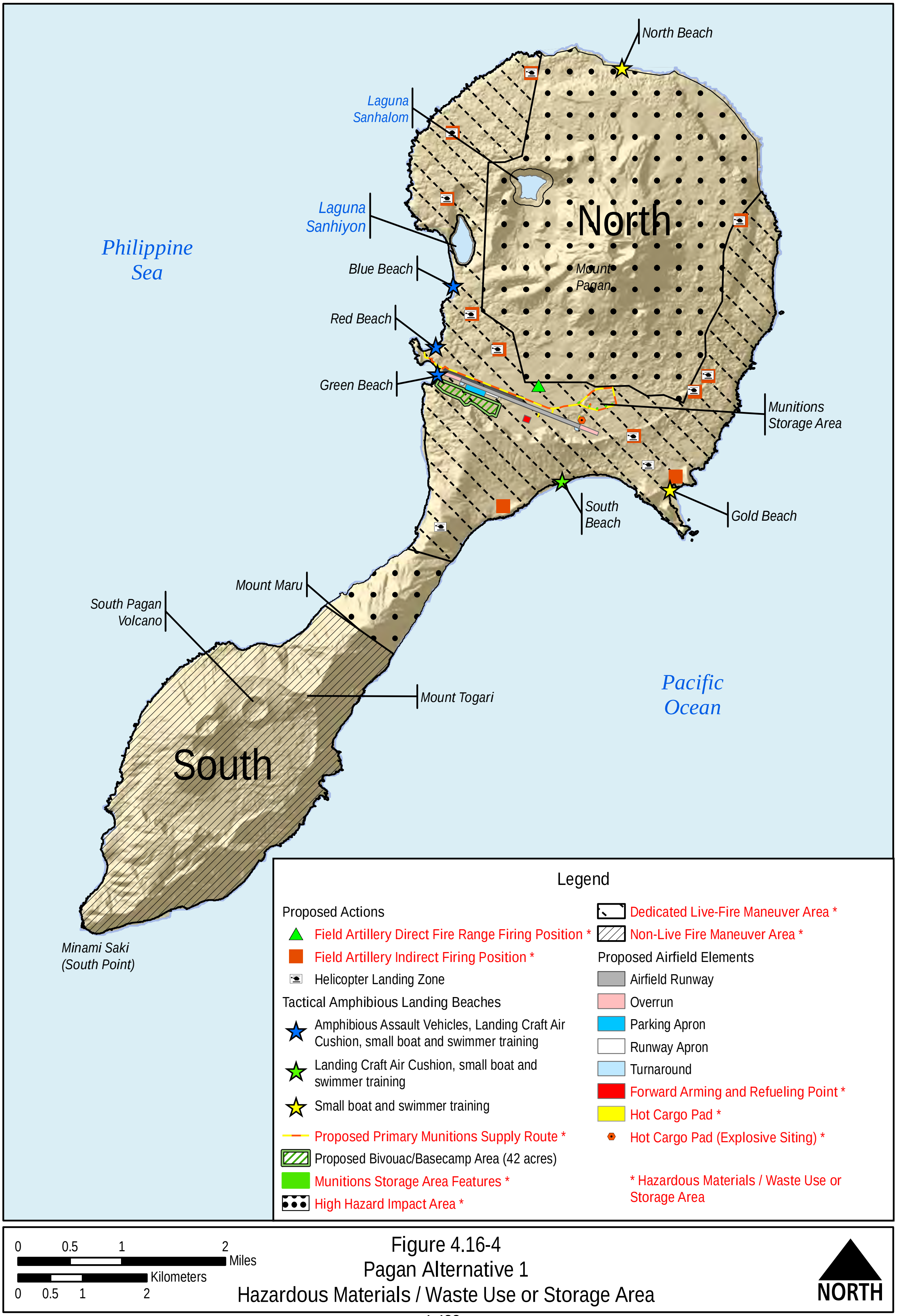


Figure 4.16-4
Pagan Alternative 1
Hazardous Materials / Waste Use or Storage Area

The majority of munitions constituents released to the environment originate from munitions that either partially detonate or do not detonate at all (DoN 2010b). Munitions constituents in partially or unexploded ordnance are contained within the munition itself and release of munitions constituents due to corrosion of the casing may take a long time to occur, although salt spray and humidity may accelerate deterioration of the casing (DoN 2010b). Unexploded ordnance is likely to occur in the High Hazard Impact Area.

The RTAs on Pagan would be managed in accordance with current Marine Corps range management policies and procedures, which are designed to ensure the safe, efficient, effective, and environmentally sustainable use of the ranges. To minimize potential impacts of munitions constituents accumulating and/or migrating in soil and surface water/groundwater, routine range clearance operations would be scheduled and conducted, as needed. Munitions that fail to function as intended during the training activity would be tracked by the Range Control Facility and rendered safe by Explosive Ordnance Disposal Technicians. Applicable U.S. military munitions and explosives of concern operations guidance protocols would also be implemented to mitigate adverse impacts from munitions and explosives of concern, including deposits that have the potential to leach into the subsurface. The resource management measures described in Section 4.16.2, including the use of the Range Environmental Vulnerability Assessment program, would be implemented to minimize potential impacts from munitions and explosives of concern.

Pagan Alternative 1 surface danger zones would extend over open ocean waters but all impact areas for munitions would be on land. In the unlikely event that fragments should land in the ocean, concentrations of munitions constituents would be very low through dilution.

Fuels, Petroleum, Oils, and Lubricants

Training on Pagan would include vehicle transport and maneuvers, resulting in the temporary storage and use of fuel, petroleum, oils, and lubricants on Pagan. No long-term storage of these materials would occur on Pagan. A Forward Refueling Point would be specified to provide aircraft refueling. The Forward Arming and Refueling Point for Pagan at the airfield would have a concrete containment berm to prevent accidental releases of fuel. Bulk fuel would be delivered by aircraft carrying approximately 5,000 gallons (19,000 liters) of fuel per delivery. Beach and amphibious training maneuvers and the use of Amphibious Assault Vehicles would have the potential for accidental fuel spills in marine and nearshore waters. However, the same best management practices and standard operating procedures to manage and minimize potential accidental releases of fuel, petroleum, oils, and lubricants described in Appendix D, *Best Management Practices*, would be followed on Pagan.

Other Hazardous Materials

Training and maintenance would also involve the use of batteries, pesticides, herbicides, paints, solvents and flameless ration heaters for meals ready to eat. Most hazardous materials (such as paints, solvents, pesticides, and herbicides) would be used up and thus not require disposal. For those hazardous materials that do require disposal, a temporary, hazardous materials storage site would be designated at the base camp to properly manage and store the materials in accordance with federal and CNMI regulations and U.S. military requirements. All hazardous materials would be removed from Pagan at the completion of the training activity and properly disposed of in accordance with applicable federal and CNMI regulations and U.S. military requirements. No long-term storage of hazardous materials would occur. The same best management practices and standard operating procedures as described in described in Section 4.16.2 would be followed on Pagan to prevent and minimize accident spills and releases, and protect human health, welfare, and the environment.

Due to the projected increase in the use of hazardous materials, Pagan Alternative 1 operations would have the potential to result in direct and indirect impacts to human health and to the natural environment (i.e., soils, surface water, groundwater, air, plants and animals).

Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, operations associated with Pagan Alternative 1 would not significantly increase the potential for impacts from hazardous materials. Therefore, Pagan Alternative 1 operations would result in less than significant direct and indirect impacts with respect to hazardous materials.

4.16.4.1.2.2 Toxic Substances

No depleted uranium or radioactive munitions would be used for live-fire training on Pagan. Use and maintenance of the training areas would not require the use or disposal of lead based paint, asbestos containing materials, or polychlorinated biphenyls as these substances have been banned from use. No human-occupied facilities would be constructed on Pagan. Therefore, there would be no impacts with regards to radon.

Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, Pagan Alternative 1 operations would not significantly increase the potential for impacts from toxic substances. Therefore, operations associated with Pagan Alternative 1 would result in less than significant direct and indirect impacts with respect to toxic substances.

4.16.4.1.2.3 Hazardous Waste

Pagan Alternative 1 operational activities would result in the generation of hazardous wastes. Munitions would be brought to Pagan by units arriving for training, stored temporarily, and used during the exercise. Any unused munitions would be packed and returned with the units. As long as the proposed live-fire ranges on Pagan remain on “active” or “inactive” status, the expenditure of munitions and explosives of concern would not likely represent an increase in hazardous waste volumes.

Other hazardous waste associated with training and maintenance activities on Pagan would primarily be used for firing range maintenance, vehicle maintenance, and aircraft maintenance and would include pesticides, herbicides, solvents, corrosive or toxic liquids, and aerosols. All hazardous waste would be containerized and removed from Pagan by trained personnel with the training units when they depart the island and would be recycled or disposed of at an appropriately permitted off-island facility. Transportation of hazardous waste would be properly manifested from either the point of generation or from the satellite accumulation area. The increases in hazardous waste would be managed (stored, transported, disposed) according to best management practices and standard operating procedures that would minimize the potential for accidental spills and releases that could expose people and the environment to hazardous waste.

Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, Pagan Alternative 1 operations would not significantly increase the potential for impacts from hazardous waste. Therefore, Pagan Alternative 1 operations would result in less than significant direct and indirect impacts with respect to hazardous waste.

4.16.4.1.2.4 Contaminated Sites

Several potentially contaminated sites have been identified within or near the proposed RTAs on Pagan. If contaminated soil, groundwater, or munitions and explosives of concern are encountered or disturbed during training activities, there could be potential direct and indirect impacts to human health to the natural environment (i.e., soils, surface water, groundwater, air, plants, and animals). These impacts would be minimized through the use of appropriate resource management measures. These may include relocating the training area to avoid a contaminated site and/or having qualified unexploded ordnance personnel perform surveys to identify and remove potential munitions and explosives of concern before training activities begin. Where appropriate, limited testing of soils and groundwater may also occur to identify potential health risks where hazardous wastes or environmental contamination are suspected to be present. Additional precautions, such as unexploded ordnance personnel supervision during training activities, and/or providing munitions and explosives of concern awareness training to personnel before training activities begin could also be taken. The identification and removal of munitions and explosives of concern, hazardous wastes, and/or environmental contamination prior to initiating training activities, in addition to training military personnel to the hazards associated with unexploded military munitions, would minimize potential impacts during operations.

Disturbance of contaminated sites would be avoided to the maximum extent practicable. Where contaminated sites cannot be avoided, the use of resource management measures described in Section 4.16.2 would minimize potential impacts.

Based on the above analysis and the implementation of the resource management measures described in Section 4.16.2, operations associated with Pagan Alternative 1 would not increase the potential for impacts to contaminated sites. Therefore, Pagan Alternative 1 operations would result in less than significant direct and indirect impacts with respect to contaminated sites.

4.16.4.2 Pagan Alternative 2

4.16.4.2.1 Construction Impacts

Pagan Alternative 2 would use similar construction materials and methods as those described in Section 4.16.4.1 for Pagan Alternative 1. Alternative 2 would also follow the same resource management measures which would minimize the potential impacts associated with hazardous materials, toxic substances, hazardous waste, and contaminated sites. The only difference is that Pagan Alternative 2 would have no isthmus High Hazard Impact Area, and the northern High Hazard Impact Area would be smaller than that for Pagan Alternative 1 (Figure 4.16-5). With either alternative, only a small portion of the High Hazard Impact Area would be improved for target placement. Under Alternative 2 no target placement improvements would occur on the isthmus of Pagan. The difference in the size of the northern High Hazard Impact Area would not create much difference between the two alternatives from a hazardous materials/waste perspective at that location. Construction impacts associated with hazardous materials, toxic substances, hazardous waste, and contaminated sites for Pagan Alternative 2 would be similar to those identified under Pagan Alternative 1 in Section 4.16.4.1.

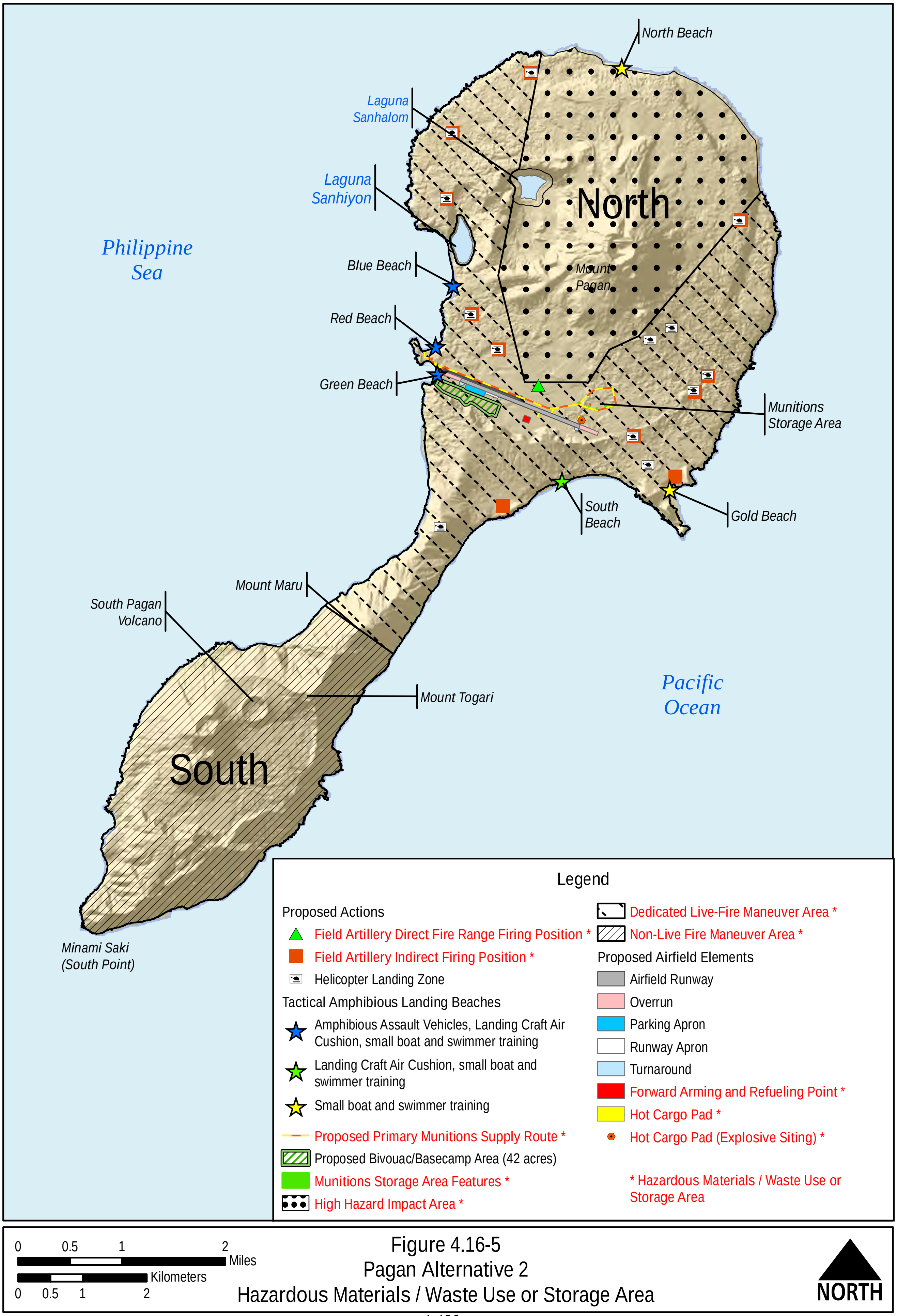


Figure 4.16-5
Pagan Alternative 2
Hazardous Materials / Waste Use or Storage Area

Based upon the above analysis and the implementation of the resource management measures described in Section 4.16.2, construction activities associated with Pagan Alternative 2 would not significantly increase the potential for impacts from hazardous materials, toxic substances, hazardous waste, and contaminated sites. Therefore, Pagan Alternative 2 construction would result in less than significant direct and indirect impacts with respect to hazardous materials, toxic substances, hazardous waste, and contaminated sites.

4.16.4.2.2 Operation Impacts

Pagan Alternative 2 training and maintenance activities would be similar to those described in Section 4.16.4.1 for Pagan Alternative 1 with regard to hazardous materials, toxic substances, hazardous waste, and contaminated sites. Pagan Alternative 2 would also follow the same resource management measures which would minimize the potential impacts associated with hazardous materials, toxic substances, hazardous waste, and contaminated sites as described in Section 4.16.4.1 for Pagan Alternative 1. The same amounts and types of munitions would be fired under either alternative, and the same types of training activities would take place. The only differences are that under Pagan Alternative 2, all munitions would impact in the smaller, northern High Hazard Impact Area; however, the target areas would be the same as those under Pagan Alternative 2. In addition, there would be no high impact hazard area on the isthmus; and there would be more area for ground maneuver training (see Figure 4.16-5). Due to the larger maneuver area, Pagan Alternative 2 would likely use more petroleum based hazardous materials and generate more non-petroleum based hazardous waste than Alternative 1. The differences in the size of the maneuver area and hazardous materials and waste volumes would not change the effectiveness of the resource management measures in preventing or minimizing adverse environmental impacts.

Based upon the above analysis and the implementation of the resource management measures described in Section 4.16.2, Pagan Alternative 2 operations would not significantly increase the potential for impacts from hazardous materials, toxic substances, hazardous waste, and contaminated sites. Therefore, Pagan Alternative 2 operations would result in less than significant direct and indirect impacts with respect to hazardous materials, toxic substances, hazardous waste, and contaminated sites.

4.16.4.3 Pagan No-Action Alternative

The no-action alternative for Pagan would involve the continued infrequent visitations of low impact trips by small groups of eco-tourists, scientific surveys, and military non-live-fire training related to search and rescue. All visits would be approved by the CNMI government. The impacts would be short-term and very minor and would not involve the on-island use of any substantial quantities of hazardous materials or generation of hazardous waste. Therefore, the no-action alternative would result in less than significant impacts on Pagan with respect to hazardous materials and waste.

4.16.4.4 Summary of Impacts for Pagan Alternatives

Table 4.16-4 provides a comparison of the potential impacts to hazardous materials and waste resources for the two Pagan alternatives and the no-action alternative.

Table 4.16-4. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Hazardous Materials and Waste	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Hazardous Materials	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Toxic Substances	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Hazardous Waste	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Contaminated Sites	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*

Legend: *LSI* = less than significant impact.

4.17 PUBLIC HEALTH AND SAFETY

Section 4.17 describes the potential impacts to public health and safety as a result of the proposed action. The region of influence for construction activities includes the Military Lease Area on Tinian, Tinian International Airport, Port of Tinian, Unai Chulu, and Pagan. Areas of potential exposure to operational activities include airspace, land, waters, within and adjacent to the proposed military RTAs, including areas underlying airspace used for military training. Impacts to public health and safety may result from construction, military training operations, and/or materials used during military training, such as unexploded ordnance and munitions. Munitions include, but are not limited to, inert aviation ordnance, naval and field artillery projectiles, aerial rockets, mortar rounds, man-portable rockets, hand grenades, machine gun/pistol rounds, flares, and other pyrotechnic devices.

In addition, impacts to public health and safety may result from direct (e.g., traffic accidents and personal injuries), social (e.g., health care services and public services), or environmental (e.g., water quality, air quality, noise, and hazardous materials and waste) effects. Potential impacts to the police department, fire department, and health services are presented in Section 4.15, *Socioeconomics*. Potential impacts to environmental resources including water, air, and noise environment, are discussed in Sections 4.3, *Water Resources*; 4.4, *Air Quality*; and 4.5, *Noise*, respectively. For detailed information on hazardous materials, see Section 4.16, *Hazardous Materials and Waste*.

The analysis presented in this section focuses on potential health and safety impacts to the general public from associated construction and operational activities of the proposed action. Potential effects to construction and military personnel are not addressed in this EIS/OEIS. Safety risks to construction personnel are addressed under 29 CFR 1910 *et seq*., *Occupational Health and Safety Standards*. Health and safety risks to military personnel are an inherent and unavoidable aspect of military training due largely to the nature of military missions and the need to train under realistic conditions. Additional risks result from the non-training operations including military travel and transport, handling, and storage of munitions. To reduce such risks to the extent possible during training, all proposed training operations and exercises are designed and conducted in accordance with comprehensive military safety procedures, rules, and regulations.

The health and safety impacts related to the geologic hazards described Section 3.2, *Geology and Soils*, are not analyzed for construction and military personnel. The U.S. military would require appropriate plans (e.g., evacuation plans) and safety protocols related to geological hazards to be in place prior to the commencement of construction and operations to provide for adequate protection for construction and military personnel. As discussed above, safety risks to construction personnel are addressed under 29 CFR 1910 *et seq*., *Occupational Health and Safety Standards.* All proposed operations (i.e., training, maintenance) would be designed and conducted in accordance with established military safety procedures, rules and regulations. As discussed in Section 4.2, *Geology and Soils* (impact analysis), the proposed action would result in less than significant impacts to geological hazards (i.e., the proposed action would not significantly increase the likelihood of geological hazards to occur). The public's exposure to geological hazards would not increase as a result of the proposed action and, therefore, the health and safety impacts associated with geologic hazards on the public are not analyzed.

4.17.1 Approach to Analysis

Impacts to public health and safety were assessed by evaluating the relative scope and location of proposed construction and operation activities and their potential to alter or impact the existing conditions for public health and safety. Potential impacts associated with military training activities (i.e., range safety, including wildfire) and unexploded ordnance/munitions are considered as part of the operation impact analysis. Impact significance was determined by analyzing the extent or degree to which implementation of the proposed action would potentially result in an increased risk to public health and safety. Factors considered in evaluating the effects of the proposed activities on public health and safety include:

- Proximity of construction or operation activities to the public
- Frequency and duration of events
- Range safety procedures (access control, public notification, natural resource protection)
- Post-training procedures (site clean-up)

The U.S. military is required to comply with applicable regulations and laws under the enforcement authorities of both federal and local government entities. In accordance with Naval Ordnance Safety and Security Activity Instruction 8020.15D, an Explosives Safety Submission document must be prepared that details how explosive safety standards would be applied to munitions responses (DoN 2011). The Explosives Safety Submission document would address how a proposed action complies with applicable environmental requirements related to the management of munitions and explosives of concern, and would outline specific measures to be taken to ensure the safety of the public. Accordingly, documented procedures would be established to ensure that the public are not endangered by proposed military training events conducted on or around the islands of Tinian and Pagan.

The management of RTAs would be linked to the overall management of the Joint Region Marianas Mariana Islands Range Complex. As the Executive Agent for the U.S. Pacific Command for this action, Marine Corps policies and procedures are assumed to provide the basis for joint and multi-national range and training area management. Marine Corp Order P3550.10, Policies and Procedures for Range and Training Area Management, establishes Marine Corps responsibilities and prescribes policies and procedures concerning safety and management of Marine Corps operational ranges and training areas, to include associated training facilities (DoN 2005).

4.17.2 Resource Management Measures

Resource management measures applicable to public health and safety include the following.

4.17.2.1 Avoidance and Minimization Measures

- As described in Chapter 2, *Proposed Action and Alternatives,* Section 2.4.1.3, *Operation and Management of Tinian Range and Training Area*, the Military Lease Area would become an active military training area that includes hazardous activity. Gates and fencing would be employed for access control and security and signs will be posted to warn the public of hazards. Varying degrees of public access would be provided to certain portions of the Military Lease Area and waters off the Military Lease Area during the training periods.

- As described in Chapter 2, *Proposed Action and Alternatives,* Section 2.5.1.4, *Operation and Management of Pagan Range and Training Area*, a range safety program will be established per Marine Corps Order 3570.1C, *Range Safety,* detailing procedures for RTA safety, emergency response (medical and fire), explosive ordnance disposal, training mishap investigations, safety training, and range inspections.
- As described in Chapter 2, *Proposed Action and Alternatives*, Section 2.5.1.2.3, *Munitions Storage Area,* the Munitions Storage Area on Pagan would be secured by chain-link fencing with barbed wire. To provide for the safe conduct of military training, both for the public and the training participants, designated sea space and airspace would be selected to support training for all the Tinian and Pagan alternatives. Both the planned sea space and airspace would be scheduled for use during training and these active time periods would be provided to the public via the current Notice to Mariners and Notice to Airmen processes.
- As described in Chapter 2, *Proposed Action and Alternatives*, danger zones would be established around live-fire RTAs under the proposed action and its alternatives. The purpose of the danger zones are established for safe separation of non-participating military personnel and the public from live-fire training. These zones delineate areas (air, land, and sea) in which personnel and/or equipment may be endangered by ground weapons firing or detonation activities. The establishment of charted Special Use Airspace and danger zones on aeronautical and surface navigation charts provides safety information to the public including vertical hazard altitudes that could be a danger to other airspace users. Application of these safety and notification procedures would ensure safety of flight, water operations, and non-training personnel.

