3.5 NOISE

Section 3.5 describes noise as perceived from a human perspective. The region of influence for noise is the islands of Tinian, Pagan, and surrounding areas including the southern portion of Saipan that could potentially be affected by the proposed action. Noise can also affect other resources such as biological (e.g., wildlife response), cultural (e.g., historic structures), recreational (e.g., noise intrusion on experience), and land use (e.g., incompatibility with existing land uses). This section presents baseline noise levels within the study area and focuses on the human response to those levels. Other sections in this EIS/OEIS use this information but in the context of their respective resource baseline and potential impact analyses. For example, the noise environment as it relates to terrestrial biological resources is presented in Sections 3.9 and 4.9, *Terrestrial Biology* of this EIS/OEIS.

3.5.1 Definition

Noise is generally described as unwanted sound. Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air or water, and are sensed by the human ear. Unwanted sound can be based on objective effects (such as hearing loss and speech interruptions) or subjective judgments (such as noise complaints and annoyance).

There are two main concepts to understand how noise is generated—sound level and frequency.

- **Sound Level.** Sound level or intensity is a measure of the loudness of a sound expressed in decibels. A human ear can only detect sounds that are above a certain decibel level. The other end of the spectrum is sound so loud (high decibel level) that it can cause pain, discomfort, and hearing loss.
- **Frequency.** Frequency is a measure of sound-wave cycles per unit of time, with higher frequency sounds dispersing more quickly than those at lower frequencies. The standard unit of measurement for sound wave frequency is cycles per second, expressed as hertz.

Sound waves move outward in all directions from the source and weaken as the distance from the source increases. Sound waves (i.e., noise) can also be diminished or enhanced by wind movement, terrain, ground cover, and temperature. Human hearing can generally perceive frequencies between 20 and 20,000 hertz. The human ear cannot hear sounds above and below these frequencies.

Detailed definitions and explanations of noise modeling and methodology are provided in Appendix H, *Noise Study*.

3.5.1.1 Sound Level

Sound level is a measurement for the loudness of a sound, and loudness is a function of the amount of energy (or pressure) in a sound wave. A sound wave consists of a moving front of pressure that exceeds surrounding atmospheric pressure, followed by a trough that is below surrounding atmospheric pressure. The more this pressure front varies from the surrounding pressure, the louder, or more intense, the sound. Sound intensity is measured in units called decibels. The decibel system of measuring sound provides us with a simplified relationship between the physical intensity of sound and

its perceived loudness to the human ear. The decibel scale is logarithmic, therefore, sound intensity increases or decreases exponentially with each decibel of change.

Not all people are affected the same way by the same sounds. In varying situations, common sounds can interfere with our speech, disturb our sleep, or interrupt a routine task. When this occurs, these sounds become noise (Army Center for Health Promotion and Preventative Medicine 2006). Just as some people find hard rock music annoying, others find it soothing and relaxing.

The decibel levels of multiple sources of sound are not additive. In fact, doubling a noise source would only generate a 3-decibel increase. For example, a receptor under a flight path of one jet airliner 500 feet (152 meters) overhead would experience 115 decibels; if two jetliners passed side-by-side, the receptor would experience 118 decibels not 230 decibels. In addition, the decibel level of a sound decreases (or attenuates) exponentially as the distance from the source increases. For a single point source, like a construction bulldozer, the sound level decreases by approximately 6 decibels for each doubling of distance from the source. Common sound levels include a garbage disposal, which measures at about 77 decibels, and a car at 100 feet (314 meters), which measures at about 60 decibels.

3.5.1.2 Frequency Weighting (A and C Weighting)

The human ear cannot perceive all pitches or frequencies of sound equally. Therefore, sound measurement can be adjusted or weighted to compensate for the human lack of sensitivity to low-pitched and high-pitched sounds. The weighted scales used in this analysis are defined below. Please note that noise levels from one scale cannot be added or converted mathematically to levels in another weighting scale.

- **A-weighted Scale**. This scale accounts for higher-pitched sounds and used for evaluating noise sources such as aircraft, vehicles, and small arms firing (up to .50-caliber).
- **C-weighted Scale.** This scale accounts for the lower-pitched sounds and used for evaluating explosions and large-caliber weapons such as artillery and mortars (20 millimeter and greater).

3.5.1.3 Noise Metrics

Noise is measured using several metrics that reflect different noise characteristics. There are differences in continuous (e.g., aircraft flying) versus impulsive (e.g., weapons firing) types of noise, variations in frequency, duration of noise exposure. Duration of noise exposure also dictates how a person perceives noise; a relatively long steady noise, like a train, aircraft passing or traffic, “feels” different than a rapid loud gunshot type noise. Noise metrics used for the affected environment are as follows:

- Day-Night Average Sound Level is used to measure average annual noise levels around airfields and ranges. Day-night average sound levels can be either A-weighted or C-weighted depending upon the activity measured. Because noise is considered more intrusive at night, a 10-decibel penalty is applied for operations occurring during nighttime hours, between 10:00 p.m. and 7:00 a.m.
- Peak 15 Sound Level (hereafter referred to as Peak) is the instantaneous, unweighted maximum value reached by the sound pressure produced by small- and large caliber weapons. Peak measures the impulsive sounds generated by small and large munitions, explosions, and sonic

booms. It represents a single event where the maximum noise level is likely to be exceeded 15% of the time.

3.5.1.4 Noise Modeling

To derive the noise contour bands, the following software models were used for evaluating existing noise conditions. Refer to Appendix H, *Noise Study* for more detailed information.

- The Small Arms Range Noise Assessment Model calculates and displays noise contour bands for firing operations at small arms ranges (Army 2003). It considers the type of weapon and ammunition, number of rounds fired, range attributes such as size and barriers, time of day fired, and direction of both muzzle and projectile.
- The model NOISEMAP is used to generate noise contour bands around airfields and landing zones (Czech and Plotkin 1998). The model incorporates the aircraft type and number; takeoffs, landings, touch and goes (i.e., aircraft simulates landing on the runway and then taking off), as well as closed patterns (e.g., going around the airfield to land or take off because of noise abatement procedures), and time of operation to depict noise levels.
- The BNOISE2 model calculates and portrays noise contour bands for large caliber weapons (Army 2009). It considers the weapon, ammunition, rounds fired, time of day fired, range size, and direction of both the muzzle and projectile.

3.5.1.5 Noise Zones

Typically, noise contour bands are depicted on maps in 5-decibel bands, from 65 decibels to 85 decibels from the noise source. These bands are then grouped into noise zones that are used to identify whether land uses exposed to these noise zones are compatible or incompatible with the level of noise exposure. Some land uses such as residential areas, schools and hospitals are considered more sensitive than others, such as commercial endeavors. People living in residential areas, students in schools, and patients in hospitals are considered sensitive receptors. Figure 3.5-1 shows potential sensitive noise receptors on Tinian and Saipan.

3.5.2 Regulatory Framework

The Noise Control Act of 1972 and U.S. Environmental Protection Agency Guidance provide the regulatory framework used for this noise evaluation. Two programs are used by the U.S. military to address this guidance: (1) the Range Air Installation Compatible Use Zone (Office of the Chief of Naval Operations Instructions 3550.1A) for ground-based and air-to-ground operations within ranges and training areas, and (2) the Air Installation Compatible Use Zone (Office of the Chief of Naval Operations Instructions 11010.36C) for airfield operations (DoN 2008a, 2008b).

These compatible use zone programs help military installations determine noise generated by military training and operations; evaluate how the noise from these operations may impact adjacent communities, sensitive noise receptors, and activities; and assist military planners with assessing existing and proposed land uses on an installation. The U.S. military also provides this information to adjacent communities so if they wish to, they can use it in their planning and zoning decisions.