4.17.2.2 Best Management Practices and Standard Operating Procedures

Best management practices and standard operating procedures that are applicable for public health and safety are listed below and described in Appendix D, *Best Management Practices*.

- Federal Aviation Administration notification: including the Construction Safety and Phasing Plan and coordination with the Commonwealth Ports Authority and commercial aviation operators
- Bird Aircraft Strike Hazards Plan
- Traffic Management Plan and Work Zone Traffic Management
- Range Training Area and Management Plan
- Public Access Plan
- Gates, Fencing, and Signs
- Fire Management Plan
- Explosives Safety Submission
- Hazards to Electromagnetic Radiation to Ordnance safety program

The Department of Defense would prepare a fire prevention and management plan specific to proposed RTA activities on Tinian and Pagan prior to initiation of live-fire training. The fire management plan would address the preventative and immediate actions required for fire hazards connected with RTA training. Adequate water supply and manpower would be identified to ensure safe training and protection of public safety and property. On Tinian, a 90-foot (30-meter) wide firebreak would be provided around the High Hazard Impact Area. Water trucks and hydrants would be located at the base camp and Munitions Storage Area on Tinian. Prescribed burns for vegetation maintenance could occur within the High Hazard Impact Area on Tinian only after assessment of fire conditions.

An organization, such as a Marine Corps Base Guam Range Management Division, would be the designated range control facility organization with responsibility for the range and training facilities. This organization would provide safety, control, maintenance, environmental compliance, and administrative functions for aviation, ground, and combined arms training events within RTAs, to include both live-fire and non-live-fire events.

A range control facility would be established on Tinian to oversee safety, control, maintenance, and administrative functions for air, ground, and sea training activities within the Tinian RTA. Approximately 95 personnel on Tinian would be required for base camp support, range management, range operations, and range maintenance. Military personnel and/or civilian staff on Tinian would be responsible for base camp support, range management, range operations, and range maintenance. Anticipated public health and safety responsibilities of the Range Management Division include:

- **Safety**: Establish and implement required safety regulations such as a range safety program that includes specific safety regulations for each type of training facility. Develop, publish, and coordinate procedures for medical emergency response and evacuation and explosive ordnance disposal response management. Conduct training, face-to-face personnel briefs with required individuals, and conduct inspections.
- **Control**: Schedule, publish notices (electronically and other) to the public, operate a fire desk (a centralized, manned, coordinating military office/agency for range control operations), and provide management of airspace, control personnel, and aircraft movement and access. Provide and coordinate communications and radar surveillance. Establish and man the physical range control facility on Tinian. Administer a web-enabled scheduling system, the Range Facility Management Support System, to schedule training facilities, providing a standard, integrated system to efficiently schedule and manage firing ranges and training areas and providing training support for units. Perform pre-training range sweeps (for people and animals), and active observation during live-fire training. Operate Observation Posts manned or with cameras/radar, to survey the sea space and airspace. Initiate “cease fire” if situations arise where live-fire training could not be conducted safely.
- **Maintenance**: Provide and coordinate range clearance and environmental compliance and monitoring. Construct and maintain targets and training devices. Provide and maintain range boundary signs, fences, security cameras and gates, and coordinate range maintenance.

4.17.3 Tinian

4.17.3.1 Tinian Alternative 1

4.17.3.1.1 Construction Impacts

4.17.3.1.1.1 Aircraft Operations

Tinian Alternative 1 would include construction of the proposed training facilities at the Tinian International Airport, including new taxiways connecting to the north of existing Runway 08/26 within the existing Tinian International Airport boundary. Through implementation of the Construction Safety and Phasing Plan and coordination with the Commonwealth Ports Authority, Tinian Alternative 1 construction activities would result in less than significant direct or indirect impacts to public health and safety with regards to aircraft operations.

4.17.3.1.1.2 Ground Operations

Construction personnel would be required to maintain boundary signs, fences, and barricades to provide notice to the public of active construction zones. In addition, security personnel or construction safety flaggers would provide warnings to the public of ongoing construction activities along roadways and publicly visited areas (e.g., recreational areas). Because the public would be excluded from entering active construction areas, potential risks to public health and safety would be reduced. Therefore, construction of Tinian Alternative 1 construction activities would result in less than significant direct or indirect impacts to public health and safety with regards to ground operations.

4.17.3.1.1.3 Marine Operations

Proposed improvements at the Port of Tinian would include construction of a new biosecurity station and construction of a new bulk fuel storage facility, parking, and a stormwater retention pond. In addition, improvements would be made on land in the vicinity of the existing public boat ramp to facilitate egress from the ramp to the roadway. No in-water construction is proposed at the Port of Tinian.

Proposed construction at Unai Chulu to develop the amphibious landings would include in-water construction in the nearshore waters of the beach. Construction techniques would require large construction equipment and temporary construction work areas. Public beach access at Unai Chulu would be prohibited during construction activities. Construction personnel would be required to maintain boundary signs, fences, and barricades to provide notice to the public of active construction zones. In addition, security personnel or construction safety flaggers would provide warnings to the public of ongoing construction activities along roadways leading to the beach. Because the public would be excluded from entering active construction areas, potential risks to public health and safety would be reduced.

Based upon the above analysis and implementation of the resource management measures identified in Section 4.17-2, Alternative 1 construction activities would result in no direct or indirect impacts to public health and safety with regards to marine operations.

4.17.3.1.2 Operation Impacts

4.17.3.1.2.1 Aircraft Operations

Various levels of Special Use Airspace will be designated as described in Section 4.6, *Airspace*, to provide for the safe separation of military air traffic and activities of civilian and non-participating air traffic. Special Use Airspace is airspace wherein activities must be confined or limited due their nature. For example, artillery fire must be confined to Special Use Airspace to ensure public aviation safety. Also, public aviation must be restricted from certain Special Use Airspace to ensure their safety. Three types of Special Use Airspace are planned to meet the safety and control aspects of military training:

- **Military Operation Areas:** airspace designated to separate or segregate certain nonhazardous military activities from other air traffic and to identify where these activities are taking place.
- **Warning Areas:** airspace to alert nonparticipating pilots of the potential danger of military training that contains activity that may be hazardous to nonparticipating aircraft.
- **Restricted Areas:** airspace identified above an area on the surface of the earth within which the flight of aircraft is subject to restrictions.

Range control would monitor and control aircraft and unmanned aircraft system access and activities within the Special Use Airspace. Range control would also observe the airspace and sea space areas affected by live-fire and execute procedures to support safe passage of watercraft and aircraft. Planned live-fire range activities would be specified in published range regulations, with detailed procedures to accommodate the cease fire of activities in response to non-authorized aircraft. Real-time communications between on-site range safety personnel, range users, aircraft, and oversight personnel would be in place at all times during range use. Procedures would be implemented and enforced to ensure the cessation of all live-fire activities in the event of conflicting aircraft over flight, or non-authorized personnel.

Aircrew operating in Tinian airspace would be required to follow applicable procedures outlined in the Bird Aircraft Strike Hazards Plan, or similar measures developed by civilian airport authorities.

Based upon the above analysis and implementation of the resource management measures identified in Section 4.17.2, Tinian Alternative 1 operations would result in less than significant direct or indirect impacts to public safety with regard to aircraft operations.

4.17.3.1.2.2 Ground Operations

As described in Section 4.13, *Transportation Resources*, the altered circulation patterns resulting from the permanent closure of existing roads within the High Hazard Impact Area under Tinian Alternative 1 would not significantly increase the rate of traffic-related accidents. Proposed roadway improvements would decrease accident rates and increase overall transportation safety on Tinian.

Restricting public access to portions of or all of the Military Lease Area during military training activities would occur under the proposed action. Varying degrees of public access may be allowed to certain inactive areas in the Military Lease Area. Live-fire training activities would occur for 20 training weeks per year. Outside of the 20 live-fire training weeks per year, non-live-fire training activities would occur.

Active live-fire training areas would not be accessible by the public, and it would be standard protocol to provide sufficient lead-time to ensure range clearance before any training activities were conducted. In addition, the U.S. military would provide and maintain boundary signs, fences, security cameras, and/or gates in the following areas, to which public access would not be permitted at any time:

- High Hazard Impact Area
- Munitions Storage Area
- Airport improvements
- Base camp
- Fenced and gated range training areas
- Surface Radar
- Observation Posts

Unauthorized civilian entry during military training operations could result in accidents that impact public health and safety. To facilitate range safety, ground access would be controlled by traffic control points on existing roads into the Military Lease Area. Sea space and airspace restrictions would be established and published electronically by U.S. military using current methods of notifications (including Notices to Mariners and Airmen), along with schedules of when the ranges and associated danger zones are restricted. Training periods would be published electronically and signs posted to inform residents and visitors of when they are and are not allowed access to the Military Lease Area. The RTA would be patrolled each morning before use to ensure no unauthorized individuals are present.

Range control would monitor and control access of personnel and vehicles within the Military Lease Area. Planned live-fire ranges would be specified in published range regulations, with detailed procedures to accommodate the cease fire of activities in response to intruder personnel. Real-time communications between on-site range safety personnel, range users, and oversight personnel would be in place at all times during range use. Procedures would be implemented and enforced to ensure the cessation of all live-fire activities in the event of conflicting aircraft over flight, or transit of watercraft or personnel.

Live-fire operations that could result in unexploded ordnance would be restricted to the High Hazard Impact Area which would be fenced and public access restricted at all times. Activities associated with firing range operations could result in increased exposure to munitions and explosives of concern. This clearing would occur based on tabulated range usage. The Tinian RTA would be managed in accordance with current military range management policies and procedures that are designed to ensure the safe, efficient, effective, and environmentally sustainable use of the range area. Routine range clearance would be employed that involves the destruction or removal and proper disposal of munitions, including target debris, munition packaging, and crating materials.

There is also a potential for wildfire during operations within the RTA that could affect public health and safety. Range safety procedures would include measures to minimize the risk of wildfire and would provide a response plan for the event of a wildfire. To ensure public safety and protection of property, a fire management plan would be developed to address the preventative and immediate actions required to address potential fire hazards associated with military training, including considerations of both water supply and manpower.

The effects of electromagnetic environments created by stationary and mobile/portable antenna/transmitter systems (such as the International Broadcasting Bureau), located in the vicinity of ordnance operations (transportation, assembly, and loading operation areas) may present hazardous situations. A Hazards to Electromagnetic Radiation to Ordnance safety program and instruction (detailed directions pertaining to types of munitions authorized for use, based on specific transmitters/antennas in use) would provide emission control procedures for safely minimizing operational restrictions due to Hazards to Electromagnetic Radiation to Ordnance. This includes safe separation distances for all personnel (military and non-military), ground vehicles, ships, and aircraft.

Implementation of range safety and access control procedures would prevent the public from accessing the Tinian RTA during live-fire training events. The High Hazard Impact Area and certain training areas would be fenced and gated to restrict the public from entering during non-training periods. Based upon the above analysis and implementation of the resource management measures identified in Section

4.17-2, Tinian Alternative 1 operations would result in less than significant direct or indirect impacts to public safety with regard to ground operations.

4.17.3.1.2.3 Marine Operations

Planned sea space activation would serve to segregate non-participating ships from potentially hazardous military training. The sea space immediately underlying the airspace would be designated as danger zones. Specific danger zones would be broadcasted to the public. Danger zones are defined water areas used for military training, aviation ordnance, rocket firing or other hazardous operations and are designed to separate military operations from non-participating marine vessels. Danger zones would be closed to the public on a full-time or intermittent basis during training and open to the public when no training is occurring in that area. Public access would be prohibited or limited in restricted areas.

Range control would monitor and control access of personnel, vehicles, aircraft, and unmanned aircraft system activities within the Military Lease Area and supporting Special Use Airspace. Range control would also observe the sea space areas affected by live-fire and execute procedures to support safe passage of watercraft. Planned live-fire ranges would be specified in published range regulations, with detailed procedures to accommodate the cease fire of activities in response to intruder watercraft. Real-time communications between on-site range safety personnel, range users, and oversight personnel would be in place at all times during range use. Procedures would be implemented and enforced to ensure the cessation of all live-fire activities in the event of conflicting transit of watercraft or personnel.

Based upon the above analysis and implementation of the resource management measures identified in Section 4.17-2, Tinian Alternative 1 operations would result in less than significant direct or indirect impacts to public safety with regard to marine operations.

4.17.3.2 Tinian Alternative 2

4.17.3.2.1 Construction Impacts

The impacts to public health and safety resulting from construction activities associated with Tinian Alternative 2 would be the same as those described for Tinian Alternative 1. Tinian Alternative 2 would also follow the same resource management measures as described in Section 4.17.2. See Section 4.17.3.1, *Tinian Alternative 1*, for a discussion of impacts. Tinian Alternative 2 construction activities would result in less than significant direct or indirect impacts to public health and safety with regard to aircraft and ground operations; and no impact to public health and safety with regard to marine operations.

4.17.3.2.2 Operation Impacts

The impacts to public health and safety from Tinian Alternative 2 operations would be the same as those described for Tinian Alternative 1. Tinian Alternative 2 would also follow the same resource management measures as described in Section 4.17.2. See Section 4.17.3.1, *Tinian Alternative 1*, for a discussion of impacts. Tinian Alternative 2 operations would result in less than significant direct or indirect impacts to public health and safety.

4.17.3.3 Tinian Alternative 3

4.17.3.3.1 Construction Impacts

The impacts to public health and safety resulting from construction activities associated with Tinian Alternative 3 would be the same as those described for Tinian Alternative 1. Tinian Alternative 3 would also follow the same resource management measures as described in Section 4.17.2. See Section 4.17.3.1, *Tinian Alternative 1*, for a discussion of impacts. Tinian Alternative 3 construction activities would result in less than significant direct or indirect impacts to public health and safety with regard to aircraft and ground operations; and no impact to public health and safety with regard to marine transportation.

4.17.3.3.2 Operation Impacts

The impacts to public health and safety resulting from operations associated with Tinian Alternative 3 would be the same as those described for Tinian Alternative 1. Tinian Alternative 3 would also follow the same resource management measures as described in Section 4.17.2. See Section 4.17.3.1, *Tinian Alternative 1*, for a discussion of impacts. Tinian Alternative 3 operations would result in less than significant direct or indirect impacts to public health and safety.

4.17.3.4 Tinian No-Action Alternative

The periodic non-live-fire military training exercises in the Military Lease Area on Tinian would be expected to continue under the no-action alternative. The impacts to public health and safety would be less than significant during these short term duration events. The military training exercises of troop and vehicle movements would be limited to within and to/from the Military Lease Area where there would be no public access. As documented in the Guam and CNMI Military Relocation EIS (DoN 2010a), the four planned live-fire training ranges would have less than significant impacts (see Table 18.2-4; DoN 2010a). Also, for the Mariana Islands Range Complex training (see Table 3.19-2; DoN 2010b), there would be less than significant impacts to public health and safety on Tinian. Therefore, overall, the no-action alternative would have less than significant impacts.

4.17.3.5 Summary of Impacts for Tinian Alternatives

Table 4.17-1 contains a comparison of the potential impacts to public health and safety resources for the three Tinian alternatives and the no-action Alternative.

Table 4.17-1. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Public Health and Safety	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Aircraft Operations	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Ground Operations	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Operations	*NI*	*LSI*	*NI*	*LSI*	*NI*	*LSI*	*LSI*	*LSI*

Legend: *LSI* = less than significant impact; *NI* = no impact.

4.17.4 Pagan

4.17.4.1 Pagan Alternative 1

4.17.4.1.1 Construction Impacts

After the completion of an appropriate real estate agreement and notifications with the CNMI government, construction activities associated with Pagan Alternative 1 could occur. Although there is no permanent resident population on Pagan, members of the public (e.g., visitors) could be present on the island during construction. However, they would be excluded from the construction areas. Construction personnel would be required to maintain boundary signs, fences, and barricades to provide notice to the public of active construction zones. In addition, security personnel or construction safety flaggers would provide warnings to the public of ongoing construction activities along roadways and publicly visited areas (e.g., recreational areas). There would be temporary closure of the Pagan airfield during the removal of the lava flow and for the improvements on and adjacent to the runway. Based upon the above analysis and the implementation of resource management measures in Section 4.17.2, Pagan Alternative 1 construction activities would result in no direct or indirect impacts to public health and safety.

4.17.4.1.2 Operation Impacts

4.17.4.1.2.1 Aircraft Operations

Various levels of Special Use Airspace would be designated as described in Section 4.6, *Airspace*, to provide for the safe separation of military air traffic and activities from civilian and non-participating air traffic.

Range control would occur via communications (i.e., radios) between military range personnel on Pagan and the range control facility on Tinian along with surveillance capabilities supported by participating tactical training agencies (i.e., groups of military units with tactical responsibility for a training asset) and training assets. As with the Tinian alternatives (Section 4.17.3), range control personnel on Pagan would oversee personnel, aircraft, and unmanned aircraft system access and activities for direct fire, indirect fire, and aviation activity training.

Training periods would be published electronically by U.S. military using current methods of notifications (including Notice to Airmen). The restricted airspace would be off-limits during live-fire training.

Aircrews operating on Pagan would be required to follow applicable procedures outlined in the Bird Aircraft Strike Hazards Plan.

Based upon the above analysis and the implementation of resource management measures in Section 4.17.2, Pagan Alternative 1 operations would result in less than significant direct or indirect impacts to public safety with regard to aircraft operations.

4.17.4.1.2.2 Ground Operations

No permanent range control facilities are proposed for Pagan (i.e., no permanent observation towers or radars). Military range personnel on Pagan during training exercises would oversee safety, control, maintenance, and administrative functions for air, ground, and sea training activities within the RTA. Range personnel deployed to Pagan would utilize temporary lookouts (primarily located on high ground) that provide the ability to observe interlopers (non-authorized aircrafts, boats or civilians). In addition, an aircraft clearing pass (visual review) of the area would be a standard procedure to see if people, animals, vehicles, etc. are in the area prior to military operations.

Range control would occur via communications (i.e., radios) between military range personnel on Pagan and the range control facility on Tinian and surveillance supported by participating tactical training agencies and assets. As with Tinian, range control personnel on Pagan would oversee personnel, vehicles, aircraft, and unmanned aircraft system access and activities for direct fire, indirect fire, and aviation activity training.

Training periods would be published electronically by U.S. military using current methods of notifications. During training periods, public access would be restricted from accessing areas within the Pagan RTA encumbered by surface danger zones for safety reasons. Depending upon the type of training and training scenario, portions of the island could be available for public access.

Range safety procedures would include both preventative measures to minimize the risk of wildfire and a response plan in the event of a wildfire. The U.S. military would provide and maintain boundary signs, fences, and/or gates in areas around the High Hazard Impact Areas; public access to the two High Hazard Impact Areas would not be permitted at any time.

Pagan Alternative 1 would emphasize the use of air-to-ground missiles in conjunction with live-fire aerial and sea-to-surface munitions. Activities associated with firing range operations would result in unexploded ordnance and munitions constituents. If unexploded ordnance or military munitions are inadvertently discovered by a member of the public, the resulting effects could be serious or life threatening.

Live-fire operations that could result in unexploded ordnance would be restricted to the High Hazard Impact Areas which would be fenced (as feasible) and public access restricted at all times. Activities associated with firing range operations could result in increased exposure to munitions and explosives of concern. This clearing would occur based on tabulated range usage. The Pagan RTA would be managed in accordance with military range management policies and procedures, designed to ensure the safe, efficient, effective, and environmentally sustainable use of the range area. Range clearance on Pagan would occur on a case-by-case basis, based on the usage of the RTA. Range clearance involves the destruction or removal and proper disposal of munitions, including target debris, munition packaging, and crating materials.

Implementation of safety and access control procedures are designed to prevent the public from accessing the island during live-fire training events. The High Hazard Impact Area(s) would have signage posted to inform the public they are restricted from entering during non-training periods. Based upon the above analysis and the implementation of resource management measures in Section 4.17.2, Pagan Alternative 1 operations would result in less than significant direct or indirect impacts to public health and safety with regard to ground operations.

4.17.4.1.2.3 Marine Operations

The sea space immediately underlying the restricted airspace around Pagan would be designated as danger zones. Range control would occur via communications (i.e., radios) between military range personnel on Pagan and the range control facility on Tinian and surveillance supported by participating tactical training agencies and assets. Range control personnel on Pagan would also coordinate with exercise participants to ensure observation of the sea space areas surrounding Pagan impacted by live-fire effects to ensure procedures are executed to support safe passage of transiting watercraft.

Training periods would be published electronically by U.S. military using current methods of notifications (including Notice to Mariners). During training periods, public access would be restricted from accessing areas within the Pagan RTA encumbered by danger zones for safety reasons. Depending upon the type of training and training scenario, portions of the surrounding waterways may be available for public access.

Based upon the above analysis and the implementation of resource management measures in Section 4.17.2, Pagan Alternative 1 operations would result in less than significant direct or indirect impacts to public safety with regard to marine operations.

4.17.4.2 Pagan Alternative 2

Pagan Alternative 2 construction and training activities would have similar impacts to public health and safety as those identified for Pagan Alternative 1. The main differences that would affect public health and safety are the northern High Hazard Impact Area would be smaller and southern High Hazard Impact Area located across the isthmus would not be constructed.

4.17.4.2.1 Construction Impacts

The impacts to public health and safety from construction activities associated with Pagan Alternative 2 would be the same as those described for Pagan Alternative 1. Pagan Alternative 2 would also follow the same resource management measures as described in Section 4.17.2. See Section 4.17.4.1, *Pagan Alternative 1* for a discussion of impacts. Based upon the above analysis and the implementation of resource management measures in Section 4.17.2, Pagan Alternative 2 construction activities would result in no direct or indirect impacts to public health and safety.

4.17.4.2.2 Operation Impacts

The impacts to public health and safety resulting from operations associated with Pagan Alternative 2 would be the same as those described for Pagan Alternative 1. Pagan Alternative 2 would also follow the same resource management measures as described in Section 4.17.2. See Section 4.17.4.1, *Pagan Alternative 1* for a discussion of impacts. Based upon the above analysis and the implementation of resource management measures in Section 4.17.2, Pagan Alternative 2 operations would result in less than significant direct or indirect impacts to public health and safety.

4.17.4.3 Pagan No-Action Alternative

The periodic visits of eco-tourism, scientific surveys or military training related to search and rescue are assumed to continue on Pagan under the no-action alternative. The impacts to public health and safety of these activities would be considered to be less than significant.

4.17.4.4 Summary of Impacts of Pagan Alternatives

Table 4.17-2 contains a comparison of the potential impacts to public health and safety resources for the two Pagan alternatives and the no-action alternative.

Table 4.17-2. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Public Health and Safety	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Aircraft Operations	*NI*	*LSI*	*NI*	*LSI*	*LSI*	*LSI*
Ground Operations	*NI*	*LSI*	*NI*	*LSI*	*LSI*	*LSI*
Marine Operations	*NI*	*LSI*	*NI*	*LSI*	*LSI*	*LSI*

Legend: *LSI* = less than significant impact; *NI* = no impact.

4.18 PROGRAMMATIC ANALYSIS OF FUTURE POTENTIAL PROJECT COMPONENTS

The proposed action presented in this EIS/OEIS includes until level and combined level RTA construction and operation as presented in Chapter 2, and analyzed in Chapter 4 for each resource. Two additional projects that are not included within the proposed action presented in this EIS/OEIS are anticipated to be implemented at a future and unknown date in support of the CJMT effort. The two projects are: (1) relocation of the existing International Broadcasting Bureau on Tinian and (2) construction and operation of a new dock and associated breakwater on Pagan. These two projects are presented and analyzed in the following section programmatically and in a broader context than the proposed action analyzed in this EIS/OEIS.