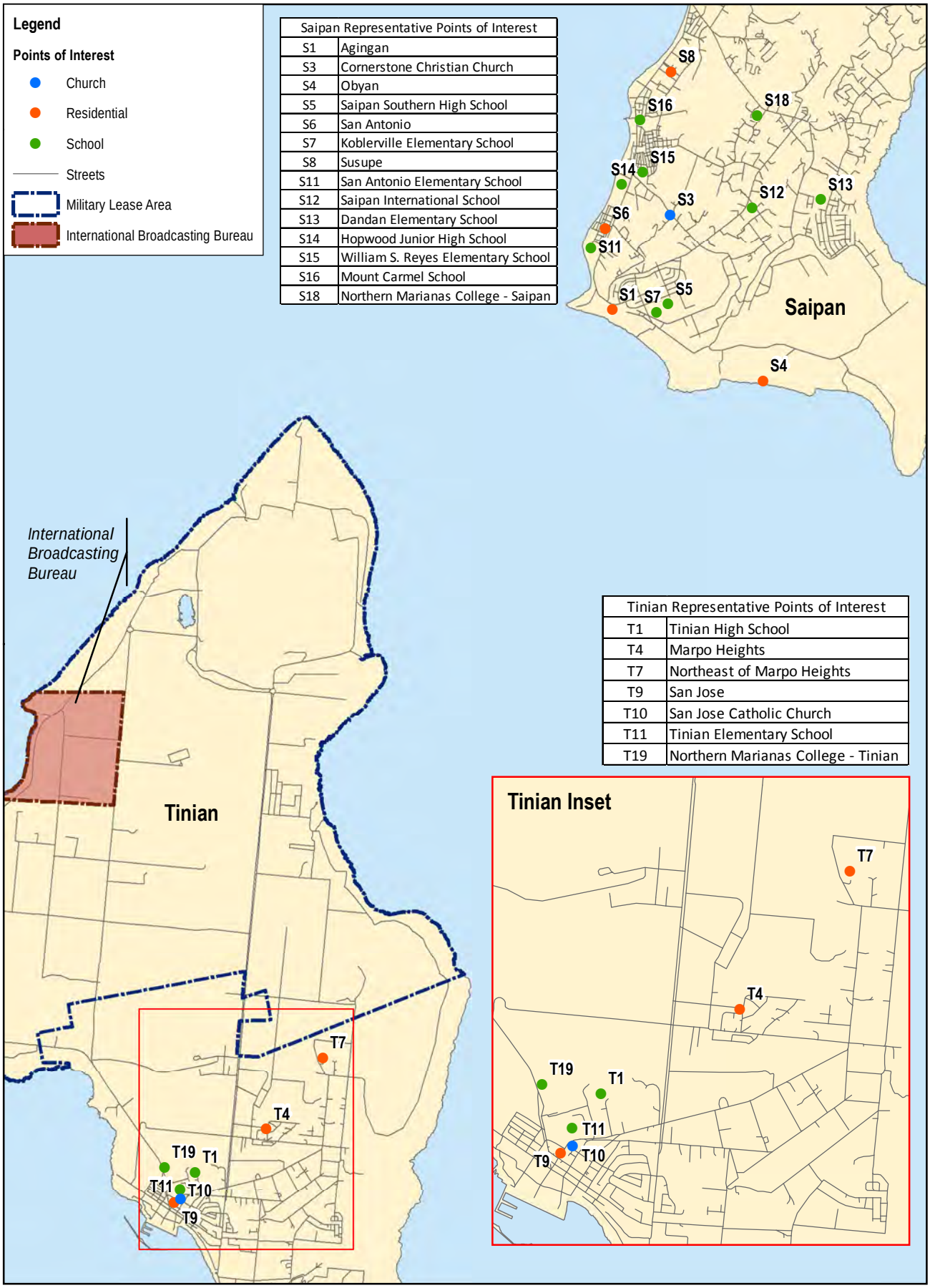

Figure 3.5-1
Sensitive Noise Receptor Locations – Tinian and Saipan

The results of the two programs are that noise contour bands based on the military activities can be modeled. These bands are then overlaid on land use planning maps to determine land use compatibility within the noise contour bands. Land use compatibility is then determined regarding the noise zone in which the land use is found.

Noise zones are defined as follows:

- **Zone I** (<65A-weighted/<62 C-weighted/<87 decibels Peak). This noise zone includes all areas in which day-night average sound levels are less than 65 decibels A-weighted, or 62 decibels C-weighted, or the Peak sound level is below 87 decibels. This noise zone is usually compatible with all types of land use activities (e.g., residential, schools, hospitals, places of worship, commercial). A subset of Zone I is the Land Use Planning Zone contours with noise levels between 57 and 62 decibels C-weighted. These noise levels are compatible with any land use, but land use planners often use this area as a buffer around military ranges. For example, although residential areas would be compatible in these areas, permitting or zoning a high-density apartment complex could invite noise complaints on days of higher than normal range activities.
- **Zone II** (65 to 75 A-weighted / 62 to 70 C-weighted / 87 to 104 Peak). Exposure to noise within this zone is normally considered incompatible with noise-sensitive land uses such as residences, hospitals, schools, and places of worship. Activities such as industrial, transportation, and resource production (e.g., farming, ranching, and mining) are considered compatible within this zone.
- **Zone III** (>75 A-weighted / >70 C-weighted / >104 Peak). Exposure to noise within this zone is considered incompatible with noise-sensitive land uses such as residences, schools, hospitals, places of worship, parks, and playgrounds but compatible with industrial, transportation, and resource production.

Table 3.5-1 lists the noise zones in tabular format, presents the noise levels encompassed within the particular noise zone, and identifies whether sensitive land uses such as homes, schools, hospitals, places of worship are compatible with that zone (Army 2007). Table 3.5-2 provides general land uses and identifies which are typically compatible with particular noise zones.

Table 3.5-1. Noise Zones and Sensitive Land Use Compatibility

Zone	*Decibel A-weighted / C-weighted / Peak*	*Land Use Compatibility Level*
I	<65 / <62 / <87	Compatible
II	65 to 75 / 62 to 70 / 87 to 104	Normally Incompatible
III	>75 / >70 / >104	Incompatible

Note: *Compatibility refers to sensitive land uses such as homes, schools, hospitals, and places of worship.
Sources: Army 2007; Army Center for Health Promotion and Preventative Medicine 2009.

Table 3.5-2. General Land Use Compatibility by Noise Zone

Noise Zones		*I*	*II*		*III*	
Aircraft/Small Caliber (A-weighted)		*<65*	*65-70*	*70-75*	*75-80*	*>80*
Large Caliber/Explosives (C-weighted)		*<62*	*62-70*		*>70*	
Percussive Munitions (Peak)		*<87*	*87-104*		*>104*	
Land Use	Commercial	Yes	Yes	Yes[2]	Yes[2]	No
	Industrial	Yes	Yes	Yes	Yes[2]	Yes[2]
	Open/Agricultural	Yes	Yes	Yes	Yes[1]	Yes[1]
	Recreational	Yes	Yes	Yes	No	No
	Residential	Yes	Yes[2]	No	No	No

Notes: [1]Open land acceptable.
[2]With noise attenuation features.
Sources: Army 2007; Army Center for Health Promotion and Preventative Medicine 2009.

Another guideline used by the military for assessing noise generated by large-caliber and explosive munitions is risk of complaints. This approach uses Peak sound levels within low, moderate, and high ranges for risk of complaints. Table 3.5-3 provides the decibel levels associated with each level for risk of complaint.

Table 3.5-3. Large-caliber Weapons and Explosives Risk of Complaints Levels

Risk of Complaints	*Peak Decibel*
Low	< 115
Moderate	115 – 130
High	> 130

3.5.3 Methodology

Reports, studies, data sets, and regulations of the federal government and the CNMI government were reviewed and NEPA documents evaluated to define the existing noise environment for Tinian and Pagan. Site visits to Tinian and review of aerial photography of Saipan and Pagan were used to identify points of interest, such as residential areas, schools, and places of natural and cultural importance, for specific noise evaluation. Personal interviews with air traffic control and airspace managers, as well as review of regional flight records yielded information about current operations at Tinian and Saipan International Airports and within the regional CNMI airspace.

3.5.4 Tinian

The current noise environment on Tinian is typical of a rural town or small suburban area. Over half of Tinian's population resides in San Jose. Other residential areas include Marpo Heights, Marpo Valley, Carolinas Heights, and Carolinas village. All of Tinian's population resides outside of the Military Lease Area. As of the 2010 U.S. Census, total population was 3,136 people. Schools on Tinian include Tinian Elementary School, Tinian High School, and Northern Marianas College.

Although infrequent, most noise-generating activities stem from existing military aviation, marine, and ground-based training activities primarily occurring in the Military Lease Area once or twice per year. Other noise contributors include civil and commercial aircraft operations at Tinian International Airport, cargo vessel operations at the Port of Tinian, and aircraft activities in regional airspace.