A programmatic approach is considered the most effective way to characterize these future potential projects. Programmatic environmental analyses of this type are conducted when a federal agency plans or contemplates a broad action or program, the specific details of which have not yet been defined. The intention is to comply with Council on Environmental Quality guidance that recommends integration of the environmental process with other planning efforts at the earliest possible time to ensure that planning and decisions reflect environmental value. A programmatic analysis at a conceptual level of detail provides early identification and analysis of potential impacts, methods to mitigate anticipated impacts, and a strategy to address issues at a tiered level if necessary.

The CJMT EIS/OEIS proposed action could require relocating the International Broadcasting Bureau facility on Tinian, currently located in the Military Lease Area. Based on a relocation study completed in 2014, other locations are being considered including on Tinian, in the CNMI or Guam. Specifically, Tinian Alternatives 2 or 3 could require relocating the International Broadcasting Bureau facility to accommodate a unit level RTA in the Military Lease Area. The new International Broadcasting Bureau facility must be completely and fully operational before relocation occurs.

Construction of a dock and associated breakwater on Pagan is also being considered. Proposed raining on Pagan could be enhanced by constructing and operating a new dock and associated breakwater on Pagan to facilitate movement of supplies, equipment and personnel.

If, in the future, there is a decision to move forward with either of these projects, then the appropriate level of project-specific environmental studies and consultations would be conducted. Additional NEPA analyses and agency consultations would be completed to address those changes as warranted. Subsequent NEPA documentation could tier from this EIS/OEIS and use the framework of the following programmatic analysis as a foundation to further address the potential impacts of those site-specific actions.

This section presents the programmatic environmental analyses of these two future potential project components. Section 4.18.1 is a programmatic analysis of potential environmental impacts of the International Broadcasting Bureau relocation, and Section 4.18.2 is a programmatic analysis of potential environmental impacts of a new Pagan dock and breakwater.

4.18.1 International Broadcasting Bureau Programmatic Analysis

The International Broadcasting Bureau on Tinian is one of two transmitter sites in the CNMI: one on Tinian and the other on Saipan. The Bureau's mission is to promote freedom and democracy through communication of accurate, objective, and balanced news to audiences overseas. The International Broadcasting Bureau facility on Tinian provides high-power shortwave transmissions for the following organizations and target audiences:

- Radio Free Asia: China, North and South Korea, all of Southeast Asia, and Tibet
- Voice of America: China, East Asia, Korea, and South Asia
- Australian and British Broadcasting Corporations: Indonesia

The CJMT EIS/OEIS proposed action would require relocating the International Broadcasting Bureau facility on Tinian, currently located in the Military Lease Area, to another location in the CNMI or Guam. Specifically, Tinian Alternatives 2 or 3 would require relocating the International Broadcasting Bureau facility to accommodate the establishment of a unit level RTA in the Military Lease Area.

A relocation study to identify potential sites was conducted in 2013-14. This section introduces the objectives of that study, presents a summary of the siting requirements applied to identify potential relocation sites, identifies and describes the viable relocation sites, and then broadly or programmatically evaluates the environmental consequences of the International Broadcasting Bureau facility relocation to the alternative sites. If there is a decision to move forward with relocating the International Broadcasting Bureau in the future, then more detailed and project-specific environmental studies, consultations, NEPA documentation, and public review will be undertaken.

4.18.1.1 Relocation Study

The *International Broadcasting Bureau-Voice of America Tinian Transmitter Station Relocation Study* (Relocation Study) evaluated potential locations for siting the International Broadcasting Bureau. The scope of the Relocation Study limited the evaluation of potential locations to within the CNMI and Guam (DoN 2014a). Transmitter station operational requirements were based on those identified in the *International Broadcasting Bureau-Voice of America Tinian Transmitter Station Requirements Study* (DoN 2013) and then further refined as part of the Relocation Study.

According to the Relocation Study, relocation site considerations focused primarily on technical- and construction-related requirements. The following are the minimum requirements for a site to be suitable for transmitter establishment:

- Be relatively flat, and depending on location be between 200 and 285 acres (81 and 114 hectares) in size (i.e., large enough to accommodate the antennae array, associated facilities comprising the transmitter station, and security fencing)
- On property owned by the U.S. or by a host government that allows unrestricted rights to broadcast programming to meet the International Broadcasting Bureau's mission
- Be positioned so that antennas can transmit to the target audiences
- Be separated from adjoining land uses to afford worker safety within, and minimize radio frequency interference outside of the transmitter site

- Have appropriate infrastructure such as roads, utilities (e.g., electricity, communication lines, potable water), and community support
- Be able to accommodate, in existing airports and sea ports, the weight and size of equipment (construction and transmitters) needed for station establishment

Potential relocation sites needed to be in the CNMI or on Guam to be considered viable because the sites need to be within an area where the station can broadcast to its audiences. The only locations where the minimum requirements listed above were met were on Rota, Saipan, Tinian, and Guam. In total, 7 sites were first identified for potential Tinian transmitter station relocation: 3 on Rota, 2 on Saipan, 1 on Tinian, and 1 on Guam. Through further refinement and requirements application, four sites were determined as feasible relocation candidates for more in-depth evaluation. These four candidate sites included one location each on Rota, Saipan, Tinian, and Guam (DoN 2014a).

4.18.1.1.1 Potential Rota Site

The potential transmitter site on Rota is located on the south side of the island on a plateau that is centrally located between the east and west coast, northeast of Teneto Village on the CNMI public land (Figure 4.18-1). The site is relatively flat and has sufficient area to support the relocation of the transmitter station. There is adequate infrastructure to support communications needs; however, the on-island power supply and access roads would need upgrading. There is sufficient separation from adjacent land uses to ensure safety and avoid radio frequency exposure. While there is capacity at the airport to accommodate cargo, ocean shipment of materials and equipment would be limited due to the crane capacity and water depth in harbor. Housing may be in short supply to accommodate the approximately 25 transmitter personnel.

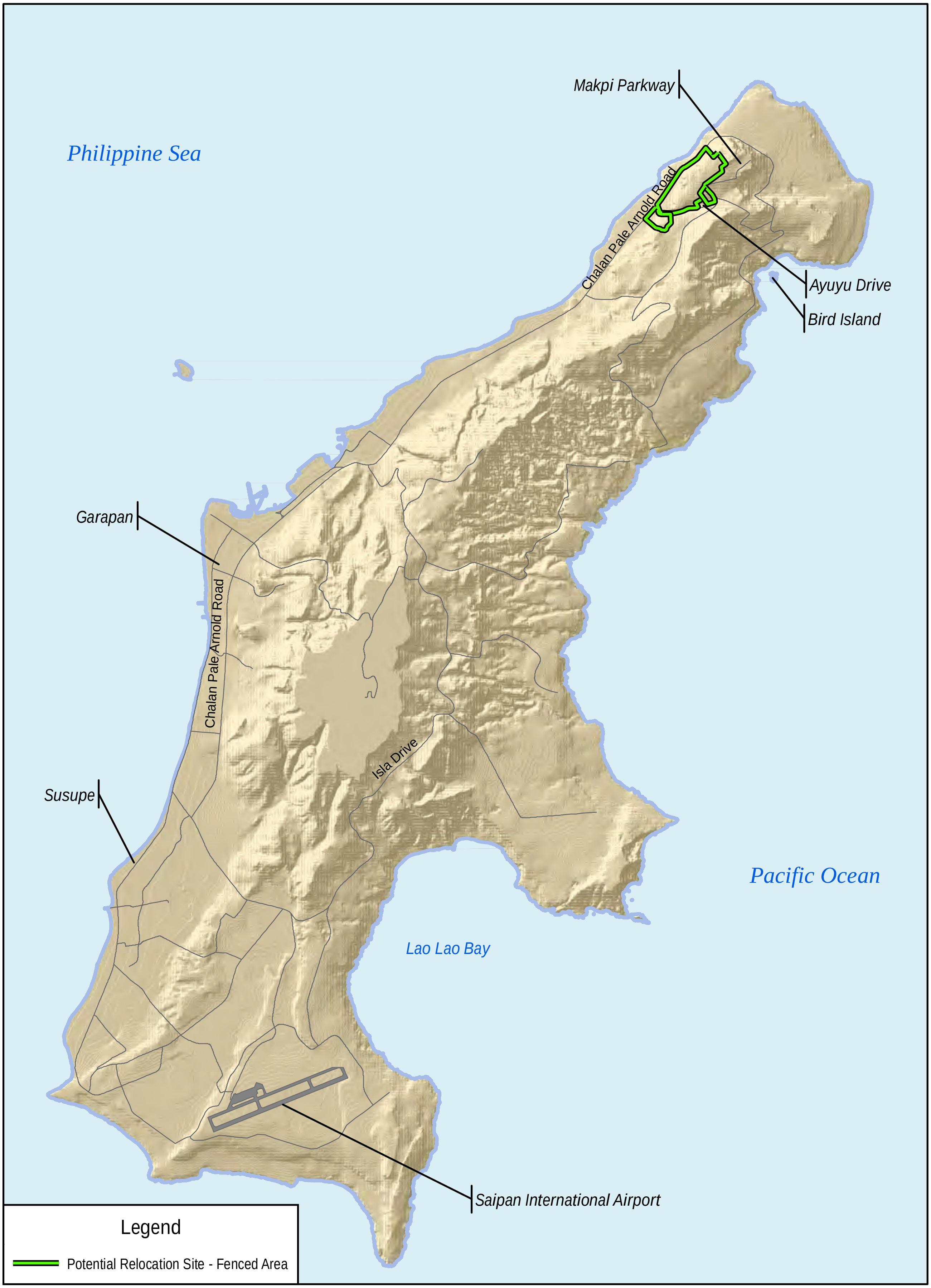
4.18.1.1.2 Potential Saipan Site

The potential transmitter site on Saipan is located on the north side of the island near the west coast (east of Chalan Pale Arnold Road, west of Marpi Road). The southernmost array would be on the south side of Ayuyu Drive on both the CNMI Government and private lands (Figure 4.18-2). The site has steep terrain but is of sufficient size to accommodate the antennae field, associated facilities, and security fencing. There is adequate infrastructure to deliver electricity, support communications needs, and provide road access. There is sufficient separation from adjacent land uses to ensure safety and avoid radio frequency exposure. The airport and port are adequate to receive construction material and transmitter equipment shipments and enough on-island housing to accommodate the transmitter personnel.

4.18.1.1.3 Potential Tinian Site

The potential transmitter site on Tinian is located on the extreme south end of the island on the Carolinas plateau, which is centrally located between the east and west coast of the island (Figure 4.18-3). The site is relatively flat and of sufficient size to accommodate the antennae field, associated facilities, and security fencing. There is adequate infrastructure to deliver electricity, support communications needs, and provide road access. There is sufficient separation from adjacent land uses to ensure safety and avoid radio frequency exposure. The airport and port are adequate to receive construction material and transmitter equipment shipments and enough on-island housing to accommodate the transmitter personnel.

Figure 4.18-1
Potential Rota Site



0 0.5 1 2 Miles

0 0.5 1 2 Kilometers

Figure 4.18-2
Potential Saipan Site

NORTH

Figure 4.18-3
Potential Tinian Site

4.18.1.1.4 Potential Guam Site

The potential transmitter site on Guam is located primarily on Government of Guam property with a small portion on private land, in the northwest portion of the island, south of Naval Computer and Telecommunications Station Finegayan and the former Federal Aviation Administration site, and west of South Finegayan Family Housing Area (Figure 4.18-4). The site is relatively flat and of sufficient size to accommodate the antennae field, associated facilities, and security fencing. There is adequate infrastructure to deliver electricity, support communications needs, and provide road access. There is sufficient separation from adjacent land uses to ensure safety and avoid radio frequency exposure. The airport and port are adequate to receive construction material and transmitter equipment shipments and enough on-island housing to accommodate the transmitter personnel. The potential site is notional and would be adjusted based on site-specific data (e.g., existing installation restoration sites).

4.18.1.2 Programmatic Analysis

This summary of the programmatic environmental consequences provides a general analysis of the potential impacts of establishing a transmitter facility at any of the four site locations identified in the Relocation Study (DoN 2014a). The programmatic approach identifies potential environmental issues that inform the decision maker during the environmental review process. If in the future there is a decision to move forward with relocating the International Broadcasting Bureau, then, the appropriate level of environmental studies, consultations, and NEPA documentation and public review will be undertaken. Consultation with agencies may be required. Potential consultations include:

- Endangered Species Act, Section 7: U.S. Fish and Wildlife Service and National Marine Fisheries Service
- Magnuson-Stevens Fishery Conservation and Management Act: National Marine Fisheries Service
- Marine Mammal Protection Act, National Marine Fisheries Service
- National Historic Preservation Act, Section 106: Advisory Council on Historic Preservation, CNMI Historic Preservation Office, and Guam State Historic Preservation Office
- Coastal Zone Management Act: CNMI Bureau of Environmental and Coastal Quality and Guam Bureau of Statistics and Plans

The programmatic analysis of potential impacts associated with the International Broadcasting Bureau relocation is presented generally for all sites below. Where possible, site-specific information is presented for each resource.

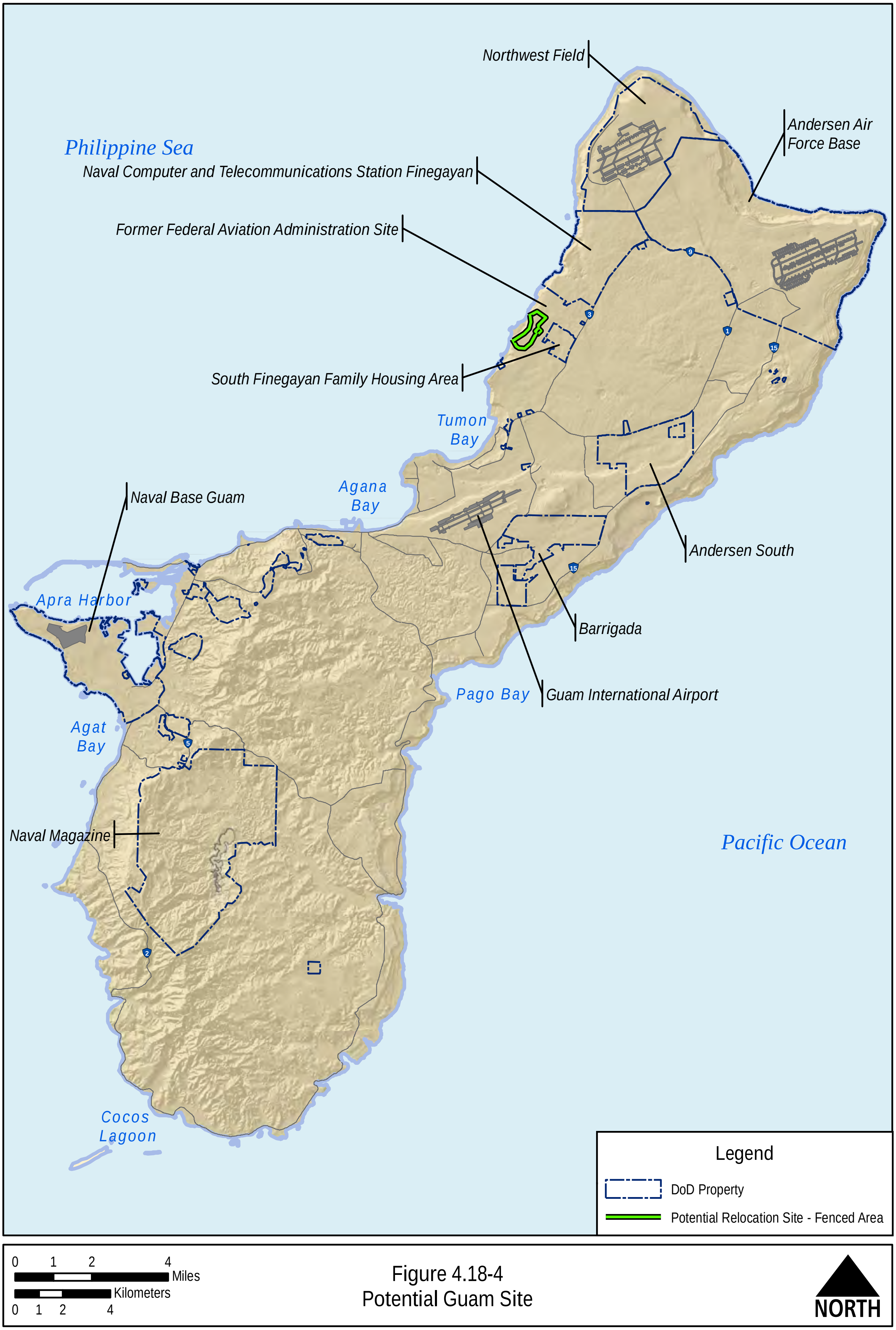


Figure 4.18-4
Potential Guam Site

4.18.1.2.1 Geology and Soils

4.18.1.2.1.1 General

Given the known geology of the Mariana Islands, there is likely probability that sinkholes would be present at each of the sites. These geologic hazards would need to be identified and avoided or addressed during facility design and construction to avoid potential impacts. There also could be fault lines on the sites. For facilities, roadways, or other infrastructure where construction or other improvements that could not avoid fault lines, then engineering design would be require construction that would minimize any potential effects from earthquakes and associated fault ruptures. Buildings, facilities, and infrastructure would be designed, situated, and constructed in accordance with Unified Facility Criteria recommendations for seismic protection. The proposed International Broadcasting Bureau facility locations are each in a tsunami evacuation safe zone. A hazard communication and evacuation plan for site workers would be required as a construction safety best management practice.

Construction of the transmitter station would require site clearing, grubbing, and grading; excavating (cut); and filling. This could result in over 200 acres (81 hectares) of cleared land depending upon existing conditions at each site. Best management practices including soil and erosion controls would need to be followed during construction to minimize impacts on soils and other natural resources. There would be impacts associated with changes to topography including slope instability and alteration of surface drainage patterns that would need to be managed. These temporary effects could occur when excavation and fill would take place to form level surfaces for site development. There is a potential for increased erosion, compaction, and soil loss from physical disturbance caused by construction activities and changes to existing topography. Project design and construction would incorporate engineering controls as best management practices (see Appendix D, *Best Management Practices*) to minimize erosion as required by the CNMI Earthmoving and Erosion Control Regulations.

Site-specific information is described below.

4.18.1.2.1.2 Rota

The site is relatively flat, with a slight difference of about 40 feet (12 meters) in elevation across the site. This location has sufficient area for the transmitter station. The limestone formations may have sinkholes and below-ground voids, so further geotechnical investigation would be needed for this site. The majority of the soils are shallow, well-drained, and appear suitable for construction of the transmitter station. The site is above Sinapalu Village, which is designated as a tsunami evacuation safe zone. The site has no known fault zones or seismic features.

4.18.1.2.1.3 Saipan

There are relatively steep grades at this site, increasing from elevation 520 feet (158 meters) to 820 feet (250 meters) above MSL across the site. The site has a relatively constant rise across the proposed antenna field. The site continues to rise toward the north. These grades could be overcome through design and site grading. The limestone formations may have sinkholes and below-ground voids, so further geotechnical investigation would be needed for this site. The majority of the soil types are shallow, well-drained, and appear suitable for construction of the transmitter station. There are moderately steep soils and rock outcrops on a limestone plateau and side slopes. The site is above

Capitol Hill, which is designated as a tsunami evacuation safe zone. The site has no known fault zones or seismic features.

4.18.1.2.1.4 Tinian

The site is relatively flat, with a change of about 40 feet (12 meters) across the site. It has sufficient area for the transmitter station. The limestone formations may have sinkholes and below-ground voids, so further geotechnical investigation would be needed for this site. The majority of the soil types are shallow, well-drained, and appear suitable for construction of the transmitter station. The site is above Tinian International Airport, which is designated as a tsunami evacuation safe zone. The site has no known fault zones or seismic features.

4.18.1.2.1.5 Guam

The site is basically flat, with a change of only about 20 feet (6 meters) across the site. It has sufficient area for the transmitter station. The limestone formations may have sinkholes and below-ground voids, so further geotechnical investigation would be needed for this site. The majority of the soil types are shallow, well-drained, and appear suitable for construction of the transmitter station. The site is high enough in elevation to be designated as a tsunami evacuation safe zone. Minor faults and fault zones exist north of the site. Presence of faults near sites would need to be addressed in facility design. In general, construction on fault lines would be avoided as much as practicable.

4.18.1.2.2 Water Resources

None of the sites contain intermittent or perennial surface water systems, although potential wetland areas are located at the Rota site. The Guam site overlies the northern Guam aquifer. No known groundwater aquifers are located immediately beneath the other sites.

Construction of the transmitter station would include clearing, grubbing, and grading; excavating (cut); and filling. These activities, all of which would increase the potential for erosion and sedimentation from exposed earth. During the construction phase and prior to any ground-disturbing activities, a Stormwater Pollution Prevention Plan (as required by the National Pollutant Discharge Elimination System permit program) would be submitted by construction contractors and approved by regulatory authorities. As required by the CNMI Bureau of Environmental and Coastal Quality, an erosion and sediment control plan would be developed based on a 25 year/24 hour duration storm event. Best management practices (e.g., silt fencing) and engineering controls (e.g., soil stabilization) would be implemented to minimize potential impacts to water resources during construction.

A comprehensive drainage and Low Impact Development study would be performed for the transmitter station site. Findings from the comprehensive drainage and Low Impact Development study would be used to inform and design the post-development stormwater management system.

Best management practices that would be implemented during construction to protect groundwater resources include vegetation buffers to protect sinkholes; limiting use of heavy equipment in areas that support groundwater recharge; proper abandonment of historic groundwater wells; and proper management of spills and leaks of hazardous materials and waste. Construction activities could result in the accidental release of pollutants (e.g., oil or chemicals) due to failure of a materials handling best management practice, which could affect groundwater quality through percolation. Any accidental release or spill of pollutants would be cleaned up immediately.

4.18.1.2.3 Air Quality

Operation of construction equipment and associated vehicles would result in short-term impacts to air quality at any of the potential sites. Operation of the facility once it is constructed would involve typical types of emissions sources such as vehicles, generators, and maintenance equipment. If average annual emissions during construction or annual operations are below the 250 tons (227 metric tons) per year threshold, construction would result in less than significant direct or indirect impacts to air quality. The transmitter station would not affect the operational capacity of existing utility systems. Therefore, no adverse air quality impacts from stationary sources (i.e., new or modified fixed or immobile facilities) would occur.

4.18.1.2.4 Noise

Earth-moving equipment (e.g., graders, excavators, dozers) and impact devices (e.g., pile drivers and jackhammers) are examples of heavy (large) equipment that would be used for construction. Smaller construction equipment includes generators, concrete saws, and compressors. Equipment and other construction activities typically generate noise levels ranging from 70 to 90 decibels at a distance of 50 feet (15 meters), see Appendix H, *Noise Study* (see Table 2.4-1) for specific equipment noise levels (U.S. Department of Transportation 2006).

From a noise perspective, construction activities are too distant to generate elevated noise levels that would be detectable in residential areas of Rota, Saipan, and Tinian. However, construction noise would potentially be audible at the military family housing area east of the Guam Site. In addition, construction noise would be audible to other sensitive land uses surrounding the various sites, such as World War II memorial sites (Rota and Tinian), a National Historic Landmark (Saipan), and a country club (Saipan). Operation of the facility would involve noise sources typical to an industrial facility. These would include vehicles and maintenance equipment. These activities would generate less noise than construction activities. Operational noise would not likely be audible at the sensitive land use locations mentioned above.

4.18.1.2.5 Airspace

The proposed sites are not adjacent to airports. The antenna heights would be the same as the existing International Broadcasting Bureau facilities, ranging between 150 feet (46 meters) and 400 feet (122 meters).Prior to constructing the new transmitter station, the Federal Aviation Administration would be contacted to ensure the tower height is compatible with aircraft safety restrictions.

4.18.1.2.6 Land and Submerged Land Use

It is possible that the U.S. military would need to prepare a Coastal Zone Management Federal Consistency Determination. Depending on the location, the determination would be submitted to the CNMI Bureau of Environmental and Coastal Quality or to the Guam Bureau.

4.18.1.2.6.1 Rota

The site is on publicly owned land (by the CNMI government) within the Sabana Conservation Area. Nearby land uses include a small botanical garden, a World War II memorial, a communications tower, and a small firing range. The communication tower would be incompatible with the proposed transmitter station and would need to be relocated. Other land uses would not be affected. Therefore, this site is moderately compatible with existing land uses.