3.5.4.1 Ground-based Military Training Activities

Existing military training consists mostly of infrequent ground-based non-live-fire training and occurs primarily in the Military Lease Area. A limited amount of small arms are employed during training using either simulated munitions or firing live ammunition into steel bullet traps. The small arms firing produces Peak sound levels of 90 to 100 decibels at 500 feet (152 meters) and 80 to 90 decibels at 1,000 feet (305 meters) for the most common types of small arms (5.56 and 7.62 millimeter, and .50 caliber). These activities occur well within the Military Lease Area and noise is imperceptible (undetectable) to populations outside Military Lease Area boundaries. Sound dissipates at the rate of 6 decibels per doubling of the distance from the source. The distance from where the small arms are employed, to the closest population in the village of Marpo Heights, is approximately 4 miles (6 kilometers). At this distance, the noise level reduces to a Peak sound level of 65 decibels (or Noise Zone I), well within the compatibility limits presented in Table 3.5-1.

Small unit field exercises and expeditionary warfare training occurs primarily on the northern portion of the Military Lease Area, including within an expeditionary airfield at North Field. On the southern portion of the Military Lease Area, limited military training primarily consists of reconnaissance exercises. With the maximum noise levels at about 65 decibels, none of these activities generate noise levels exceeding Noise Zone I outside of military boundaries, therefore adjacent land uses are considered compatible. Under current conditions, all of Tinian is considered to be in Noise Zone I, except in the immediate vicinity of the airport.

3.5.4.2 Aircraft and Airspace Activities

3.5.4.2.1 Military Lease Area

North Field (Photo 3.5-1) is an unimproved World War II-era airfield currently used for military vertical and short-field landings as part of existing military training. North Field is occasionally used for other military operations, such as helicopter insertion and extraction of personnel. Pyrotechnics (e.g., flares) are also used during existing training operations occurring throughout the main North Field area. These activities all create noise, as do the small arms and the limited amount of aircraft operations. These activities are infrequent and do not generate perceptible noise levels for populated areas to the south in San Jose or to the north in Saipan. Operations at North Field were evaluated but there are so few operations that the noise contour plotting software (which cannot plot noise levels below 55 decibels) could not be applied. Using the NOISEMAP software model, noise levels fall well below 65 decibels day-night average sound level (or Noise Zone I) and, therefore are considered compatible with all land uses.

Photo 3.5-1. Aerial View of North Field

3.5.4.2.2 Tinian International Airport

Tinian International Airport, located just south of the Military Lease Area boundary, is a commercial airport that had 49,116 annual flight operations during 2012 (Federal Aviation Administration 2013). 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*). At that time there were four single-engine aircraft and two multi-engine aircraft based at the airport and it has limited airfield services. Single engine air taxi operations by Star Marianas Airlines make up the majority of the operations at Tinian International Airport. Although rare, chartered jets such as Boeing 747 or 767 occasionally fly into and out of the airport.

Although military operations comprise a small proportion of the total annual operations, military jets, such as the FA-18 are about 30 decibels louder than the civilian aircraft operating at Tinian. As such, the noise environment at Tinian International Airport is dominated by the occasional military aircraft when they are operating at the airfield. Figure 3.5-2 shows the baseline noise contours for Tinian International Airport.

Points of interest were identified for a variety of reasons; some are sensitive land uses such as residential areas or schools, others were chosen to portray the general noise environment at that location and represent areas that have a combination of biological, cultural, recreational, or other resource implications. Section 4(f) discussions are presented in Section 4.19, *Section 4(f) Evaluation*. All sensitive receptors (i.e., homes and schools) are located well away from areas affected by 65 decibel levels or louder. Table 3.5-4 shows the noise levels at representative points of interest under current noise conditions generated by typical civilian aircraft and occasional military operations at Tinian International Airport.

3.5.4.2.3 Saipan International Airport

Saipan International Airport, due to its close proximity to Tinian International Airport is included in the following discussion as it could potentially be impacted by the proposed action. In addition, during scoping the public expressed concern if noise generated in the Military Lease Area would affect southern Saipan. There are 22 aircraft based at Saipan International Airport. Daily aircraft operations average 175, consisting of air taxi/inter-island commercial flights to and from Tinian, Rota, and Guam as well as international commercial airline flights to and from countries such as Japan and China (Air Force 2012). Although there are aircraft operating over the Military Lease Area, these operations are infrequent and are done at approximately 2,100 feet (640 meters) in altitude where noise levels would not exceed 65 decibels day-night average sound level (or Noise Zone I) and are considered compatible with all land uses. Saipan International Airport is unlikely to contribute to the noise environment in residential areas of Tinian, south of the Military Lease Area.