4.18.1.2.6.2 Saipan

The site is a combination of private and publicly owned land (the CNMI government). The land south of the site (adjacent to the two proposed southernmost antennas) is owned by the Marianas Country Club. The antennas could affect access to several holes on the golf course. In addition, private land to the west would need to be acquired due to the proximity of the radio frequency hazard zone.

The northern portion of the transmitter site would be located in the National Park Service's Marpi National Historic Landmark. This is also the location of the Suicide Cliff Overlook. The central portion of the site is on a recently disestablished Far East Broadcasting Corporation Station site. This area is owned by the CNMI government and leased to a private party. Overall, this site would not be compatible with current land uses in the area as it is immediately adjacent to a country club and the Marpi National Historic Landmark.

4.18.1.2.6.3 Tinian

The site is on publicly owned land (by the CNMI government) south of the Kastiyu Wildlife Preserve and west of a World War II memorial located at the cliff edge. The antenna and facilities placement would not affect the memorial or other land uses nearby. This site is compatible with existing land uses.

4.18.1.2.6.4 Guam

The site is a combination of private and publicly owned land (Guam government). The site is situated on a plateau with a cliff to the west. The areas north and south of the site are vacant, and the area to the east is military family housing. The lands are owned by the Government of Guam but are in the process of being returned to the people of Guam through a judicial process. The portion of the site to the south is on private land that would need to be acquired. This site is moderately compatible with existing land uses.

4.18.1.2.7 Recreation

For each of the potential sites construction materials and equipment would come through the harbor and/or airport. Materials would be delivered to the construction sites via surface roadways. Introducing slow-moving construction vehicles to the roadways could affect the public's access to recreational resources on island. The increased traffic and slow operation of construction vehicles could result in negative impacts to visitor access to, and their overall experience of, recreational resources on island. Operations would not affect recreation.

4.18.1.2.8 Terrestrial Biology

Construction would involve vegetation removal to clear areas within the project site. In addition, birds in the immediate vicinity of construction activities may be disturbed by noise and human activities. Nests may be susceptible to abandonment by adults and predation of eggs or young. This would temporarily displace birds, causing them to expend additional energy, some of which may be lost or have reduced breeding success. Direct mortality from construction equipment is unlikely because noise associated with pre-construction activities and human presence is likely to disperse wildlife prior to any equipment use, although vehicle traffic would increase the potential for wildlife collisions. The noise impacts would be short-term and minor. Impacts would be minimized by implementing resource management measures summarized in Section 4.9.2 and presented in detail in Appendix D, *Best Management Practices*. Endangered Species Act, Section 7 consultation may be needed with U.S. Fish and Wildlife Service.

4.18.1.2.8.1 Rota

The site is within the Sabana Conservation Area and is within critical habitat designated under the Endangered Species Act for a federally endangered bird, the Rota bridled white-eye, and adjacent to critical habitat for the federally endangered Mariana crow. Construction would include the removal of native limestone forest. Construction of the new transmitter station site would directly affect critical habitat, and there could be indirect effects. Potential indirect operational effects to the bird species include the potential for birds to strike the antennae or fencing, as well as be subject to the electromagnetic radiation from the antennae.

4.18.1.2.8.2 Saipan

The project area supports three endangered bird species: nightingale reed-warbler, Micronesian megapode, and Mariana swiftlet. Construction of the proposed transmitter station site would directly impact reed-warbler and megapode habitat. In addition, potential indirect operational effects to the bird species include the potential for birds to strike the antennae or fencing, as well as be subject to the electromagnetic radiation from the antenna.

4.18.1.2.8.3 Tinian

There are no known wildlife species of concern at this site.

4.18.1.2.8.4 Guam

The site is in an area defined by the U.S. Fish and Wildlife Service as “recovery habitat” for the endangered Guam Micronesian kingfisher, Guam rail, Mariana crow, and Mariana fruit bat. Construction of the proposed transmitter station site would directly impact recovery habitat, and there could be indirect effects. Impacts to recovery habitat would be unavoidable but would be minimized to the maximum extent possible.

4.18.1.2.9 Marine Biology

There would be no marine biology impacts associated with the proposed relocation. All potential sites under consideration would be on land and would not have a marine component.

4.18.1.2.10 Cultural Resources

Construction could adversely impact historic properties in the project footprint. There are no historic resources at the Rota and Guam sites. The Saipan site is within the Marpi National Historic Landmark and Suicide Cliff Overlook. The Tinian site does not have historic resources but is adjacent to a World

War II memorial. Cultural resource surveys would need to be conducted at each of the sites to confirm the presence or absence of archaeological resources. National Historic Preservation Act, Section 106 may be needed with Advisory Council on Historic Preservation, CNMI Historic Preservation Office, and/or Guam State Historic Preservation Office.

4.18.1.2.11 Visual Resources

Due to their height, all or most of the antennas would be visible from many key observation points surrounding each site. Due to topography at the Rota site, the antennas would not be visible from the northern, western, or southern areas outside the site. Due to topography in northern Saipan, the antennas would be visible along the western coastline. Suicide Cliff Overlook is north of the Saipan site, and views from this location would also be affected by the Saipan transmitter station facilities. The Tinian site is situated in the southeastern part of the island below a ridgeline, so views of the antennas would be limited primarily to that part of the island. The Guam site is relatively flat, so the antennas would be visible from most locations surrounding the site.

4.18.1.2.12 Transportation

Construction of the new International Broadcasting Bureau facilities would be limited to grading, excavation, construction of structures and antennae, and installation of automation equipment. Depending on how rapidly construction is completed, construction workers may be onsite for many months. Off-island workers would likely be used for to construct the facilities. They would reside on island throughout the construction phase. Throughout the construction period, intermittent impacts to traffic circulation may result from the movement of trucks containing construction and debris removal materials, as well as from construction workers commuting. This increase in traffic volumes on roadways could affect traffic circulation or roadway Level of Service. Construction truck movements may result in generally isolated impacts that could include, but would not be limited to, congestion, slower speeds in construction zones, temporary roadway closures, and short detours that may be caused by equipment movement, delivery of construction materials, removal of construction debris, and construction of roadway improvements.

Most of the construction activities would occur within the project footprint, and as such, very limited transportation and circulation impacts from construction are anticipated. Implementation of a traffic management plan and work zone traffic management would minimize construction impacts on vehicular travel and bicycle and pedestrian circulation, and access to destinations near the construction area.

Implementation of these best management practices (see Appendix D, *Best Management Practices*) would lessen potential construction effects to traffic circulation or roadway Level of Service for vehicles, public transit, pedestrians, or bicycles, increase the rate of traffic related accidents, or reduce transportation safety.

The antenna structures are potential hazards for aircraft. However, none of the sites is near an airfield or airport. Although construction materials may be shipped to the island, the number of vessel trips would likely be minimal.

Site-specific information is described below.

4.18.1.2.12.1 Rota

Transportation of construction materials to Rota would be limited due to the crane capacity and water depth at the harbor. Thus, additional shipments would be needed for this site in relation to the other sites. Delivery of fuel oil would be via fuel tanker trucks from the east harbor. The road from Sinapalu to the Sabana Conservation Area would need improvement to provide access for construction and daily access for workers once the site is operational. A new road would be required to provide access to the operations support area. The access road from the west side of the island would need to be closed to prevent access to the plateau before the hazard area of the antenna field. The Rota International Airport can accommodate Boeing 757s with restricted landing and takeoff loads. Prior to constructing the new transmitter station, the Federal Aviation Administration would be contacted to ensure the tower height is compatible with aircraft safety restrictions. The Rota West Harbor has a narrow channel and cannot accommodate large vessels. It has boat slips and a couple of storage companies. There is no bulk fuel storage at this harbor, and the crane is rated to lift only 20-ton (18,144-kilogram) containers.

4.18.1.2.12.2 Saipan

A roadway (Ayuyu Drive) bisects the site, so the antenna arrays would be placed on either side of the road. This would require the road to be closed to the general public, thus affecting local vehicle traffic. Delivery of fuel oil would be via fuel tanker trucks from the Port of Saipan. Ayuyu Drive from Chalan Pale Arnold Road to Matansa Drive would require improvement to about 8,400 feet (2,560 meters) of road. This would be necessary to provide access for construction vehicles, as well as daily access for employees once the site is operational. Saipan International Airport can accommodate DC-10s and Boeing 747s. Prior to constructing the new transmitter station, the Federal Aviation Administration would be contacted to ensure the tower height is compatible with aircraft safety restrictions. The Port of Saipan has a deep channel, and it has two fuel storage facilities plus a bulk cement company.

4.18.1.2.12.3 Tinian

Delivery of fuel oil would be via fuel tanker trucks from Tinian Harbor. Fuel oil is delivered to the harbor fuel tanks one time per month. The current access road would require improvements, and a new road would be needed to access the administration area. The Tinian International Airport currently accommodates single-engine aircraft with a capacity of 36 passengers. Prior to constructing the new transmitter station, the Federal Aviation Administration would be contacted to ensure the tower height is compatible with aircraft safety restrictions. The main wharf at the Tinian Harbor is 2,000 feet (610 meters) long and has two piers on the southwest side, both of which are in a state of disrepair.

4.18.1.2.12.4 Guam

The site is close to existing roadways. Transportation of construction materials to Guam is not restricted by the harbor or airport size. Delivery of fuel oil would be via fuel tanker trucks from the Golf Pier in the harbor. The existing road from Route 3 and some of Royal Palm Drive would need improvement to support construction and operations of the facility. A new road would be required to the entrance of the site. The Guam International Airport can accommodate large aircraft. Prior to constructing the new transmitter station, the Federal Aviation Administration would be contacted to ensure the tower height is compatible with aircraft safety restrictions. Apra Harbor is a deepwater port that includes a container terminal, fuel oil piers, and laydown yards.

4.18.1.2.13 Utilities

Site-specific information is described below.

4.18.1.2.13.1 Rota

The electrical power system on the island would require additional generating capacity as well as replacement of some overhead power lines to support operation of the transmitter station. An additional 6.0 megawatts of generating capacity would need to be added to the island power supply. Water supply via filtered rainwater is adequate for the proposed facility. Bottled water would be used for drinking water. Wastewater would be handled with an onsite package sewage treatment system with discharge to a leach field. Solid waste would be collected and disposed of by private contractors. However, there is not a permitted landfill on Rota. Commercial carriers for telephone, internet, and television are available on the island.

4.18.1.2.13.2 Saipan

The overhead power line feeder from Power Plant I and II may be insufficient to provide adequate power to the site. This feeder line would need to be replaced. In addition, the transmitter transmission lines to the two southernmost antennas would need to be routed over Ayuyu Drive. Water supply via filtered rainwater is adequate for the proposed facility. Bottled water would be used for drinking water. Wastewater would be handled with an onsite package sewage treatment system with discharge to a leach field. Solid waste would be collected and disposed of by private contractors. Commercial carriers for telephone, internet, and television are available on the island.

4.18.1.2.13.3 Tinian

The existing overhead power lines from the power plant are insufficient to provide adequate power. These lines would need to be replaced. Water supply via filtered rainwater is adequate for the proposed facility. Bottled water would be used for drinking water. Wastewater would be handled with an onsite package sewage treatment system with discharge to a leach field. Solid waste would be collected and disposed of by private contractors. However, there is not a permitted landfill on Tinian. Commercial carriers for telephone, internet, and television are available on the island.

4.18.1.2.13.4 Guam

The site is close to existing roadways and utility infrastructure. It has adequate on-island power, municipal potable water, and municipal sanitary sewer system. Solid waste and hazardous waste can be collected and disposed of by private contractors. Commercial carriers for telephone, internet, and television are available on the island.

4.18.1.2.14 Socioeconomics and Environmental Justice

At any of the potential locations, construction work associated with the relocation would generate economic benefits. If the International Broadcasting Bureau is relocated to Rota, then some temporary construction workforce housing would likely need to be constructed to support construction activities.

International Broadcasting Bureau operations should generate economic benefits. Sufficient public services and housing capacity exist on Guam, Saipan, and Tinian to avoid stresses related to the estimated 25 permanent employees. However, additional population related to these employees may put some strain on Rota public services.

4.18.1.2.15 Hazardous Materials and Waste

Candidate sites would be screened for the presence of contamination on land proposed for development or use following the potential relocation. Neither Rota nor Tinian has a permitted landfill that would handle hazardous waste. Any hazardous materials used during construction or operations would be handled according to applicable federal and local regulations. Any generated hazardous waste would be collected and transferred by private contractors to licensed operators for regulated disposal of hazardous waste.

4.18.1.2.15.1 Hazardous Materials

Construction activities would include vegetation removal, grading, excavation, and construction. Construction activities would cause a short-term increase in the use of hazardous materials that would end when the construction is finished. Most of the hazardous materials expected to be used are common to construction (e.g., diesel fuel, gasoline, and propane; hydraulic fluids, oils, and lubricants; welding gases; paints and solvents; adhesives; and batteries). The increased volume and use of hazardous materials during the construction period would present a potential for increased accidental spills and releases of hazardous materials, resulting in potential impacts to human health (direct impacts) and the environment (i.e., soils, surface water, groundwater, air, plants and animals [indirect impacts]). The hazardous materials would be handled, stored, and disposed according to applicable best management practices, standard operating procedures, and federal and CNMI or Guam regulations.

Hazardous materials would be brought to construction sites using existing or proposed public transportation routes. Transportation of all materials would be conducted in compliance with the U.S. Department of Transportation regulations and CFR Title 49. Following the best management practices and standard operating procedures and compliance with federal and CNMI/Guam regulations would reduce the likelihood and volume of accidental releases, allow for faster spill response times, and enable timely cleanup. Similar procedures would be implemented for operation of the proposed International Broadcasting Bureau facilities.

4.18.1.2.15.2 Toxic Substances

Construction and demolition of any buildings on these candidate sites may reveal asbestos-containing materials, lead-based paint, or polychlorinated biphenyls that were used in building materials or electrical equipment at the time of original construction. If any of these toxic substances are encountered, properly trained and licensed contractors would be used to ensure that all U.S. military, federal, and CNMI/Guam hazardous waste testing, handling, and disposal procedures and requirements are followed for their collection and disposal. Because the U.S. Environmental Protection Agency banned lead-based paint in 1978, and banned most uses of polychlorinated biphenyls in 1979, these toxic substances would not be used to construct the proposed new facilities; nor would asbestos-containing materials be used. Similar procedures would be implemented for operation of the proposed International Broadcasting Bureau facilities.

4.18.1.2.15.3 Hazardous Waste

Construction activities would result in a short-term increase in the generation of hazardous waste that would end when construction is finished. Hazardous waste generated from construction activities includes pesticides, herbicides, solvents, adhesives, lubricants, corrosive liquids, batteries, and aerosols. Due to the projected increase in generation of hazardous waste, this potential relocation would have the potential to result in adverse impacts to human health and the environment (i.e., soils, surface water, groundwater, air, and biota). However, the hazardous waste would be handled and disposed per applicable best management practices and standard operating procedures (see Appendix D, *Best Management Practices*). Construction contractors would be required to comply with all applicable requirements concerning handling, storage, and disposal of construction-related hazardous waste. All hazardous waste would be containerized and shipped off the island to the appropriate disposal facility site. Existing public transportation routes, including shipping by commercial carrier, would be utilized for the conveyance of hazardous waste to the disposal facility site. Transportation of all hazardous waste would be conducted in compliance with U.S. Department of Transportation regulations and CFR Title 49. Similar procedures would be implemented for operation of the proposed International Broadcasting Bureau facilities.

4.18.1.2.15.4 Contaminated Sites

The design of the proposed International Broadcasting Bureau facilities would either avoid the disturbance and dispersion of soil and groundwater at contaminated sites, or use of best management practices to minimize them. Construction would not increase the potential for impacts to contaminated sites.

If contaminated sites are present at the project locations, consideration and careful attention during project design phases would be given prior to construction to avoid these sites. If the proposed construction location cannot be designed to avoid these contaminated sites, then various best management practices and construction operational protocols would be followed to protect human health and the environment.

In addition, special design techniques and methodology would be required to ensure the long-term structural integrity of proposed construction projects. Best management practices that would be used include, but are not limited to, development of site-specific health and safety plans; the use of engineering controls (e.g., dust suppression) and administrative controls; and the use of personal protective equipment (see Appendix D, *Best Management Practices*) for a discussion of proposed best management practices.

For construction on these candidate sites, explosives safety documentation would be prepared that outlines specific measures that would be implemented to ensure the safety of workers and the public. This would reduce the potential hazards related to the exposure to unexploded ordnance. It would also be in accordance with Department of Defense Instruction 3200.16 *Operational Range Clearance* (Department of Defense 2005), Department of Defense Instruction 4140.62 *Material Potentially Presenting and Explosive Hazard* (Department of Defense 2014), Department of Defense Directive 6055.9, *Department of Defense Ammunition and Explosive Safety Submission* (DoN 2010) and Naval Ordnance and Safety and Security Activity Instruction 8020.15D (DoN 2011). Best management practices that would be implemented include having qualified operational range clearance or unexploded ordnance personnel perform surveys to identify and remove potential unexploded ordnance before the start of ground-disturbing activities. The identification and removal of the unexploded ordnance before the start of construction activities would minimize potential impacts. However, additional safety precautions could include operational range clearance or unexploded ordnance personnel supervision during earth moving and providing a safety awareness/hazardous assessment brief to construction contractors and equipment operators to train them to identify whether materials are unexploded ordnance that potentially present an explosive hazard. Any unexploded ordnance identified during construction would be disposed of in accordance with applicable regulations.

4.18.1.2.16 Public Health and Safety

Construction personnel would be required to maintain boundary signs, fences, and barricades to provide notice to the public of active construction zones. In addition, security personnel or construction safety flaggers could provide warnings to the public of ongoing construction activities along roadways and publicly visited areas (e.g., recreational areas). Because the public would be excluded from entering active construction areas, potential impacts to public health and safety would not result in any safety risk.

Each of the four sites are located away from ordnance facilities, and fencing would restrict access to the site by the general public. Therefore, hazards of electromagnetic radiation to ordnance and personnel would not create a safety risk. Diesel fuel could be used on the site without a safety risk.

4.18.2 Pagan Dock and Breakwater

A planned 200-foot (61-meter) dock and associated 300-foot (91-meter) breakwater would be located on the west side of Pagan, at the southern end of Red Beach. The dock/breakwater would support loading/off-loading operations for a joint high speed vessel and landing craft. The dock and breakwater would accommodate landing craft logistical operations, and possibly a Littoral Combat Ship. Biosecurity inspections and wash downs of vehicles and equipment as needed would be conducted in these areas. A design has not been completed. However, it could consist of a 150-foot (56-meter) jetty extending from shore to a loading platform (dock) with its seaward face in water about 20 feet (6 meters) deep. The jetty width could be 20-35 feet (6-11 meters). The dock could be a concrete slab supported by a steel sheet pile structure. The proposed location for the dock and associated breakwater is shown in Figure 4.18-5.

Consultation with agencies may be required. Potential consultations include:

- Endangered Species Act, Section 7: U.S. Fish and Wildlife Service and National Marine Fisheries Service
- Marine Mammal Protection Act: National Marine Fisheries Service
- Magnuson-Stevens Fishery Conservation and Management Act: National Marine Fisheries Service
- National Historic Preservation Act, Section 106: Advisory Council on Historic Preservation, and CNMI Historic Preservation Office
- Coastal Zone Management Act: CNMI Bureau of Environmental and Coastal Quality
- Section 404 of the Clean Water Act: U.S. Army Corps of Engineers

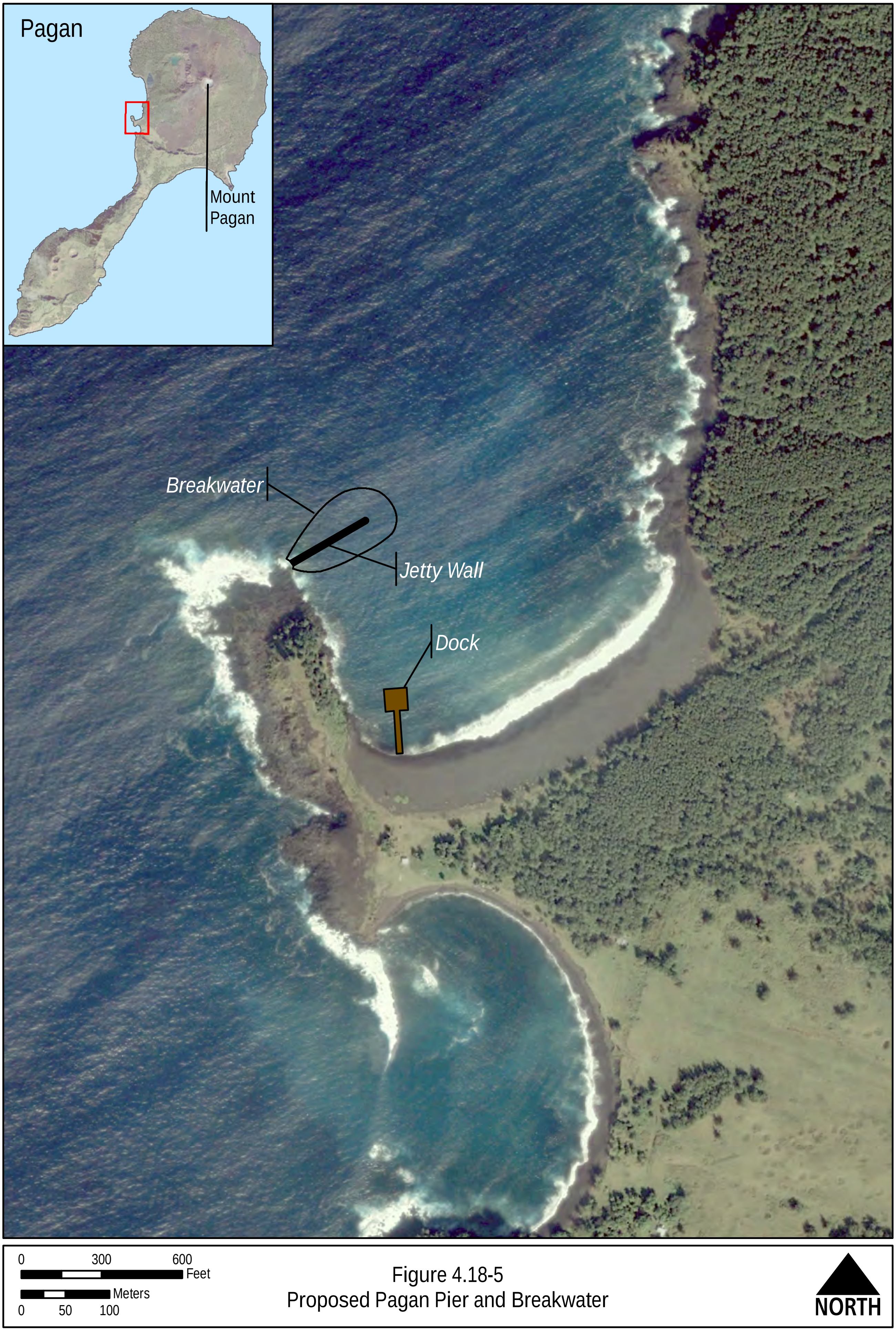


Figure 4.18-5
Proposed Pagan Pier and Breakwater

A programmatic analysis of impacts is presented below. If, in the future, there is a decision to move forward with the proposed dock and breakwater, then the appropriate level of project-specific environmental studies, consultations, and NEPA documentation and public review will be undertaken.

4.18.2.1 Geology and Soils

The proposed dock and its associated breakwater would be constructed according to appropriate Department of Defense and accepted seismic engineering standards to ensure stability and safety in the event of an earthquake. An earthquake/seismic hazard and volcanic hazard communication and evacuation plan for personnel involved in construction and training on Pagan would be implemented to minimize the potential for exposure to seismic hazards, including tsunamis. Construction would be limited to in-water areas at Red Beach and would have minimal effects to onshore geology and soils.

In-water construction would disturb marine sediments. Turbidity during construction would be monitored and minimized as much as possible. Operations at the dock would not affect topography, geologic units, or soils on Pagan. Using best management practices and standard operating procedures would lessen the potential for adverse impacts.

4.18.2.2 Water Resources

In-water construction would have short-term and localized impacts to nearshore waters. Potential impacts include turbidity, sedimentation, decreased water clarity, and potential accidental discharge of pollutants. In-water construction of both the dock and breakwater at Red Beach would result in direct impacts to nearshore waters. Both the dock and breakwater would fill waters of the U.S. that is regulated by the federal government. Construction activities would also temporarily disturb sediment and increase turbidity and thus impact water quality, clarity, and dissolved oxygen levels. Best management practices, including isolating the in-water construction area and potential use of silt curtains, would be utilized to capture sediment and debris caused by in-water construction activities. In-water construction would require authorization under Section 404 and Section 401 of the Clean Water Act, Section 10 of the Rivers and Harbors Act, and the Coastal Zone Management Act.

Operations at the dock could potentially impact water quality. The accidental release of other pollutants associated with the use and maintenance of the dock could also impact nearshore water quality. However, accidental release of these pollutants would only occur as a result of a failure of a materials-handling best management practice, and any spills would be cleaned up immediately. Spill prevention plans and other best management practices would be implemented to minimize the impact of operations on nearshore water quality.

4.18.2.3 Air Quality

Construction of the proposed dock and breakwater would create air emissions from construction equipment. The proposed dock and breakwater would facilitate more marine traffic. However, operation of the dock would not result in new types of emissions from stationary sources. No sensitive land uses are located close to the proposed dock and breakwater location, and frequent trade winds would disperse emissions.

Existing volcanic gases would continue to be released from volcanic eruptions as part of natural geological processes. Sulfur dioxide, a criteria pollutant, is one of the most common gases released in volcanic eruptions and is hazardous to humans. Periodic sulfur dioxide releases due to volcanic eruptions could potentially have an adverse impact to air quality. However, volcanic eruptions are natural geological processes. Furthermore, construction and operation of the dock and breakwater would not have an impact to the frequency of such eruptions.

4.18.2.4 Noise

The Pagan dock and breakwater would involve construction of relatively minor harbor facilities. Equipment and other construction activities typically generate noise levels ranging from 70 to 90 decibels at a distance of 50 feet (15 meters) (U.S. Department of Transportation 2006). Construction activities for the proposed dock and breakwater would not impact any residential properties or noise-sensitive receptors such as schools, houses of worship, and hospitals as no such features exist on Pagan Operations at the dock and breakwater would involve marine vessel activities, as well as ground-based equipment and vehicles. Noise would be similar to those conducted at Red Beach without these facilities.

Noise would be caused by construction equipment onshore and in nearshore waters of Red Beach. No blasting would be required. It has been found that noise levels traveling in the air, above water, from typical dredging in deeper water of harbors and rivers could be 87.3 decibels at 50 feet (15 meters), dropping to 61.2 decibels at 1,000 feet (305 meters), and to 55.2 decibels at 2,000 feet (610 meters) from the source (DoN 2010). The highest typical in-water noise levels for dredging operations in harbors and rivers are generally 150 to 162 decibels or 1 micro Pascal at 3 feet (1 meter) (Greene and Moore 1995). Proposed construction operations would occur within shallow waters, typically at or near low tide. Underwater noise levels would be, therefore, less than noise levels presented above for deep-water harbors and rivers. However, underwater noise from pile driving to construction the dock could affect marine mammals. It will be important to have future modeling done of underwater noise that simulates the distance and strength of underwater noise based on the number and type of piles as well duration of construction and presence of any marine mammals or sea turtles in the area. These studies would be done should the dock and its associated breakwater proposals move forward.

Noise impacts would not affect residential areas, schools, houses of worship, and hospitals (i.e., sensitive receptors). Operational noise would be consistent with noise proposed for Red Beach (see Section 4.5, *Noise*). This includes vessel activity, terrestrial vehicle activity, and human sources.

4.18.2.5 Airspace

The proposed dock and breakwater would not affect the airspace or airfield, nor would it alter new or existing airspace that would impact civilian air traffic.

4.18.2.6 Land and Submerged Land Use

Construction of the dock and breakwater harbor facilities would facilitate safe access to Pagan. There are currently no federal lands or privately owned lands on Pagan. The CNMI government owns all of Pagan. Under the CJMT EIS/OEIS proposed action, the federal government would seek to acquire a real estate interest for the entire island of Pagan (approximately 11,794 acres [4,773 hectares]) from the

CNMI government. This would include the area needed to construct the dock and breakwater. Therefore, construction and operation of the dock and breakwater would not create any new changes to land ownership, submerged land ownership and management, or the CNMI Areas of Particular Concern. The Territorial Submerged Lands Act was amended to convey certain submerged lands to the CNMI government, which included submerged lands around Pagan. The submerged lands around Pagan are now owned by the CNMI government. The proposed dock and breakwater would not affect compatibility with plans and polices or with current land uses. This project would allow easier public access to Pagan when military training is not occurring.

Since 1981, Pagan has been largely closed to public access due to volcanic risk. Operation of the dock and breakwater would not change the amount of time that Pagan is available to the public during the training. The remainder of the year all but the High Hazard Impact Areas would be open to the public, should the volcano risk be reduced. While unauthorized (i.e., no use permits obtained from the CNMI government), individual visitors use the land for subsistence. Scientific studies do occasionally take place on Pagan. There is also some recreation use with occasional ecotourism visits to Pagan by groups and individuals. None of these activities would be affected by operation of the dock and breakwater.

There is no CNMI land use designation for Pagan, so it is therefore assumed to be conservation. The proposed use of submerged land by the U.S. military for the dock and breakwater would constitute a change in submerged land use from the present use (conservation). The dock and breakwater would introduce a new use and thus a change in the use of submerged lands, but not completely incompatible. However, this use would be consistent with activities proposed to occur there for proposed CJMT training. This includes transport and offloading of equipment and personnel at Red Beach.

The proposed dock and breakwater would affect coastal uses and resources that are subject to Coastal Zone Management Act federal consistency requirements. These facilities would be consistent to the maximum extent practicable with the enforceable policies of the CNMI Bureau of Environmental and Coastal Quality. The proposed action would be consistent to the maximum extent practicable with the Coastal Zone Management Act and the enforceable policies of the CNMI Bureau of Environmental and Coastal Quality.

The proposed dock and breakwater would not be located in the CNMI Areas of Particular Concern. Therefore, the proposed dock and breakwater would be inconsistent with the intended special (protective) management of the CNMI Areas of Particular Concern. The impact on the corals, beaches, and marine environment, and potential measures to lessen these impacts, are discussed in detail in Section 4.18.2.9, *Marine Biology*.

4.18.2.7 Recreation

Pagan is officially uninhabited and does not contain any official recreational areas. Nevertheless, there have been discussions about developing Pagan as an eco-tourism destination and a staging area for visitors to the Marianas Trench National Marine Monument area. The proposed dock and breakwater would be permanent structures at Red Beach. Construction at this location would not limit the impact to the island's potential recreational resources during the construction phase.

Operation of the proposed dock and breakwater would not result in additional closure of the northern portion of the island beyond what is proposed for the CJMT EIS/OEIS proposed action. Therefore, no additional restrictions of recreational activities would occur due to operation of the dock and breakwater.

Consequently, the proposed dock and breakwater would not alter the areas available for recreational use. The proposed harbor improvements could provide beneficial impacts to the island recreational areas by facilitating safe access to the island for visitor traffic.

4.18.2.8 Terrestrial Biology

The construction of the dock and breakwater would occur in water and would not change the project footprint onshore. Additional vessel activities would occur at Red Beach, but overall noise levels would not substantially increase. The dock and breakwater would not cause additional foot traffic, vehicle traffic, or ordnance use at other places throughout the island. Therefore, vegetation communities, native wildlife, and special-status species would not be affected.

4.18.2.8.1 Vegetation Communities

Temporary disturbance would occur near the construction area for staging of construction vehicles, equipment and supplies. However, no vegetation communities or habitat would be permanently affected by construction activities. No native limestone forest would be affected by construction. Limestone forests on Pagan are important as they retain the functional ecological components of native forest. This habitat provides for the majority of Pagan's native species, including candidate and listed special-status species, as well as maintaining water quality and reducing fire risk.

4.18.2.8.2 Native Wildlife

No long-term habitat loss would result from the construction of the proposed dock and breakwater. Damage of forested areas, particularly native limestone forest, by non-native mammals (i.e., feral goats and pigs) is a serious concern on Pagan. Construction of the proposed dock and breakwater would not affect the concentrations or locations of these animals on site or at other areas on the island. Therefore, the island vegetation community and its function would not be affected. In addition, implementation of best management practices would occur, as identified in Appendix D, *Best Management Practices*.

Since there would be no loss of forested habitats, there would not be resulting loss of nesting areas or other effects to native bird populations because suitable nesting habitat occurs throughout the island. Short-term construction noise may temporarily affect areas with suitable habitat for some, but birds could relocate to other suitable habitat and return when construction is completed. Nests in the immediate vicinity of construction activities also could be disturbed by noise and human activities and susceptible to abandonment and depredation. This would temporarily displace birds, some of which may be lost or have reduced breeding success. Construction noise impacts would be short-term and minor at Red Beach.

Increased traffic and human presence, as well as noise from construction, may temporarily displace wildlife species, causing them to expend additional energy. Direct mortality from construction equipment is unlikely since noise associated with pre-construction activities and human presence is likely to disperse wildlife prior to any equipment use.

4.18.2.8.3 Special-status Species

Direct impacts to special-status species from proposed construction activities can include the removal of habitat, fragmentation of remaining habitat, and associated noise and human activities. Red Beach is not within the vicinity of federally listed species habitat on Pagan. Therefore, there would be no impacts to these species resulting from construction. The proposed dock footprint also would not affect foraging habitat. Therefore, no effects from construction would occur to the Mariana fruit bat.

The proposed dock and breakwater construction activities would not reduce the amount of habitat available to Migratory Bird Treaty Act-listed birds on Pagan. There would be no loss of forested habitats, and therefore no resulting loss of nesting, roosting, or foraging areas. Therefore, adverse effects on the migratory bird populations on Pagan would not occur. Short-term construction noise may temporarily impact suitable habitat for some birds in the vicinity of the construction area, but they would relocate to other suitable habitat, and could return to the area following construction. In addition to the impacts to habitat identified above, nests in the immediate vicinity of construction activities may be disturbed by noise and human activities and susceptible to abandonment and depredation. This would temporarily displace birds, some of which may be lost or have reduced breeding success. Therefore, implementation of dock and breakwater construction activities would not result in less than significant impacts to Migratory Bird Treaty Act-listed birds. In addition, the potential best management practices minimize the potential for impacts.

No sea turtles have been observed nesting on the beaches of Pagan. In addition, sightings of sea turtles on the beaches of Pagan are rare, with one green sea turtle observed resting on Red Beach (Kessler 2011). Pre-construction monitoring could occur to ensure there are no sea turtles resting on the beach or in their nests. The monitoring could include pre-construction surveys to delineate boundaries around nest sites as well as postponing construction activities when a nesting sea turtle is observed near the proposed dock location.

4.18.2.9 Marine Biology

Actions that could potentially impact marine biology include in-water construction and associated increase in vessel traffic. The proposed dock and breakwater would affect marine biological resources near the new construction if habitats are disturbed or removed. There would be temporary impacts to mobile marine resources near construction due to increased noise levels. A Clean Water Act Section 404 permit would be required for construction and mitigation would be developed through consultation with regulatory agencies.

There would be impacts associated with the use of the new dock. The level of noise would not increase over that of the CJMT EIS/OEIS proposed action, but there would be more days per year that noise is generated on land that could result in impacts to marine mammals and sea turtles. There would be operational noise in the harbor associated with use of the new dock that could impact species in the area.

Consultation with agencies may be required. Potential consultations include:

- Endangered Species Act, Section 7: U.S. Fish and Wildlife Service and National Marine Fisheries Service

- Magnuson-Stevens Fishery Conservation and Management Act: National Marine Fisheries Service
- Marine Mammal Protection Act, National Marine Fisheries Service

4.18.2.9.1 Marine Habitats

Proposed in-water construction of the dock and breakwater could potentially impact marine habitats. This includes in-water construction activities as well as associated vessel traffic and land-based vehicle activities. The evaluation of potential impacts to marine habitats focuses on the ecological function of the physical substrate; impacts specific to marine biological organisms are described in the sections below. Construction activities at Red Beach could impact marine habitats by disturbing or altering the seafloor, water quality, or physical environment (e.g., underwater noise). Marine habitats may be exposed to direct and indirect physical disturbance. Construction activities could result in the loss of marine habitat anywhere from +3 feet (1 meter) mean-mean low water to -20 feet (6 meters) mean-mean low water.

The marine habitats (soft shore, hard bottom, and aquatic bed) currently found within the designated amphibious landing areas would be modified through direct, physical disturbance. Erosion or changes in sediment transport (extent to be determined following additional information via modelling or an engineering study) may result in long-term direct and indirect impacts to the abundance and distribution of marine organisms that utilize habitat impacted by such changes, particularly soft shore habitat and aquatic beds.

Physical alteration of hard bottom habitat could also impact ecological function at Red Beach. The removal of some coral and homogenization of the slope of the reef could result in changes to refuge availability, differences in wave energy propagation, the runoff profile of the beach, and filtration by marine organisms.

Alterations to a marine habitat’s exposure to wave action, sunlight (i.e., shading from the proposed dock), and tidal fluctuations may in turn affect the temperature, salinity, and pH of the water. Such changes could impact the distribution and composition of marine organisms (Cowardin et al. 1979).

Construction of the proposed dock and breakwater would result in direct temporary impacts to the water quality of nearshore waters, particularly to such parameters as turbidity, sediment deposition, and dissolved oxygen levels due to the physical process of constructing the proposed dock and breakwater. Construction of the proposed dock and breakwater could result in long-term and permanent, direct and indirect adverse impacts to marine habitat, since current habitat types and ecosystem function would be lost or degraded.) Impacts would be minimized to the maximum extent practicable through adherence to best management practices, such as limiting in-water work to low tidal conditions and installation of silt/turbidity curtains.

4.18.2.9.2 Marine Flora

Marine flora impacts at Red Beach could be minimized through design considerations and adherence to best management practices.

4.18.2.9.3 Marine Invertebrates

Construction activities would impact corals by removing coral, filling coral reefs or by stirring up the seafloor, leading to increased turbidity that could reduce water quality. Impacts to corals would be expected to affect other invertebrates, and design considerations and adherence to best management practices to protect the corals are expected to protect other invertebrates as well.

4.18.2.9.4 Coral

Construction impacts would primarily result from removal of corals and other invertebrates. Red Beach has low topographic complexity, low coral cover, and high sand cover. The areas of the footprints for the dock and breakwater have moderate topographic complexity, low coral cover, and low sand cover. There is minimal coral cover in the dock footprint (ranging from 1-10%), but more coral cover and diversity in the breakwater footprint (ranging from 10-30%). The majority of the coral at Red Beach was observed at depths shallower than 12 feet (4 meters) at the headlands to the north and south of Red Beach, but not directly in front of the sandy beach. By contrast, the footprint areas have greater species richness than any of the other beaches surveyed in 2013 (DoN 2014b), and the corals occur at greater depth than along the actual beach. In the footprint areas, small coral colonies of all species present are abundant and large colonies are uncommon. Corals would be directly affected in locations where piles for the dock would be driven. One Endangered Species Act-listed coral species (*Acropora globiceps*) was observed at Red Beach (DoN 2014b). In the footprint of the breakwater, all corals within the footprint would be directly affected by the material placed for the base of the breakwater.

4.18.2.9.5 Fish

Construction activities may have temporary adverse effect on fish species. However, impacts would be short term and localized. Changes to the structure and complexity of the environment by the addition of a dock and breakwater could change the distribution of some fish species by aggregating individuals and increasing interaction among species.

4.18.2.9.6 Essential Fish Habitat

There is Essential Fish Habitat is the vicinity of the proposed dock and breakwater. Construction activities could impact Essential Fish Habitat by disturbing or altering the seafloor, water quality, or physical environment (e.g., underwater noise) at Red Beach, which is designated as Essential Fish Habitat.

Potential impacts to water quality characteristics of the marine environment during coastal and inland operational activities would be reduced but not avoided by implementing best management practices to control sedimentation, control stormwater runoff, eutrophication (i.e., enriched in dissolved nutrients), and fuel or chemical spills.

Construction would result in Essential Fish Habitat within the footprints of the proposed dock and breakwater at Red Beach being permanently unavailable. The location of the jetty would be permanently unavailable, but after completion, the area along the jetty and beneath the dock would add structural complexity to the environment and would be available for fish and invertebrates to use. The habitat types and ecosystem function within these areas would be chronically lost or degraded. Construction may adversely affect Essential Fish Habitat under the Magnuson-Stevens Fishery

Conservation and Management Act. An Essential Fish Habitat Assessment would be prepared as part of future environmental studies of these proposed projects.

4.18.2.9.7 Sea Turtles

Sea turtle densities at Pagan during the 2-week survey conducted in August 2013 survey appear relatively uniform, with density calculations ranging between 49 sea turtles per square mile (19 sea turtles per square kilometer) on the northwestern coast to 101.3 sea turtles per square mile (39.1 sea turtles per square kilometer) on the western coast (DoN 2014c). However, few turtles were observed near Red Beach during the 2013 survey, and no sea turtles have been observed nesting on the beaches of Pagan. In addition, sightings of sea turtles on the beaches of Pagan are rare, with only one green sea turtle observed resting on Red Beach (Kessler 2011).

Construction activities could potentially impact sea turtles. Sea turtle hearing is less sensitive to impacts than marine mammals, although in the shallow waters of near the dock and breakwater locations they would likely be much closer to the noise source. The highest intensity in-water noise would be due to impulsive noise associated with pile driving. If construction or operational vessel noise exceeds 180 decibels in the area of a turtle, and they are unable to leave the area, adverse impacts to sea turtles could occur. Proposed construction could adversely affect sea turtles that may be exposed to sound levels capable of causing behavioral changes during construction. This could occur through a series of behavioral modification in the form of mild alert and startle responses, avoidance of the construction area, and alteration of swimming and diving patterns. It is not likely that turtles would be injured or killed by the construction noise source. In addition, their exposure would likely have no measurable impact on their ability to forage, shelter, reproduce, or avoid predators and other threats. Construction and operation could cause localized turbidity. However, construction best management practices would likely keep suspended sediments immediately adjacent to the construction activity. It would be unlikely that sea turtles would approach close enough to the construction to be exposed to project-related elevated turbidity.

Pre-construction monitoring could occur to ensure there are no sea turtles resting on the beach or in their nests. The monitoring could include pre-construction surveys to delineate boundaries around nest sites as well as postponing construction activities when a nesting sea turtle is observed near the proposed dock location. Construction could cause temporary habitat loss for sea turtles since turtles may be temporarily displaced for the duration of construction activities at Red Beach.

Section 7 consultation with National Marine Fisheries Service and the U.S. Fish and Wildlife Service under the Endangered Species Act may be required.

See Section 4.18.2.8, *Terrestrial Biology*, for impacts to sea turtle nesting.

4.18.2.9.8 Marine Mammals

Construction of the dock and breakwater may impact marine mammals acoustically as well as via an increase for the potential of marine mammal-vessel interaction. Once the breakwater has been constructed, it is not anticipated to impact marine mammals, as it will become a permanent structure. Operation of the dock structure will increase the potential for marine mammal-vessel interactions as vessels enter the embayment associated with Red Beach; however, the increase in the potential for marine mammal-vessel interaction is not anticipated to be significant, based on the low number of marine mammal sightings in the area.

Marine mammals have been both visually and acoustically detected in the CNMI (DoN 2007; Ligon et al. 2011; HDR 2012; Hill et al. 2012, 2013a, 2013b, 2014; Oleson 2013), as well as specifically off Pagan (DoN 2014d). The *Marine Mammal Survey* conducted in support of this EIS/OEIS identified five marine mammals in the nearshore waters of Pagan using both acoustic and visual methods. These included sperm whales, common bottlenose dolphins, spinner dolphins, Cuvier's beaked whales, and Blainville's beaked whales. All of these species are afforded protections under the Marine Mammal Protection Act and the sperm whale is also protected under provisions of the Endangered Species Act.

Under the Marine Mammal Protection Act, National Marine Fisheries Service has defined levels of harassment for marine mammals. The National Marine Fisheries Service uses generic sound exposure thresholds to determine when an activity in the ocean produces sound that might result in impacts to a marine mammal such that a take by harassment might occur (National Marine Fisheries Service 2005). Recent studies of pile driving used to construct offshore wind turbines have validated the distances over which underwater sound from pile driving may exceed National Marine Fisheries Service thresholds (Bailey et al. 2010), as well as behavioral responses of harbor porpoises (*Phocoena phocoena*) to intense sound from pile driving (Thompson et al. 2010; Brandt et al. 2011). Current National Marine Fisheries Service practice regarding exposure of marine mammals to high level sounds is that cetaceans and pinnipeds exposed to impulsive sounds of 180 and 190 decibel root mean squared or above, respectively, are considered to have been taken by Level A (injurious) harassment. Level A acoustic harassment under the Marine Mammal Protection Act constitutes harm under the Endangered Species Act, whereas Level B acoustic harassment under the Marine Mammal Protection Act is also harassment under the Endangered Species Act. Since pinniped species are not known to occur in the vicinity of the project, acoustic thresholds for cetacean species will be discussed in this section. Impact pile driving is considered an impulse (non-continuous) sound source, and vibratory pile driving is a continuous sound source, so the two types of hammers are treated differently for Level B take thresholds.

Pile driving and/or vibratory pile extraction would generate underwater noise that potentially could result in disturbance to marine mammals. Transmission loss underwater is the decrease in sound intensity due to sound spreading and chemistry and viscosity-based absorption as an acoustic pressure wave propagates out from a source. Parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography.

Pile driving during the construction period (for the new sheet pile bulkhead and mooring dolphins) would comprise the project's greatest noise source of concern in the underwater environment. The frequency and intensity of the sound energy generated by pile driving is primarily a function of the type and size (diameter or length) of the piling or sheet pile, the driving mechanism (e.g., impact or vibratory hammer), and the type of substrate into which the pile is being driven. Several different types of piles would be used during construction, including steel sheet piles, and round mooring piles. In the absence of site-specific acoustic data, measured source levels from similar pile driving events were used to estimate pile driving source levels for this project (California Department of Transportation 2012). Because pinniped haul out locations have not been observed in the project area, airborne noise levels are not evaluated relative to National Marine Fisheries Service airborne threshold criteria.

Table 4.18-1 provides the density estimates for those species that may potentially occur in the Project Area. No seasonal variation in marine mammal density was noted for these species. While the spinner dolphin, bottlenose dolphin, Cuvier's beaked whale, Blainville's beaked whale and sperm whale are the only species that have been either visually or acoustically detected during surveys around Pagan (DoN 2014d), any of the species presented in Table 4.18-1 may occur within the zone of influence associated with pile driving. For example, Hill et al (2014) found that satellite tagged marine mammals routinely moved great distances between islands or island groups. While none of the satellite tagged animals were shown to occur off Pagan, this does not preclude them from potentially occurring within the 120-decibel zone of influence.

Table 4.18-1. Density Estimates for Species Potentially Occurring in the Project Area

Common Name	*Scientific Name*	*Density Estimate (animals/km^2)*
Family Delphinidae		
Bottlenose dolphin	*Tursiops truncatus*	0.00131[1]
False killer whale	*Pseudorca crassidens*	0.00111
Melon-headed whale	*Peponocephala electra*	0.00428
Pantropical spotted dolphin	*Stenella attenuata*	0.00226
Pygmy killer whale	*Feresa attenuata*	0.00014
Rough-toothed dolphin	*Steno bredanensis*	0.00355[1]
Short-finned pilot whale	*Globicephala macrorhynchus*	0.00362[1]
Spinner dolphin	*Stenella longirostris*	0.00699[1,2]
Family Ziphiidae		
Cuvier's beaked whale	*Ziphius cavirostris*	0.00621
Family Hyperoodontidae		
Blainville's beaked whale	*Mesoplodon densirostris*	0.00117[1]
Family Kogiidae		
Dwarf sperm whale	*Kogia sima*	0.00291[1]
Family Physeteridae		
Sperm whales	*Physeter macrocephalus*	0.00123

Notes: [1]Derived from density data from the Hawaii Range Complex.
[2]Based on density estimates for waters in a main Hawaiian Islands stratum (Barlow 2006).
Sources: Barlow 2006; Fulling et al. 2011; DoN 2014d; Hill et al. 2014.

Results of visual surveys in 2013 indicate that spinner dolphins and bottlenose dolphins would be present around Pagan during project construction and would hear pile driving noise (DoN 2014d). Based on the density estimates in Table 4.18-2, deeper-water species that could occur in the greatest concentration in the area covered by the 120-decibel threshold are the melon-headed whale, short-finned pilot whale, and the rough-toothed dolphin. Based on information provided in Hill et al (2014), these species were detected in waters greater than 1,400 feet (430 meters) deep where the effects of the pile driving noise would likely be mitigated by environmental variables (e.g., bathymetry variation, temperature and salinity fluctuations). However, these species may also be sighted in the nearshore environment at depths of as little as 853 feet (260 meters). Of the species most likely found in the nearshore environment, the bottlenose and spinner dolphins would be the most likely species to be impacted by noise during construction. Hill et al (2014) found that median depths for was 289 feet (88 meters) for the bottlenose dolphins and 155 feet (47 meters) for spinner dolphins. Regardless, because of their highly mobile nature, it is expected that individuals would avoid the area and the construction would not pose a substantial risk to individuals, populations or the species as a whole.

Construction of the breakwater to the north of the dock would have short-term impacts to marine mammals. Noise as a result of adding material to the breakwater for establishment and stabilization purposes is not anticipated to reach levels that would exceed regulatory thresholds. Construction-related vessels may also be in the area associated with the breakwater, but they are not anticipated to substantially increase the likelihood for marine mammal-vessel interactions. Sightings data in the vicinity of Red Beach, and known habitat characteristics, indicates that dolphin species would be the most likely species to be in the vicinity of the construction. However, based on their highly mobile nature, it is expected that individuals would avoid the area and the construction would not pose a substantial risk to individuals, populations or the species as a whole. Furthermore, impacts would be minimized through design considerations and adherence to best management practices.

Use of the dock structure by vessels is not anticipated to pose a substantial risk to marine mammals. However, if a strike were to occur, the collision could cause major wounds and may be fatal to marine mammals. In addition, sound from surface vessel traffic may cause behavioral responses of marine mammals. While an increase in the number of vessels in the area would increase the potential for marine mammal-vessel interactions, the potential for strike is not anticipated to pose a risk to the populations or the species as a whole. Individuals may change direction to avoid incoming/outgoing vessels, but this change in behavior is anticipated to be short-term and no long-term effects are anticipated.

Consultation with National Marine Fisheries Service under the Marine Mammal Protection Act may be required.

4.18.2.9.9 Special-status Species

The DoN recorded the presence of coral species proposed for listing under the Endangered Species Act on Pagan. None were identified at Red Beach (DoN 2014b). No Endangered Species Act-proposed coral species were identified at Red Beach.

4.18.2.10 Cultural Resources

Historic properties could include Pre-Contact *latte* complexes, pre-World War II Japanese Administration sites, and World War II-era Japanese defensive sites. Construction of the proposed dock and breakwater would include in-water construction and some onshore ground disturbance. However, no historic properties are identified in the project footprint. Visual setting effects to historic properties would be less than significant because the proposed dock and breakwater would not be visible to most historic properties. Also, the proposed dock and breakwater would not affect areas identified as potential traditional cultural properties. Therefore, the proposed dock and breakwater would not alter or affect archaeological sites recommended eligible for listing in the National Register of Historic Places. There would be no direct impacts to historic properties.

In addition, potential impacts could be minimized by developing an agreement document through the Section 106 process with the CNMI Historic Preservation Office and other consulting parties. The agreement document would include the measures that will be taken to avoid, minimize, and/or mitigate the effects of the undertaking on historic properties. Such measures typically include data recovery excavations, documentation, public education, and additional investigations. See Appendix N, *Cultural Resources Technical Memo* for a discussion of the consultation process.

4.18.2.11 Visual Resources

Construction would be required at Red Beach, and would involve creation of a new dock extending out from shore and a breakwater farther offshore (see Figure 4.18-5). The construction would mostly involve in-water construction activities, associated vessel activities, and some onshore activities. Because of the overlap between the construction period and operation, visual impacts are presented in Operation Impacts.

Permanent changes to the visual environment at Red Beach would occur. The harbor improvements would change the visual landscape of the harbor. However, since Pagan is essentially uninhabited, no impact would occur.

4.18.2.12 Transportation

The proposed dock and breakwater would not affect the air transportation facilities of Pagan.

Currently there are no roads, transit networks, pedestrian, bicycle facilities and no significant vehicular traffic patterns occur on Pagan. Only all-terrain vehicle pathways exist on Pagan and their use is limited. Construction of the proposed dock and breakwater would require heavy equipment, including, but not limited to: road graders, vibratory compactors, dump trucks, and backhoes. Construction would not increase the potential for impacts to traffic circulation or Level of Service for vehicles, public transit, pedestrians, bicycles, increase the rate of traffic related accidents, or reduce transportation safety.

There is currently no functional dock or appreciable marine vessel traffic to Pagan. Therefore, the proposed dock and breakwater would have a beneficial impact to marine transportation. Operation of a usable dock would facilitate transport of cargo through a more efficient method than transferring cargo directly to beaches via amphibious vehicles or rubber riding craft.

4.18.2.13 Utilities

There is no current electrical power utility, potable water utility, wastewater infrastructure, or information technology/communications infrastructure on Pagan. The proposed dock and breakwater would have no effects to existing or proposed utilities infrastructure on Pagan.

No permanent wastewater infrastructure exists for Pagan. It is anticipated that wastewater generated due to construction and operation of the proposed dock and breakwater would be managed with field sanitation devices. Field sanitation devices would include toilets with collection bags or burn-out latrines and field urinals. With the potential use of burn-out latrines, the burning of human waste would create air quality impacts. It is anticipated that the ash produced by the burn-out latrines would be collected in containers and shipped to the U.S. military transfer station located on Tinian or another suitable location, such as Saipan. Construction workers would be housed in temporary facilities onshore or on a support vessel.

A small stormwater management system at Red Beach would be proposed as part of the proposed projects. Construction activities would require a Stormwater Pollution Prevention Plan and appropriate use of erosion control procedures to protect ecology and water resources.

The primary solid waste impact would consist of green waste generated during construction. Green waste would be managed on site through composting and mulching operations. All waste generated during construction that cannot be processed and reused on Pagan would be shipped to an acceptable off-island location for proper handling and disposal or reuse.

4.18.2.14 Socioeconomics and Environmental Justice

Construction of the proposed breakwater and dock would generate economic activity, which would be beneficial to the CNMI economy. Temporary construction worker housing would need to be built to support construction activities.

The dock and breakwater would improve access to Pagan Harbor. This would facilitate visitor engagement in cultural and recreational activities as well as potential economic activities (such as mining and ecotourism), leading to a beneficial impact.

4.18.2.15 Hazardous Materials and Waste

The proposed dock and breakwater would increase use of hazardous materials and generation of hazardous waste during construction, but it would not increase the volume of hazardous materials and waste to be managed during operations.

4.18.2.15.1 Hazardous Materials

Construction for the proposed dock and breakwater at Red Beach would cause a short-term increase in the volume of construction-related hazardous materials that would cease at the completion of construction activity. Best management practices and standard operating procedures described for Tinian (see Appendix D, *Best Management Practices*) would be followed to minimize or prevent accidental releases of hazardous materials during construction on Pagan. The use, transport, storage, and handling of hazardous materials would be in accordance with applicable federal and CNMI regulations and U.S. military requirements. Similar procedures would be implemented for operation of the proposed dock.

4.18.2.15.2 Toxic Substances

No demolition would take place to construct either the new dock or its associated breakwater, so it is unlikely that toxic-substance building materials would be encountered. In the event that asbestos-containing materials, lead-containing paint, or polychlorinated biphenyls are discovered, these materials would be managed by properly trained and licensed personnel to ensure that applicable hazardous waste testing, handling, and disposal procedures and requirements are followed. No toxic-substance building materials would be used in construction. Similar procedures would be implemented for operation of the proposed dock.

4.18.2.15.3 Hazardous Waste

Construction activities would result in a short-term increase in the generation of hazardous waste (e.g., pesticides, herbicides, solvents, adhesives, lubricants, corrosive liquids, batteries, and aerosols) that would end when construction is finished. The projected increase in hazardous waste would have the potential to result in adverse impacts to human health and the environment. All construction would be conducted in compliance with all applicable requirements concerning handling of hazardous waste. Best management practices and standard operating procedures (see Appendix D, *Best Management Practices*) would be followed to reduce the likelihood and volume of accidental releases, allow for accelerated spill response times, and allow for the timely implementation of cleanup measures. The generation, transport, storage, and handling of hazardous waste would be in accordance with applicable federal and CNMI regulations and U.S. military requirements. All hazardous waste would be containerized and shipped off the island to the appropriate disposal facility site. Existing transportation routes, including shipping by commercial carrier, would be utilized for the conveyance of hazardous waste to a disposal facility site. Transportation of all hazardous waste would be conducted in compliance with U.S. Department of Transportation regulations and CFR Title 49. Similar procedures would be implemented for operation of the proposed dock.

4.18.2.15.4 Contaminated Sites

If the proposed dock and breakwater cannot be constructed without avoiding contaminated sites, then appropriate best management practices would be followed (see Appendix D, *Best Management Practices*). To reduce potential hazards related to exposure to munitions and explosives of concern, appropriate U.S. military requirements and best management practices be followed and implemented (see Appendix D, *Best Management Practices*). Through the use of best management practices and the identification and removal of munitions and explosives of concern, impacts resulting from the disturbance and dispersion of contaminated soil and groundwater would be minimized.

4.18.2.16 Public Health and Safety

The CNMI Homeland Security and Emergency Management Office would be notified of construction activities on Pagan. Because there is no permanent resident population on Pagan, construction of the proposed dock and breakwater would result in no direct or indirect impacts to public health and safety. The proposed dock and breakwater could potentially benefit public health and safety by providing a safer method to move people and cargo than the smaller vessels. The public would continue to be restricted from the island during training for health and safety reasons.

4.19 SECTION 4(F) EVALUATION

4.19.1 Introduction

Section 4(f) of the Department of Transportation Act of 1966, codified in Federal law at 49 U.S. Code § 303, declares that "[i]t is the policy of the United States Government that special effort should be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites."

Section 4(f) specifies that the Secretary [of Transportation] may approve a transportation program or project requiring the use of publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance, or land of an historic site of national, State, or local significance (as determined by the Federal, State, or local officials having jurisdiction over the park, area, refuge, or site) only if

1. “there is no prudent and feasible alternative that would avoid using those resources, and
2. the program or project includes all possible planning to minimize harm resulting from the use. (FAA 2007:7-1)"

In general, a Section 4(f) "use" occurs with a Department of Transportation approved project or program when (1) the proposed project or a reasonable alternative would physically occupy a portion of or all of a Section 4(f) resource; (2) the proposed project permanently incorporates the resource for project purposes through acquisition or easement; (3) alteration of structures or facilities located on Section 4(f) properties is necessary, even though the action does not require buying the property; (4) there is a temporary occupancy of Section 4(f) land that is adverse in terms of the Section 4(f) preservation purposes; or (5) when Section 4(f) land is not incorporated into the transportation project, but the project’s proximity impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under Section 4(f) are substantially impaired (constructive use) (Federal Aviation Administration 2007:7-5).

Section 4(f) is considered satisfied with respect to historic sites and parks, recreation areas, and wildlife and waterfowl refuges if the Secretary makes a de minimis impact finding. These requirements apply only to actual physical impacts, not constructive use.

(1) De minimis findings for historic sites. The Federal Aviation Administration may make this finding on behalf of the Secretary if:

> (a) under Section 106 of the National Historic Preservation Act, it has determined the project will not adversely affect or not affect historic properties;
>
> (b) the Section 106 finding has received written concurrences from the State Historic Preservation Officer or the Tribal Historic Preservation Officer (and the Advisory Council on Historic Preservation, if the Advisory Council on Historic Preservation is participating); and
>
> (c) the Section 106 finding was developed in consultation with parties consulting in the Section 106 process.

(2) De minimis findings for parks, recreation areas, and wildlife or waterfowl refuges. The Federal Aviation Administration may make this finding on behalf of the Secretary if:

> (a) it has determined, after public notice and opportunity for public review and comment, that the project will not adversely affect the activities, features, and attributes of the eligible Section 4(f) property; and
>
> (b) the officials with jurisdiction over the Section 4(f) property have concurred with the Federal Aviation Administration's determination (Federal Aviation Administration 2007:7-1).

If there is no physical use and no temporary occupancy, but there is the possibility of constructive use, the Department of Transportation, or in the case of this project, the Federal Aviation Administration determines if the potential impacts would substantially impair the 4(f) property. Substantial impairment occurs when the protected activities, features, or attributes of the Section 4(f) property are extensively diminished. Generally, this means that the value of the resource, in terms of its Section 4(f) purpose and significance, will be meaningfully reduced or lost.

This Section 4(f) evaluation discusses the Tinian International Airport improvements and use of historic properties, which are the only potential Section 4(f)-protected resources affected by the proposed action in the area where the Department of Transportation is the approval authority. In the case of the proposed alternative, the Federal Aviation Administration is serving as the approval authority.

Section 4(f) protects historic properties (historic or archaeological properties on or eligible for inclusion on the National Register of Historic Places) that warrant preservation in place. If historic properties are determined to warrant preservation in place, then an individual Section 4(f) evaluation is done to analyze whether there is a feasible or prudent alternative that avoids the Section 4(f) property or an alternative that causes the least overall harm to Section 4(f) properties. Historic properties subject to data recovery (excavations and/or documentation) to mitigate impacts due not warrant preservation in place and are not considered 4(f)-protected resources; therefore, Section 4(f) would not apply. The Department of Transportation agency must consult with the State Historic Preservation Officer to determine whether or not they warrant preservation in place.

Typical airport actions that may cause Section 4(f) impacts include airside/landside expansion (new or expanded terminal and hangar facilities, new or extended runways and taxiways, navigational aids); land acquisition for aviation-related use, new or relocated access roadways, remote parking facilities, and rental car lots; substantial amounts of construction or demolition activity; and a significant change in aircraft operations that results in new or changed flight tracks and accompanying noise impacts.

The Department of Transportation has no approval authority for 4(f) resources on Pagan. Therefore, this section only evaluates 4(f) resources on Tinian.

As consultation is in process and no definitive mitigations (data recovery or preservation) have been determined for impacts to historic properties, the following discussion will outline the main elements of a 4(f) evaluation in the event that consultation determines that these historic properties warrant preservation in place and are 4(f)-protected resources. If it is determined through consultation with the CNMI Historic Preservation Officer and other consulting parties that impacts to historic properties at the Tinian International Airport area will be mitigated through data recovery, then they will not be considered 4(f)-protected resources and no 4(f) evaluation will be needed. If it is determined through consultation that preservation in place is appropriate, then a more detailed Section 4(f) evaluation will be completed prior to the publication of the Final EIS/OEIS.

Public Law 105-85, div A, title X § 1079, Nov 18 1977, 111 Stat. 1916, Treatment of Military Flight Operations, provides that “no military flight operation (including a military training flight), or designation of airspace for such an operation, may be treated as a transportation program or project for purposes of section 303(c) of 49 U.S. Code. Therefore, impacts related to noise resulting from an increase in military aircraft activity is not included in this evaluation.

4.19.2 Description of the Proposed Action

As described in Chapter 2, the proposed action is to establish a series of live-fire ranges, training courses, and maneuver areas within the CNMI to reduce existing joint service training deficiencies and meet the U.S. Pacific Command Service Components’ unfilled unit level and combined level training requirements in the Western Pacific. Under the proposed action, unit level training would occur on the island of Tinian and combined level training would occur on the island of Pagan. The proposed action includes construction and operations on an area north of the Tinian International Airport runways. The following discussion presents the need for the project and the project description.

4.19.2.1 Need for Project

The purpose of the proposed action is to reduce joint training deficiencies for military services in the Western Pacific (see Section 1.3). Existing U.S. military live-fire, unit and combined level training ranges, training areas, and support facilities are insufficient to support U.S. Pacific Command Service Components’ training requirements in the Western Pacific, specifically in the Mariana Islands. The proposed action is needed to enable U.S. Pacific Command forces to meet their U.S. Code Title 10 requirements to maintain, equip, and train combat and humanitarian forces in the Western Pacific. The proposed action assists in correcting these training deficiencies by establishing live-fire unit and combined level RTAs in the CNMI. Establishing unit and combined level RTAs in the CNMI would support ongoing operational requirements, changes to U.S. force structure, geographic repositioning of forces, and support U.S. training relationships with allied nations.

4.19.2.2 Description of Alternatives

Selection of the project location included careful planning and full consideration of the existing airport environment and project locations were determined early in the planning process. The proposed airport improvement construction projects on Tinian International Airport are included under all action alternatives for Tinian. In addition to Tinian Alternatives 1, 2, and 3, this evaluation analyzes the no-action alternative. For a more detailed description of the operational siting criteria and alternatives refer to Chapter 2.

4.19.2.2.1 No–Action Alternative

As described in Chapter 2, the no-action alternative would continue current training activities on Tinian, including those contained in other Department of Defense documents such as the Mariana Islands Range Complex EIS/OEIS (July 2010 Record of Decision), and would complete construction of four live-fire ranges on Tinian contained in the September 2010 Record of Decision in the Guam and CNMI

Military Relocation EIS/OEIS (DoN and Department of the Army 2010). Under the no-action alternative, no improvements would be made to the area north of the Tinian International Airport runways. Thus no approval by an agency of the U.S. is associated with the no-action alternative and Section 4(f) would not apply.

4.19.2.2.2 Tinian Airport Improvements (all Tinian Alternatives)

Each of the three Tinian action alternatives has common elements. These include: (1) Land Use Agreements; (2) Construction and Improvements, (3) Training Operations, (4) Operations and Management; (5) Transportation; (6) Munitions; (7) Danger Zones; (8) Amphibious Operations; (9) Airspace Requirements; and (10) Sea Space Requirements. Included within these common elements are construction and operations associated with improvements at the Tinian International Airport.

To accommodate the anticipated aircraft training tempo and equipment/cargo needs, taxiways, directly north and adjacent to the runway of Tinian International Airport, would be constructed. Airport improvements are depicted on Figure 2.4-4 and would include: (1) tactical aircraft parking ramp; (2) cargo aircraft parking ramp; (3) connecting taxiways; (4) ordnance arming and de-arming pads; (5) hot cargo (i.e., munitions) pad/combat aircraft loading area; (6) expeditionary/temporary refueling area; (7) arresting gear pads; (8) munitions holding pads; (9) and access roads connecting to the airfield Ground disturbance associated with construction of the airfield improvements would be approximately 228 acres (93 hectares) with approximately 41 acres (17 hectares) of that being newly created impervious surface.

Use of the Tinian International Airport and adjacent range and training areas allows for the integration of air and ground force training at the unit level. Use of the airport also supports military training throughout the Pacific. The proposed Airport Layout Plan would require approval from the Commonwealth Ports Authority and Federal Aviation Administration. The Commonwealth Ports Authority manages and operates the airports and seaports throughout the CNMI. The U.S. military has been working with the Commonwealth Ports Authority to develop an Airport Layout Plan for the proposed improvements at Tinian International Airport. The Airport Layout Plan shows the existing airport layout and planned future development. The Commonwealth Ports Authority, as the airport sponsor, maintains the Airport Layout Plan and is required to submit any proposed changes on the Airport Layout Plan to the Federal Aviation Administration for review and approval to confirm that the proposed changes meet Federal Aviation Administration airport standards and requirements. The proposed new military development at Tinian International Airport, which is the subject of this EIS/OEIS, is shown on the Airport Layout Plan in Appendix S.

4.19.3 Description of Section 4(f) Properties

Two Section 4(f) resources have been identified within the potential footprint for the proposed improvements to the Tinian International Airport. These include 1) a Japanese Third Farm District (IV) archaeological site (-5043) and 2) a World War II American military site (West Field). These resources are located on public lands under the jurisdiction and control of the Commonwealth Ports Authority. Under the proposed action, the Department of Defense would lease the area north of Tinian International Airport (460 acres [186 hectares]) and construct parking ramps, taxiways, and other facilities described above. No public parks, wildlife refuges, or public recreation area is located within or adjacent to the airport property.

Consistent with federal law, certain types of information related to cultural resources are protected from general distribution. National Historic Preservation Act and Archaeological Resources Protection Act each contain confidentiality restrictions to prevent inappropriate general releases of locational data for archaeological sites. In keeping with these restrictions, this section does not contain detailed locational descriptions or figures showing the specific locations of archaeological sites.

4.19.3.1 Japanese Third Farm District (IV) (Site SC-5043)

Site SC-5043, the Japanese Third Farm District (IV), contains the remnants of a Japanese sugarcane farm. It is located on the west side of 8th Avenue at the northwest corner of Tinian International Airport. The site is located on lands within a portion of the Military Lease Area and within the Tinian International Airport boundaries.

Although SC-5043 has been modified by World War II and modern farming, the fields and some concrete structures remain. In addition, a Japanese railroad berm segment crosses the site; there is also a Pre-Contact component consisting of ceramic sherds on the surface (Athens 2009:232). The Japanese Third Farm District is divided into various sites based on divisions created by World War II modifications or other factors. The “Third Farm District” was populated with tenant farmers cultivating sugarcane in the 1930s. In 1939 the Third Farm District contained 255 families (Tuggle 2009:51,231). Site SC-5043 was recommended eligible for listing on the National Register of Historic Places under Criterion A for its association with pre-war Japanese agriculture and under Criterion D for its potential to provide information on Japanese agricultural practices and Pre-Contact settlement on Tinian.

4.19.3.2 West Field (Site TN-6-0030)

Site TN-6-0030 (West Field) was originally constructed as an airfield by the Japanese. In 1945, following the 1944 American capture of Tinian, West Field was expanded to provide a base, together with the North Field, for B-29 operations against Japan (see Section 3.11, *Cultural Resources*). The site is located on lands within a portion of the Military Lease Area and within the Tinian International Airport boundaries. West Field measures approximately 1870 acres (757 hectares).

The West Field airfield originally included 3 airstrips, 18 miles of taxiways, 4 service aprons, 361 hardstands, and more than 675 buildings. The 444th, 462nd, and 468th Bomb Groups, under the 58th Bomb Wing, utilized this airfield after its completion. All three bomb groups received Distinguished Unit Citations for their missions against Japan (Crowl 1960: 572).

In 1994, West Field, site TN-6-0030, included three runways and taxiways and coral gravel hardstands. Runway #3 was used for Tinian’s airport, and a new airport building, access road, parking lots, and aircraft parking apron were constructed at the southeast comer. The other two runways and the taxiways had not been maintained, as they were no longer in use. Concrete building foundations are still extant in the northwest corner of the Army Air Corps area and the southeast corner of the Naval Air Base area. Currently, the area north of the airport runways contains historic taxiways, hardstands, and concrete pads associated with West Field.

Features associated with West Field between the central taxiway and the Tinian International Airport were recorded during an archaeological survey of the West Tinian Airport Improvement Area (Dixon and Tuggle 2002:A-5). These features include two complexes (N-8 and N-10). Feature Complex N-8 consists of three concrete pads and coral foundations. Feature Complex N-10 consists of a paved taxiway, 22 hardstands (paved areas for parking and maintenance of B-29 bombers), a Flack Tower, and a coral fill quarry (Dixon and Welch 2002:A-5, A-6). The site was recommended eligible for listing in the National Register of Historic Places:

> The site is associated with WWII and the bombing of Japan prior to the war's end with General Curtis Lemay of the 21st Bomber Command and Brigadier General Ramey of the 58th Bomb Wing, is an excellent architectural example of a B-29 bomber base and has information pertinent to our understanding of WWII American military history (Dixon and Tuggle 2002:A-6).

4.19.4 Impacts on the Section 4(f) Properties by the Project

Potential impacts of the project are discussed below as they relate to the Section 4(f) use of Site SC-5043 (Japanese Third Farm District [IV]), Site TN-6-0030 (West Field) on Tinian.

4.19.4.1 Japanese Third Farm District (IV) (Site SC-5043)

Potential adverse impacts to site SC-5043 include ground disturbance due to the construction of a new paved road and gravel shoulder, and erection of fences along the perimeter of the airport. The road would be comprised of two 10.0-foot (3.0-meter) wide paved lanes (one lane in each direction) with 4.0-foot (1.2-meter) wide graded gravel shoulders on both sides. Associated construction activities would include clearing overgrown vegetation, resurfacing existing paved roads, and reconstructing/upgrading existing dirt/gravel roads to paved roads. The total site size is 55.4 acres (22.4 hectares). Approximately 1.2 acres (0.48 hectare) or 2.2% of the site would be disturbed by construction and would be direct taking and a permanent use of the site. Although a small portion of the overall site, the site is considered important for its contribution to World War II history and research potential. As discussed in Section 4.11, ground disturbance within the boundaries of a historic property would be a significant direct impact under NEPA. The area would be fenced and, although no longer accessible to the public, this minimal loss of access to 2% of the site area would not be a significant impact to the site.

4.19.4.2 West Field (Site TN-6-0030)

Potential adverse impacts to site TN-6-0030 include ground disturbance (grading, excavating, digging, clearing, leveling, trenching, and drilling) during construction of proposed support facilities, roads, utilities, and training facilities. Ground disturbance associated with construction of the airfield improvements would be approximately 228 acres (93 hectares) with approximately 41 acres (17 hectares) of that being newly created impervious surface, most occurring within the boundary of Site TN-6-0030. Construction would affect a total of 12% of the site and would be direct taking and a permanent use of the site. Although the construction of support facilities, roads, utilities, and training facilities is consistent with the current use of the site, the new construction would impact a substantial portion of the site that is considered important for its association with World War II and its research potential. As discussed in Section 4.11, ground disturbance within the boundaries of this historic property would result in significant impacts to the airstrips, taxiways, service aprons, and hardstands and would be a significant direct impact under NEPA. As this area of the site is already not accessible to the public, there would be no loss of access from the proposed action.

4.19.5 Avoidance Alternatives

This section considers potential alternatives that were considered but eliminated from detailed analysis as they would not meet the purpose or need of the proposed action.

4.19.5.1 No-Action Alternative

Under the no-action alternative the proposed action would not take place. Additionally, the proposed Tinian RTA, including support facilities on the north side of the Tinian International Airport, would not be constructed. The identified training deficit would persist, and the existing Western Pacific RTAs would remain insufficient to support U.S. Pacific Command Service Components' Title 10 training requirements for the region. Therefore, it has been determined that the no-action alternative is not feasible and prudent.

4.19.5.2 Alternative 1. Locate Outside of the CNMI

The 2012 Training Needs Assessment: An Assessment of Current Training Ranges and Supporting Facilities in the U.S. Pacific Command Area of Responsibility (DoN 2013b), examined the unmet training requirements of four areas that make up the majority of the Pacific region force structure: Hawaii, Japan, Korea, and the Mariana Islands. The Assessment concluded that the Mariana Islands region has significantly more unmet training requirements than the other areas (i.e., Hawaii, Japan, and Korea) (see Section 1.3.5, Training Needs Assessment). The 2013 CNMI Joint Military Training Requirements and Siting Study (DoN 2013a), concluded that within the Mariana Islands, Guam training opportunities are limited to the existing activities plus future individual skills training for the Marine forces and that there is no additional capacity to address the U.S. Pacific Command's unmet training requirements. Therefore, land, sea, and airspace on and around Guam were excluded from further consideration as it does not meet the purpose and need, and would not provide adequate training facilities. As such it is not a feasible and prudent alternative.

4.19.5.3 Alternative 2. Locate at Single Location within the CNMI

Both unit level and combined level training must be included in the proposed action to meet unfilled training requirements in the Mariana Islands. Combined level training brings several units (U.S. and allied nations) together working as a team towards a single objective. Combined level training also involves maneuvering and use of live-fire ranges and training areas; however, because of the greater number of troops and tasks, this training requires larger areas. Separate range complexes are required to support each type of training because of the nature of unit and combined training along with the frequency of this training. Neither Tinian nor Pagan alone can support both levels of training identified as unfilled training requirements. Therefore, use of only one island (Pagan) does not meet the purpose and need, and the fundamental purpose of locating at two separate sites would not be served by this avoidance alternative. As such it is not a feasible and prudent alternative.

4.19.5.4 Alternative 3. Locate Airport Improvements at North Field

While training and support facilities would be located on Tinian, the airport improvements would occur at North Field rather than adjacent to existing runways at the Tinian International Airport. Location at North Field would require more extensive construction of a new runway in addition to the proposed support facilities and would be a significant impact to a National Historic Landmark. It also would create constraints on proposed live-fire training activities in the northern portion of Tinian. As such it is not a feasible and prudent alternative.

4.19.5.5 Alternative 4. Alternative Options at Tinian International Airport

In addition to proposed airport improvements is the proposed base camp. The base camp needs to be situated away from proposed training areas. Given space constraints within the Military Lease Area, the southern boundary of the Military Lease Area creates the largest separation between the base camp and proposed training activities. Location of the base camp east or west of Tinian International Airport would place it within airport safety zones, so these options were not considered feasible. A central location north of the airport is necessary to avoid interfering with proposed military approach, departure, and closed loop patterns that would occur at the ends of the runway. Therefore, locations of the base camp toward the western or eastern ends of the runway is not a feasible and prudent alternative.

Reducing the disturbance footprint to avoid the potential 4(f) resources was also considered. As part of the planning process, ground disturbance was minimized to the degree possible. However, as the West Field site (Site TN-6-0030) is very large and encompasses the entire airport area, it is not possible to avoid disturbing this historic property.

4.19.6 Measures to Minimize or Mitigate Harm

To the degree possible, historic properties were avoided when planning initial construction and operations areas for the proposed action. These efforts included siting ranges and support facilities in proximity to each other and to existing roads to minimize impacts to historic resources in the area. A constraints analysis was conducted in April, 2013 that examined the locations of ranges and support facilities in relation to historic properties and final siting decisions were made at that time. However, as discussed above, there is no alternative, except the no-action alternative, that would avoid all impacts to 4(f) resources. Avoidance alternatives would either have an impact on historic properties or not meet the purpose and need of the proposed action. Measures, however, can be taken to mitigate harm to the identified 4(f) resources.

4.19.6.1 No-Action Alternative

No action would be taken under this alternative. There would be no impacts to Section 4(f) properties under this alternative. No measures to minimize harm are proposed for this alternative.

4.19.6.2 Tinian Airport Improvements (All Tinian Alternatives)

Consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, and other interested parties for the entire proposed action is ongoing with the intent to identify measures to mitigate the significant impacts to historic properties. These potential mitigation measures would be formalized in an agreement document between the Department of Defense and various stakeholders representing the interests of the local government and the public. They may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures. Once completed, the Programmatic Agreement would be signed by the State Historic Preservation Officer, the Advisory Council on Historic Preservation, the Department of Defense as well as consulting parties such as representatives of the CNMI agencies. Interested parties such as preservation groups, historical societies, and traditional groups have been invited to contribute to the process of developing these measures. A copy of the executed programmatic agreement will be included in the Final EIS/OEIS. Under the requirements of the Transportation Act, the Federal Aviation Administration would consult with the CNMI State Historic Preservation Officer and other parties to determine if the two historic properties, the Japanese Third Farm District (IV) (SC-5043) and West Field (TN-6-0030, warrant preservation and place and are considered 4(f) protected properties or if other forms of mitigation are sufficient. At that point, Section 4(f) analysis may be completed.

4.19.7 Coordination

Compliance with Section 106 of the National Historic Preservation Act and its implementing regulations is being achieved through coordination among the Department of Defense, the Federal Aviation Administration, the State Historic Preservation Officer, and the Advisory Council on Historic Preservation.

Representatives of the Department of Defense have met with the CNMI officials, the Tinian Mayor's office, and public interest groups at public meetings in 2013 and at other informal meetings in 2013 and 2014. Several individuals are also participating as consulting parties in the Section 106 consultation process.

4.19.8 Concluding Statement

If the historic properties are considered to be 4(f) protected resources, based on the above considerations, there is no feasible and prudent alternative to the use of land from Japanese Third farm District (IV) and West Field. However, the proposed action includes planning to minimize harm to the Japanese Third Farm District (IV) and West Field resulting from such use; however, no other alternative would meet the project's stated purpose and need.

4.20 SUMMARY OF IMPACTS AND POTENTIAL MITIGATIONS

Section 4.20 summarizes the impacts and potential mitigation measures for the Tinian alternatives and the Pagan alternatives analyzed in this EIS/OEIS. Table 4.20-1 and Table 4.20-2 provides a summary of the impacts for both construction and operation activities for the Tinian and Pagan alternatives.

As described in Section 4.1, this EIS/OEIS applies resource management measures before making impact determinations. Briefly, resource management measures could include avoidance and minimization measures, best management practices, and standard operating procedures.

The *Resource Management Measures* section discusses applicable (1) avoidance and minimization measures and, (2) best management practices and standard operating procedures, and how they serve to lessen impacts to specific resources.

- Avoidance and minimization measures are not necessarily required by law, regulation, or policy, but are designed and implemented specifically for the proposed action to further reduce environmental impacts (i.e. avoiding areas of the limestone forest, not landing Amphibious Assault Vehicles on certain beaches, avoiding wetlands). Examples of avoidance and minimization include moving target locations, moving firing positions, adjusting engagement zones, limiting weapons deployment, adjusting High Hazard Impact Area boundaries, and adjusting use of tactical landing beaches.
- Best management practices include standard operating procedures and commonly accepted practices routinely implemented by the DoN in design, construction, and operations to provide for the safety of personnel and equipment, as well as aid with regulatory compliance. The EIS/OEIS impact analysis (Chapter 4) assumes that resource management measures are successfully incorporated into the proposed action. Best management practices and standard operating procedures are described in Appendix D, *Best Management Practices.*

For the purpose of this EIS/OEIS, mitigation measures are additional project-specific measures to actively minimize, rectify, reduce, or provide compensation for impacts identified through the NEPA environmental review process. Mitigation measures are implemented and monitored as practicable in addition to the resource management measures that are included as part of the proposed action. Examples of potential mitigation measures include habitat restoration to mitigate for habitat removed during construction, and removal of existing non-native invasive species. The U.S. military's commitment to a mitigation measure is determined on a project-by-project basis and documented in the Record of Decision and regulatory agency consultation and permits. A single mitigation could potentially reduce significant impacts to less than significant, but it may take multiple mitigation measures to achieve that desired result. Table 4.20-3 provides a summary of potential mitigation measures for both construction and operation activities for the Tinian and Pagan alternatives.

Under the no-action alternative, there would be impacts to resources as discussed in each individual resource section. The no-action alternative impacts and mitigation are included in Table 4.20-1 and Table 4.20-2.

4.20.1 Summary of Impacts for Tinian Alternatives

Table 4.20-1 contains a summary of impacts for Tinian alternatives for all resource areas.

Table 4.20-1. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Geology and Soils	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Topography	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Geology	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Soils	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Prime Farmland Soils	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*
Water Resources	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Surface Water Resources	*NI (Lake Hagoi, Bateha isolated wetlands) LSI (Mahalang Complex) LSI (flooding hazards and surface water quality)*	*NI (Lake Hagoi, Bateha isolated wetlands) LSI (Mahalang Complex) LSI (flooding hazards and surface water quality)*	*NI (Lake Hagoi, Bateha isolated wetlands) LSI (Mahalang Complex) LSI (flooding hazards and surface water quality)*	*NI (Lake Hagoi, Bateha isolated wetlands) LSI (Mahalang Complex) LSI (flooding hazards and surface water quality)*	*NI (Lake Hagoi, Bateha isolated wetlands) LSI (Mahalang Complex) LSI (flooding hazards and surface water quality)*	*NI (Lake Hagoi, Bateha isolated wetlands) LSI (Mahalang Complex) LSI (flooding hazards and surface water quality)*	*LSI*	*LSI*
Groundwater Resources	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Nearshore Water Resources	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Air Quality	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Air Quality (General)	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*

Table 4.20-1. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Noise	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
On Land	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*LSI/Not applicable*
In-water	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*LSI/Not applicable*
Ground-Based Operation	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*LSI*	*LSI*
Airfield and Airspace Based Operations	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*Not applicable*
Waterborne Operation	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*Not applicable*
Traffic	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*LSI*	*LSI*
Occupational Noise	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*	*NI*	*NI*
Airspace	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Tinian	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*NI*
Saipan	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*NI*

Table 4.20-1. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Land and Submerged Land Use	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Land Acquisition (Jurisdictional Control)	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*
Submerged Land Acquisition (Jurisdictional Control)	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*LSI*
Land Use Within the Military Lease Area – Existing and Planned Land Use	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*LSI*
Land Use Within the Military Lease Area – Public Access	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*LSI*
Land Use Outside the Military Lease Area – Existing and Planned Land Use	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*
Land Use Outside the Military Lease Area – Public Access	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*LSI*
Land Use Outside the Military Lease Area – Noise	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*
Submerged Land Use – Existing and Planned Land Use	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*
Submerged Land Use – Public Access	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*

Table 4.20-1. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Recreation	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Recreation (Construction Only)	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*
Historic and Cultural	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*LSI*
Beaches and Parks	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*LSI*
Ocean-based Resources	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*LSI*
Scenic Points	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*LSI*
Annual Events	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*SI mitigated to LSI*	*Not applicable*	*LSI*
Training Noise Impacts	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*
Roadway and Access Improvements	*Not applicable*	*BI/LSI*	*Not applicable*	*BI/LSI*	*Not applicable*	*BI/LSI*	*Not applicable*	*LSI*

Table 4.20-1. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Terrestrial Biology	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Vegetation Communities	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Native Wildlife	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Special-status Species: Endangered Species Act – Listed and Proposed Species	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode, sea turtles). NI (humped tree snail, Heritiera longipetiolata Dendrobium guamense)*	*LSI (Mariana fruit bat, Micronesian megapode, Mariana common moorhen sea turtles). NI (humped tree snail, Heritiera longipetiolata Dendrobium guamense)*	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode, sea turtles). NI (humped tree snail, Heritiera longipetiolata Dendrobium guamense)*	*LSI (Mariana fruit bat, Micronesian megapode, Mariana common moorhen sea turtles). NI (humped tree snail, Heritiera longipetiolata Dendrobium guamense)*	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode, sea turtles). NI (humped tree snail, Heritiera longipetiolata Dendrobium guamense)*	*LSI (Mariana fruit bat, Micronesian megapode, Mariana common moorhen sea turtles). NI (humped tree snail, Heritiera longipetiolata Dendrobium guamense)*	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode). NI (sea turtles, humped tree snail)*	*LSI (Mariana fruit bat, Mariana common moorhen, Micronesian megapode). NI (sea turtles, humped tree snail)*
Special-status Species: Migratory Bird Treaty Act	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Special-status Species: CNMI-listed Species	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*	*NI (Micronesian gecko)*
Marine Biology	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Marine Habitat/Essential Fish Habitat (Coral Reef)	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Marine Flora	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Invertebrates (Coral)	*SI*	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*	*LSI*
Marine Invertebrates (Non-coral)	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Fish	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Special Status Corals	*SI*	*SI*	*SI*	*SI*	*SI*	*SI*	*LSI*	*LSI*
Sea Turtles	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Mammals	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*

Table 4.20-1. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Cultural Resources	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Range Complex A	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*Not applicable*	*Not applicable*
Range Complex B	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*Not applicable*	*Not applicable*
Range Complex C	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*Not applicable*	*Not applicable*
Range Complex D	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*NI*	*LSI*	*Not applicable*	*Not applicable*
Military Lease Area-wide Training Assets and Support Facilities Outside of the Range Complexes	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*Not applicable*	*Not applicable*
Tinian International Airport	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*Not applicable*	*Not applicable*
Outside Military Lease Area	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*SI mitigated to LSI*	*LSI*	*Not applicable*	*Not applicable*
Military Lease Area	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*SI mitigated to LSI*	*SI mitigated to LSI*
Visual Resources[1]	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
National Historic Landmark at North Field (#1)	*Not applicable*	*BI/LSI*	*Not applicable*	*BI/LSI*	*Not applicable*	*BI/LSI*	*Not applicable*	*Not applicable*
Unai Chulu (#2), *Unai Babui* (#3) and *Unai Lam Lam* (#4)	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*Not applicable*
Ushi “Cross” Point A and B (#5 and #6)	*Not applicable*	*NI (#5); SI (#6)*	*Not applicable*	*NI (#5); SI (#6)*	*Not applicable*	*NI (#5); SI (#6)*	*Not applicable*	*Not applicable*
Blow Hole (#7)	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*Not applicable*
Mount Lasso Lookout A and B (#8 and #9)	*Not applicable*	*SI (#8); LSI (#9)*	*Not applicable*	*SI (#8); LSI (#9)*	*Not applicable*	*SI (#8); LSI (#9)*	*Not applicable*	*LSI*
8th Avenue-North of the Airport (#10)	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*Not applicable*

Table 4.20-1. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Broadway North (#11)	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*LSI*
Broadway South A and B (#12 and #13)	*Not applicable*	*LSI (#12); NI (#13)*	*Not applicable*	*LSI (#12); NI (#13)*	*Not applicable*	*LSI (#12); NI (#13)*	*Not applicable*	*LSI*
Unai Dankulo (#14) and Unai Masalok (#15)	*Not applicable*	*LSI (#14-15)*	*Not applicable*	*LSI (#14-15)*	*Not applicable*	*LSI (#14-15)*	*Not applicable*	*Not applicable*
Transportation	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Air Transportation	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*
Ground Transportation	*LSI*	*LSI/BI*	*LSI*	*LSI/BI*	*LSI*	*LSI/BI*	*LSI*	*LSI*
Marine Transportation	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*
Utilities	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Electrical Power	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Potable Water	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Wastewater	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Stormwater Management	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Solid Waste	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Information Technology/ Communications	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Socioeconomic and Environmental Justice	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Population[2]	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*
Economic Conditions								
Tourism	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Gross Domestic Product	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*	*LSI*	*LSI*
Employment and Income	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*
Government Revenues	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*	*LSI*	*LSI*
Housing	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Agriculture	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Commercial Fishing and Aquaculture	*NI*	*LSI*	*NI*	*LSI*	*NI*	*LSI*	*LSI*	*LSI*
Airports and Sea Ports	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*	*LSI*	*LSI*

Table 4.20-1. Summary of Impacts for Tinian Alternatives

Resource Area	***Tinian (Alternative 1)***		***Tinian (Alternative 2)***		***Tinian (Alternative 3)***		***No-Action Alternative***	
Power Utility Rates	*NI*	*BI*	*NI*	*BI*	*NI*	*BI*	*LSI*	*LSI*
Public Services								
Education	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Emergency Services	*LSI*	*BI*	*LSI*	*BI*	*LSI*	*BI*	*LSI*	*LSI*
Public Health	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Community and Social Topics	*LSI/SI*	*LSI/SI*	*LSI/SI*	*LSI/SI*	*LSI/SI*	*LSI/SI*	*LSI*	*LSI*
Environmental Justice and Protection of Children	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*	*LSI*	*LSI*
Hazardous Materials and Waste	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Hazardous Materials	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Toxic Substances	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Hazardous Waste	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Contaminated Sites	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Public Health and Safety	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Aircraft Operations	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Ground Operations	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Operations	*NI*	*LSI*	*NI*	*LSI*	*NI*	*LSI*	*LSI*	*LSI*

Notes: [1]# indicates Key Observation Point (see Section 4.12, Figure 4.12-1).
[2]A change in population is not considered an impact itself. However, population change has the potential to drive positive or negative impacts to other socioeconomic factors.

Legend: *BI* = beneficial impact; *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts. *Not Applicable* indicates an element or category with no potential for impacts.

4.20.2 Summary of Impacts for Pagan Alternatives

Table 4.20-2 contains a summary of impacts for Pagan alternatives for all resource areas.

Table 4.20-2. Summary of Impacts for Pagan Alternatives

Resource Area	*Pagan (Alternative 1)*		*Pagan (Alternative 2)*		*No-Action Alternative*	
Geology and Soils	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Topography	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Geology	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Soils	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Prime Farmland Soils	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Water Resources	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Surface Water Resources	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Groundwater Resources	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Nearshore Water Resources	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Air Quality	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Air Quality	*LSI*	*LSI; NI (regarding volcanic activity)*	*LSI*	*LSI; NI (regarding volcanic activity)*	*NI*	*NI*
Noise	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
On Land	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*
In Water	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*
Ground-Based Operation	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*
Airfield and Airspace Based Operations	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*
Waterborne Operation	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*
Traffic	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*
Occupational Noise	*Not applicable*	*NI*	*Not applicable*	*NI*	*Not applicable*	*NI*

Table 4.20-2. Summary of Impacts for Pagan Alternatives

Resource Area	***Pagan (Alternative 1)***		***Pagan (Alternative 2)***		***No-Action Alternative***	
Airspace	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Pagan	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*
Land and Submerged Land Use	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Land Acquisition (Jurisdictional Control)	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*NI*
Submerged Land Acquisition (Jurisdictional Control)	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*
Land Use – Current and Planned Use	*Not applicable*	*SI*	*Not applicable*	*SI*	*Not applicable*	*NI*
Land Use – Public Access	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*
Submerged Land Use – Current and Planned	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*
Submerged Land Use – Public Access	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*
Recreation	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Recreation	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*
Terrestrial Biology	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Vegetation Communities	*SI*	*LSI*	*SI*	*LSI*	*NI*	*NI*
Native Wildlife	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*
Special-status Species: Endangered Species Act – Listed and Proposed Species and CNMI-listed Species	*LSI*	*SI (Mariana fruit bat) LSI (Micronesian megapode, sea turtles, humped tree snail, Slevin's skink) NI (Cycas micronesica, Bulbophyllum guamenese)*	*LSI*	*SI (Mariana fruit bat) LSI (Micronesian megapode, sea turtles, humped tree snail, Slevin's skink) NI (Cycas micronesica, Bulbophyllum guamenese)*	*NI*	*NI*
Special-status Species: Migratory Bird Treaty Act-listed	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*

Table 4.20-2. Summary of Impacts for Pagan Alternatives

Resource Area	*Pagan (Alternative 1)*		*Pagan (Alternative 2)*		*No-Action Alternative*	
Marine Biology	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Marine Habitat/Essential Fish Habitat	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Flora	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Invertebrates (Coral)	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Invertebrates (Non-Coral)	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Fish	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Special Status Coral Species	*LSI*	*SI*	*LSI*	*SI*	*LSI*	*LSI*
Sea Turtles	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Marine Mammals	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Cultural Resources	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
North Range Complex	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*SI mitigated to LSI*	*LSI*	*LSI*
South Range Complex	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Visual Resources	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Visual Resources	*Not applicable*	*LSI*	*Not applicable*	*LSI*	*Not applicable*	*NI*
Transportation	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Air Transportation	*LSI*	*BI*	*LSI*	*BI*	*NI*	*NI*
Ground Transportation	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*
Marine Transportation	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*
Utilities	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Electrical Power	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
Potable Water	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
Wastewater	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
Stormwater Management	*LSI*	*LSI*	*LSI*	*LSI*	*Not applicable*	*Not applicable*
Solid Waste	*LSI*	*LSI*	*LSI*	*LSI*	*Not applicable*	*Not applicable*
Information Technology/ Communications	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
Socioeconomics and Environmental Justice	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Population[1]	*NI*	*NI*	*NI*	*NI*	*NI*	*NI*
Economic Conditions	*BI*	*BI*	*BI*	*BI*	*NI*	*LSI*
Public Services	*NI*	*LSI*	*NI*	*LSI*	*NI*	*NI*
Community and Social Topics	*NI*	*Potential for SI*	*NI*	*Potential for SI*	*NI*	*LSI*

Table 4.20-2. Summary of Impacts for Pagan Alternatives

Resource Area	*Pagan (Alternative 1)*		*Pagan (Alternative 2)*		*No-Action Alternative*	
Hazardous Materials and Waste	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Hazardous Materials	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Toxic Substances	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Hazardous Waste	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Contaminated Sites	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
Public Safety and Health	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Aircraft Operations	*NI*	*LSI*	*NI*	*LSI*	*LSI*	*LSI*
Ground Operations	*NI*	*LSI*	*NI*	*LSI*	*LSI*	*LSI*
Marine Operations	*NI*	*LSI*	*NI*	*LSI*	*LSI*	*LSI*

Notes: [1]A change in population is not considered an impact itself. However, population change has the potential to drive positive or negative impacts to other socioeconomic factors.

Legend: *BI* = beneficial impact; *LSI* = less than significant impact; *NI* = no impact; *SI* = significant impact. Shading is used to highlight the significant impacts. *Not Applicable* indicates an element or category with no potential for impacts.

4.20.3 Summary of Potential Mitigation Measures

Table 4.20-3 contains a summary of potential mitigation measures for Tinian and Pagan construction and operation phases.

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	*Category*	*Potential Mitigation Measures*	*Tinian Phase*		*Pagan Phase*	
			Construction	*Operation*	*Construction*	*Operation*
AIRSPACE						
Tinian The increase in military air traffic would not restrict access to Tinian International Airport. Private flights could experience minimal delays in departures and arrivals during the time when military aircraft are practicing approaches to the Tinian International Airport runway. Restricted Area 7203 was segmented to minimize impacts to commuter flight traffic between Tinian and Saipan. Civilian aircraft can be routed around the restricted airspace while staying within the minimum safety glide slope except for periods when Restricted Area 7203A/B/C/X/Y/Z/E/W are activated together. Indirect effects such as increased fuel consumption and time en route could be experienced. No impacts would be expected with activation of the Tinian Military Operations Area.	*SI mitigated to LSI*	• Establish a Letter of Procedure or Joint Use Agreement to accommodate civilian arrivals and departures into the airport. • Establish communication procedures between Tinian Range Control and Saipan International Airport Air Traffic Control to ensure priority access to Tinian International Airport for life-flight and other emergency-related activities. • Add positive control measures (e.g., air traffic control tower at Tinian, short-range radar on Tinian or Saipan that would allow air traffic controllers to see aircraft operating below 2,000 feet [609 meters]), and communications capability at Saipan or Tinian to ensure non-participating aircraft are advised of military operations. • Establish communication procedures to provide immediate feedback between air traffic controllers and range control to accommodate smaller inter-island commuter aircraft travelling between Saipan and Tinian.		X		
Saipan Air and ground activities would have the potential to significantly impact current airspace procedures during the 140 days per year that the Restricted Areas 7203A/B/C and W are scheduled and activated for use.	*SI mitigated to LSI*	• Establish a Letter of Procedure between the Federal Aviation Administration and the U.S. military that contains the procedures for access to the airspace and gives priority to large commercial aircraft. The agreement would ensure proper range scheduling		X		

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	Category	Potential Mitigation Measures	Tinian Phase		Pagan Phase	
			Construction	Operation	Construction	Operation
Restricted areas would not be activated during times with scheduled Saipan International Airport commercial large passenger jet and jetliner activity. Existing procedures used to manage aircraft operations at Tinian North Field and deconflict military and civilian aircraft would be expected to continue.		procedures are in place to ensure no significant disruption of normal flights into and out of Saipan International Airport. • Electronically monitor each training event through the use of radar and other surveillance equipment such as an expeditionary control tower that would continually monitor the airspace to ensure the safety of the flying public during times when training is occurring. • Schedule and coordinate training events with Saipan International Airport arrivals and departures as to not conflict. • Establish procedures and communications that allow for air traffic controllers and range controllers to simultaneously see the airspace and ensure priority is given to any aircraft heading to or from Saipan International Airport. In the event of an unforeseen incursion into an active restricted airspace, the simultaneous ability to monitor activities on the ground and in the air should provide the ability to stop any training in seconds.				
LAND AND SUBMERGED LAND USE						
<u>Land Use Within the Military Lease Area – Existing and Planned Land Use</u> There would be land use incompatibilities associated with the Tinian Military Retention Land for Wildlife Conservation and the agricultural and cattle grazing activities in the Lease Back Area.	*SI mitigated to LSI*	• Four areas are being assessed as potential conservation areas for the protection of the Tinian monarch and other wildlife species (Section 4.9, *Terrestrial Biology*, Figure 4.9-2). These areas may also be used for additional natural resource conservation actions such as forest enhancement and/or invasive species control. The Department of Defense is coordinating with the Federal Aviation Administration and the U.S. Fish and Wildlife		X		

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	*Category*	*Potential Mitigation Measures*	*Tinian Phase* Construction	*Tinian Phase* Operation	*Pagan Phase* Construction	*Pagan Phase* Operation
		Service on these potential conservation areas. • The DoN has identified and proposed a total of 2,554 acres (1,034 hectares) of land for grazing areas within the Military Lease Area. Of this total 1,010 acres (409 hectares) would be unencumbered and 1,544 acres (625 hectares) would be encumbered by surface danger zones.				
RECREATION						
Historic and Cultural Attractions Due to restricted access, there would be significant impacts to: historic and cultural attractions (10 of 12 sites). These impacts would remain significant even with the implementation of the proposed mitigation measures.	*SI*	• In as much as possible, training would be scheduled around peak tourist holidays, such as the three tour seasons that correspond to specific World War II anniversaries. • There is no mitigation currently proposed to minimize this impact to the Shinto Shrine and Hinode American Memorial. The DoN is consulting with the CNMI Historic Preservation Officer and other interested parties regarding impacts to the Shinto Shrine and Hinode American Memorial as part of the Section 106 process (see Appendix N, *Cultural Resources Technical Memo* for a discussion of the consultation process). Potential mitigation will be determined through this consultation process and could include documentation and relocation of the Shinto Shrine and Hinode American Memorial.		X		
Annual Events Closure of recreational areas on Tinian during training operations could result in reduced event attendance. Impacts would be mitigated to less than significant with implementation of the proposed mitigation measures.	*SI mitigated to LSI*	• In as much as possible, the DoN would coordinate with event sponsors to ensure that training events do not occur during annual events.		X		

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	Category	Potential Mitigation Measures	Tinian Phase Construction	Tinian Phase Operation	Pagan Phase Construction	Pagan Phase Operation
TERRESTRIAL BIOLOGY						
Vegetation Communities *Alternatives 1, 2, and 3*: The conversion of 6.3 acres (2.5 hectares) of native limestone forest on Tinian to developed land would be unavoidable.	*SI*	• Department of Defense may implement forest enhancement on 6.3 acres (2.5 hectares) to replace the area of native limestone forest removed during construction. Forest enhancement would include removal of non-native vegetation and establishment of native species that are characteristic of native limestone forest habitats. • To avoid and minimize impacts to native limestone forest on Tinian, the Department of Defense will implement training restrictions within native limestone forest. All limestone forest habitat within the Military Lease Area will be designated as "No Wildlife Disturbance Areas," with the following actions prohibited: off-road vehicle travel; vehicle parking except on existing roads or trails; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; and aircraft landings. Any maneuvers conducted in native limestone forest will be on foot (no off-road vehicle maneuvers), and units will be tactical, with no support camps. Limestone forest "No Wildlife Disturbance Area" restrictions will be implemented upon initiation of CJMT training activities on Tinian. • Department of Defense may implement forest enhancement in areas of tangantangan or herbaceous scrub habitat to replace the forested habitats removed during construction. Forest enhancement would include removal of non-native vegetation and establishment of	X			

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	Category	Potential Mitigation Measures	Tinian Phase: Construction	Tinian Phase: Operation	Pagan Phase: Construction	Pagan Phase: Operation
		native species that are characteristic of native forest habitats.				
Native Wildlife • *Alternative 1:* The removal of 1,745 acres (706 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the Tinian monarch, and other native wildlife species would be unavoidable. • *Alternative 2:* The removal of 1,883 acres (762 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the Tinian monarch, and other native wildlife species would be unavoidable. • *Alternative 3:* The removal of 1,862 acres (754 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the Tinian monarch, and other native wildlife species would be unavoidable .	*SI*	• Department of Defense may implement forest enhancement in areas of mixed introduced forest, tangantangan, or herbaceous scrub habitat to replace the forest habitat removed during construction. Forest enhancement would include removal of non-native vegetation and establishment of native species that are characteristic of native forest habitats. • Department of Defense may replace the current Tinian Military Retention Land for Wildlife Conservation by establishing a conservation area(s) for the protection of the Tinian monarch and other wildlife species with one or more conservation sites within the Military Lease Area. Forest enhancement and invasive species control may also be implemented within the replacement Wildlife Conservation site(s). • To improve habitat quality for native wildlife on Tinian, the Department of Defense may implement monitoring and control of non-native invasive species within forest habitat, including control of invasive plant, mammal, and insect species. • To avoid and minimize impacts to native wildlife species that use native limestone forest on Tinian, the Department of Defense will implement training restrictions within native limestone forest. All limestone forest habitat within the Military Lease Area will be designated as "No Wildlife Disturbance Areas," with the following actions prohibited: off-road vehicle travel;	X			

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	***Category***	***Potential Mitigation Measures***	***Tinian Phase***		***Pagan Phase***	
			Construction	***Operation***	***Construction***	***Operation***
		vehicle parking except on existing roads or trails; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; and aircraft landings. Any maneuvers conducted in native limestone forest will be on foot (no off-road vehicle maneuvers), and units will be tactical, with no support camps. Limestone forest “No Wildlife Disturbance Area” restrictions will be implemented upon initiation of CJMT training activities on Tinian.				
<u>Special-status Species: Endangered Species Act-listed and Proposed Species</u> Noise impacts to foraging Mariana common moorhens at the Mahalang sites from large-caliber munitions on the High Hazard Impact Area would be unavoidable.	*SI*	• To avoid impacts to Mariana common moorhens at the Lake Hagoi and two Bateha wetland sites, the Department of Defense will designate the three wetland sites as "No Training Areas.” Ground disturbance and vegetation removal of any kind will be prohibited within these "No Training Areas." In addition, CJMT-associated aircraft overflights of these sites will be limited to a minimum altitude of 500 feet (152 meters) above ground level. Wetland “No Training Area” restrictions would be implemented upon initiation of CJMT training activities on Tinian. • To mitigate for loss of Mariana common moorhen foraging habitat at Mahalang, the Department of Defense may implement portions of the DoN Tinian Wetlands Management Plan at Hagoi and two Bateha sites. This may include invasive plant surveys, monitoring, and control; habitat restoration and improvement; baseline surveys for moorhen predators; and predator control at Hagoi and Bateha. • To avoid and minimize impacts to special-status species		X		

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	*Category*	*Potential Mitigation Measures*	*Tinian Phase* Construction	*Tinian Phase* Operation	*Pagan Phase* Construction	*Pagan Phase* Operation
		that use native limestone forest on Tinian, the Department of Defense will implement training restrictions within native limestone forest. All limestone forest habitat within the Military Lease Area will be designated as "No Wildlife Disturbance Areas," with the following actions prohibited: off-road vehicle travel; vehicle parking except on existing roads or trails; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; and aircraft landings. Any maneuvers conducted in native limestone forest will be on foot (no off-road vehicle maneuvers), and units will be tactical, with no support camps. Limestone forest “No Wildlife Disturbance Area” restrictions will be implemented upon initiation of CJMT training activities on Tinian. • To avoid and minimize impacts to nesting sea turtles, the Department of Defense will implement training protocols at all beaches used for amphibious operations on Tinian. Biologists trained in identifying sea turtle nests will survey landing beaches no more than 6 hours prior to the first craft landing or use of other beach landing equipment. Any potential sea turtle nests will be flagged, with a buffer zone of 20 feet (6 meters) from the edge of the nesting activity (area disturbed by the turtle) to ensure complete avoidance. The flagged area will be avoided by landing craft and personnel. Beach training activities will also be coordinated with monthly sea turtle nest monitoring, during which any potential turtle nests will be flagged, with a buffer zone of 20 feet				

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	*Category*	*Potential Mitigation Measures*	*Tinian Phase* *Construction*	*Tinian Phase* *Operation*	*Pagan Phase* *Construction*	*Pagan Phase* *Operation*
		(6 meters) to ensure avoidance. If an active nest with a pre-hatch hole is discovered on a beach during monitoring, night training over the next 5 nights will be conducted only on other beaches. If beach sand is compacted by landing craft, the beach topography will be restored within 3 days using non-mechanized methods (e.g., rakes or other hand tools). The Department of Defense will implement beach training protocols upon initiation of CJMT amphibious training activities.				
<u>Special-status Species: Migratory Bird Treaty Act-listed Species</u> • *Alternative 1:* The removal of 1,745 acres (706 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the collared kingfisher, Mariana fruit dove, and white-throated ground-dove, would be unavoidable. • *Alternative 2:* The removal of 1,883 acres (762 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the collared kingfisher, Mariana fruit dove, and white-throated ground-dove, would be unavoidable. • *Alternative 3:* The removal of 1,862 acres (754 hectares) of forested and herbaceous scrub habitats (including Tinian Military Retention Land for Wildlife Conservation) used by native landbirds, including the collared kingfisher, Mariana fruit dove, and white-throated ground-dove, would be unavoidable.	*SI*	• Department of Defense may implement forest enhancement in areas of tangantangan or herbaceous scrub habitat to replace the mixed introduced forest and herbaceous scrub removed during construction. Forest enhancement would include removal of non-native vegetation and establishment of native species that are characteristic of native forest habitats. • Department of Defense may establish a conservation area for the protection of the Tinian monarch and other wildlife species with one or more conservation sites within the Military Lease Area. Forest enhancement and invasive species control may also be implemented within the wildlife conservation site(s). • To avoid and minimize impacts to Migratory Bird Treaty Act-listed species that use native limestone forest on Tinian, the Department of Defense will implement training restrictions within native limestone forest. All limestone forest habitat within the Military Lease Area will be designated as "No Wildlife Disturbance Areas,"	X			

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	Category	Potential Mitigation Measures	Tinian Phase: Construction	Tinian Phase: Operation	Pagan Phase: Construction	Pagan Phase: Operation
		with the following actions prohibited: off-road vehicle travel; vehicle parking except on existing roads or trails; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; and aircraft landings. Any maneuvers conducted in native limestone forest will be on foot (no off-road vehicle maneuvers), and units will be tactical, with no support camps. Limestone forest "No Wildlife Disturbance Area" restrictions will be implemented upon initiation of CJMT training activities on Tinian. • To improve habitat quality for native wildlife on Tinian, Department of Defense may implement monitoring and control of non-native species within forest habitat, including control of invasive plant, mammal, and insect species. • To avoid and minimize impacts to Mariana fruit bats and sea turtles, hooded lights will be used to the maximum extent practicable at all new roads and facilities within sea turtle nesting habitat and fruit bat foraging and roosting habitat. "Night-adapted" lights will be installed in the briefing and bleacher areas. Illumination of forests, coastlines, and beaches will be kept to an absolute minimum. Lighting will be designed to meet minimum safety, anti-terrorism, and force protection requirements. • To avoid impacts to Migratory Bird Treaty Act-listed species that use the Lake Hagoi and two Bateha wetland sites, the Department of Defense will designate the three wetland sites as "No Training Areas." Ground				

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	*Category*	*Potential Mitigation Measures*	*Tinian Phase*		*Pagan Phase*	
			Construction	*Operation*	*Construction*	*Operation*
		disturbance and vegetation removal of any kind will be prohibited within these "No Training Areas." In addition, CJMT-associated aircraft overflights of these sites will be limited to a minimum altitude of 500 feet (152 meters) above ground level. Wetland "No Training Area" restrictions would be implemented upon initiation of CJMT training activities on Tinian.				
<u>Pagan Vegetation Communities</u> Loss of 20 acres (8 hectares) of native forest habitat would result in an unavoidable impact.	*SI*	• To minimize the effects of construction on native vegetation communities on Pagan, Department of Defense may facilitate native habitat regeneration on Pagan by implementing feral ungulate removal. This would consist of active control (i.e. trapping, snaring, shooting) of animals, with the goal of eradicating all feral ungulates from southern Pagan.			X	
<u>Pagan Special-status Species, Endangered Species Act-listed and Proposed Species and CNMI-listed Species</u> Large-caliber weapons firing would result in direct impacts to Mariana fruit bats associated with the northeastern colony and on the isthmus colony. Impacts would be unavoidable.	*SI*	• To minimize the effects of operations on Mariana fruit bats on Pagan, Department of Defense would facilitate native habitat regeneration on southern Pagan by implementing feral goat and pig removal. This would consist of active control (i.e. trapping, snaring, shooting) of animals, with the goal of eradicating all feral ungulates from southern Pagan. • To improve habitat quality for Mariana fruit bats on Pagan, Department of Defense may implement monitoring and control of non-native invasive species within forest habitat, including control of invasive plant, mammal, and insect species. • To avoid and minimize impacts to the Mariana fruit bat, Micronesian megapode, and tree snails, the Department of Defense will implement training restrictions within				X

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	*Category*	*Potential Mitigation Measures*	*Tinian Phase*		*Pagan Phase*	
			Construction	*Operation*	*Construction*	*Operation*
		native forest on southern Pagan. All native forest habitat on southern Pagan will be designated as "No Wildlife Disturbance Areas," with the following actions prohibited: vehicle maneuvers; firing of live or inert munitions; mechanical vegetation clearing; digging or excavation without prior approval; open fires; flights below 500 feet (152 meters) above ground level, with the exception of personnel insertion/extraction via helicopter; and aircraft landings. Any maneuvers conducted in native forest will be on foot. In addition to restricting aircraft flights to a minimum of 500 feet (152 meters) above ground level in southern Pagan, a 0.5-mile (0.8-kilometer) lateral buffer zone will be established for the two fruit bat colonies in southern Pagan. In addition to avoiding and minimizing noise disturbance to fruit bat colonies, the proposed 0.5-mile (0.8-kilometer) buffer zone around each colony will significantly reduce the potential for aircraft strikes of fruit bats. Native forest "No Wildlife Disturbance Area" restrictions will be implemented upon initiation of CJMT training activities on southern Pagan.				

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	***Category***	***Potential Mitigation Measures***	***Tinian Phase***		***Pagan Phase***	
			Construction	***Operation***	***Construction***	***Operation***
MARINE BIOLOGY						
• Marine Habitat and Essential Fish Habitat • Construction of underwater landing areas for Amphibious Assault Vehicles at Unai Chulu would result in the loss of 20.6 acres (8.3 hectares) of marine habitat within these areas impacted by direct and indirect physical disturbance stressors at Unai Chulu. • Construction would cause short- and long-term impacts to ecological function, including abundance/distribution of marine organisms. • Construction would result in loss/alteration of hard-bottom habitat and bathymetry.	*SI*	• DoD may consider transplantation of coral species. • DoD may consider debris removal and disposal as a one-time effort to collect large quantities of debris from a area such as Dankulo Beach on Tinian. • DoD may consider recreational mooring Buoys and/or Fish Aggregation Devices to avoid impacts to coral by dropping anchors and to reduce the potential effects on access to fishing areas. • Implementation of Marine Species Awareness Training for all lookouts and other key personnel. • Additional measures may be recommended during agency consultations.	X	X		
<u>Marine Invertebrates</u> • A total area of 20.6 acres (8.3 hectares) of marine habitat that includes coral reef substrate (coral colonies and coral reef habitat) and supports populations of non-coral invertebrates would be directly and indirectly impacted by the construction of the Amphibious Assault Vehicle landing area at Unai Chulu. Adjacent corals outside the Amphibious Assault Vehicles landing areas may be indirectly impacted from the construction activities due to movement of coral rubble, and from the movement of mobile species out of the construction area. Construction would cause direct loss of coral reef substrate: 10.3 acres (4.1 hectares). • Amphibious training activities at Unai Babui would directly impact 3.05 acres (1.2 hectares), 3.83 acres (1.55 hectares) would be directly impacted at Unai Lam Lam, and 4.50 acres	*SI*	See above, *Potential Mitigation Projects to Offset Impacts to Coral.*	X	X		

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	***Category***	***Potential Mitigation Measures***	***Tinian Phase***		***Pagan Phase***	
			Construction	***Operation***	***Construction***	***Operation***
(1.82 hectares) of marine habitat, including corals and coral reef habitat, would be directly impacted at Unai Masalok.						
Special-status Species - Coral • Construction of the Amphibious Assault Vehicle landing area would cause a loss of 1,344 *Acropora globiceps* coral colonies at Unai Chulu. • At Unai Chulu, an estimate of 995 colonies of *Acropora globiceps* would be likely to be directly affected by training activities. At Unai Babui, an estimate of 381 colonies of *Acropora globiceps* would be likely to be directly affected by amphibious landings; at Unai Lam Lam, an estimate of 550 colonies of *Acropora globiceps* would likely be directly affected by amphibious landings; and at Unai Masalok, an estimate of 22 colonies of *Acropora globiceps* would likely be directly affected by amphibious landings.	*SI*	• See above, *Potential Mitigation Projects to Offset Impacts to Coral.*	X	X		
Special-status Species - Coral Amphibious training activities would cause a loss of 1 *Acropora globiceps* coral colony at Green Beach and an estimated 10,609 colonies at South Beach.	*SI*	• DoD may consider transplantation of coral species. • DoD may consider debris removal and disposal as a one-time effort to collect large quantities of debris from an area such as Gold Beach. • DoD may consider recreational mooring Buoys and/or Fish Aggregation Devices to avoid impacts to coral by dropping anchors and to reduce the potential effects on access to fishing areas. • Implementation of Marine Species Awareness Training for all lookouts and other key personnel. • Additional measures may be recommended during agency consultations.				X

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	*Category*	*Potential Mitigation Measures*	*Tinian Phase*		*Pagan Phase*	
			Construction	*Operation*	*Construction*	*Operation*
CULTURAL RESOURCES						
All Tinian alternatives would have a significant direct impact on historic properties in the Military Lease Area, immediately north of Tinian International Airport runways, and at the Port of Tinian. • *Tinian Alternative 1* would have a significant direct impact to 172 historic properties from construction and to 15 historic properties from operations, as well as significant indirect impacts to 4 historic properties. These historic properties include the North Field National Historic Landmark; Pre-Contact *latte* sites, pottery scatters, and rock shelters; pre-World War II Japanese farms and shrines; World War II-era Japanese and American military sites; and potential traditional cultural properties. • *Tinian Alternative 2* would have a significant direct impact to 182 historic properties from construction and to 15 historic properties from operations, as well as significant indirect impacts to 4 historic properties. These historic properties include. North Field National Historic Landmark; Pre-Contact latte sites, pottery scatters, and rock shelters; pre-World War II Japanese farms and shrines; World War II-era Japanese and American military sites; and potential traditional cultural properties. • *Tinian Alternative 3* would have a significant direct impact to 179 historic properties from construction and to 15 historic properties from operation, as well as significant indirect impacts to 4 historic properties. These historic properties include the North Field National Historic Landmark; Pre-Contact *latte* sites, pottery scatters, and rock shelters; pre-World War II Japanese farms and shrines; World War II-era	*SI mitigated to LSI*	Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.	X	X		

Table 4.20-3. Summary of Potential Mitigation Measures

Impacts	***Category***	***Potential Mitigation Measures***	***Tinian Phase***		***Pagan Phase***	
			Construction	***Operation***	***Construction***	***Operation***
Japanese and American military sites; and potential traditional cultural properties.						
All Pagan alternatives would have a significant direct impact to historic properties. • *Pagan Alternative 1* would have a significant direct impact to 27 historic properties and resources of cultural importance in the range complexes and expeditionary area due to vegetation clearance, as well as 54 historic properties due to operations. These historic properties include Pre-Contact *latte* complexes, pre-World War II Japanese Administration sites, and World War II-era Japanese defensive sites. • *Pagan Alternative 2* would have a significant direct impact to 25 historic properties and resources of cultural importance in the range complexes and expeditionary area due to construction, as well as 50 historic properties due to operations. These historic properties include Pre-Contact *latte* complexes, pre-World War II Japanese Administration sites, and World War II-era Japanese defensive sites.	*SI mitigated to LSI*	Measures to mitigate significant impacts to historic properties will be identified through consultation with the CNMI Historic Preservation Officer, Advisory Council on Historic Preservation, National Park Service, and other interested parties representing the interests of the local government and the public. These measures, which may include data recovery excavations, archaeological monitoring, documentation, public education, and/or other appropriate measures, will be formalized in an agreement document.			X	X

Legend: *LSI* = less than significant impact; *SI* = significant impact. Shading is used to highlight the significant impacts.
Note: Mitigation measures only change the significance of impacts where noted.

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