3.5.4.2.4 Airspace

Under baseline conditions, one Special Use Airspace unit (Air Traffic Controlled Assigned Airspace 6) and several airport departure and arrival routes produce aircraft-generated noise around Tinian and Saipan. These levels are negligible and do not perceptibly contribute to the baseline noise environment. These activities do not generate noise levels exceeding 65 decibels day-night average sound level.

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	Old West Field
T19	Northern Marianas College - Tinian
T20	Ushi Point
T21	Native Limestone Forest
T22	Unai Lam Lam

0 0.5 1 2 Miles

0 0.5 1 2 Kilometers

Figure 3.5-2
Baseline Noise Contours at Tinian International Airport

NORTH

Table 3.5-4. Baseline Noise Levels at Representative Points of Interest

Tinian Representative Points of Interest			*Noise Level – A-weighted Day-Night Average Sound Level (decibels)*
Identification Number	*Description*	*Type*	
T1	Tinian High School	School	36.7
T2	Lake Hagoi	Other	44.1
T3	Mahalang Ephemeral Ponds	Other	39.5
T4	Marpo Heights	Residential	45.4
T5	Mount Lasso Overlook Area	Other	40.7
T6	Bateha 1 - Isolated Wetlands	Other	38.8
T7	Northeast of Marpo Heights	Residential	48.5
T8	Bateha 2 - Isolated Wetlands	Other	45.6
T9	San Jose	Residential	37.3
T10	San Jose Catholic Church	Church	37.1
T11	Tinian Elementary School	School	36.9
T12	Unai Chiget	Other	35.4
T13	Unai Chulu	Other	44.0
T14	Unai Dankulo/Long Beach	Other	47.0
T15	Unai Masalok	Other	48.8
T16	North Field National Historic Landmark	Other	41.2
T17	International Broadcasting Bureau	Administrative	41.8
T18	Old West Field	Other	54.6
T19	Northern Marianas College - Tinian	School	37.2
T20	Ushi Point	Other	36.3
T21	Native Limestone Forest	Other	50.0
T22	Unai Lam Lam	Other	39.0

Note: Shading indicates that points of interest are within the Military Lease Area.

3.5.4.3 Waterborne Activities

Currently, there are occasional Amphibious Assault Vehicle landings at the Port of Tinian. While these operations are rare, their noise levels are temporarily noise levels of 88 A-weighted decibels at 100 feet (30 meters). These noise levels are single events and not an average noise level used for compatibility. While average noise levels exceeding 65 decibels are considered incompatible with sensitive land uses, these areas are at least 1,000 feet (305 meters) from the port. To put it into perspective, at this distance noise levels from an Amphibious Assault Vehicle would be about as loud as two dump trucks operating in the harbor area. Therefore, sensitive land uses are not exposed to incompatible noise levels under baseline conditions. In the waters around Tinian, small fishing and dive boats operate and a cargo vessel makes regular trips between the Saipan and Tinian ports (in 2010, ferryboat operations between Tinian and Saipan ceased operations). Fishing and dive boats, as well as the cargo vessel operations generate noise levels that are low enough to be considered compatible with adjacent land uses.

3.5.4.4 Traffic

Roads on Tinian currently experience very light traffic volumes. According to the 2008 CNMI Comprehensive Highway Master Plan, the largest traffic volumes were on Broadway, Canal, and Grand Streets in San Jose with annual daily trips of 1,470, 1,520, and 2,240, respectively (Commonwealth

Department of Public Works 2008). Traffic volume on all other roads, including those in the Military Lease Area and Port of Tinian, is well below 500 daily trips. Traffic volumes this low contribute very little to the noise environment and do not exceed 65 decibels day-night average sound level. Again, all land uses within Noise Zone I are considered compatible.

3.5.4.5 Pagan

Currently the noise environment on Pagan is limited to visitors on the northern portion of the island. Man-made noise-generating activities (all-terrain vehicles, generators, and occasional aircraft) are rare and temporary. The only constant noise sources are naturally occurring and include wind, surf, and wildlife. Acoustically, this area would be typical of a rural or wilderness setting with ambient noise levels between 35 and 45 decibels A-weighted (U.S. Environmental Protection Agency 1978). Noise levels of this level cannot be modeled; therefore, no noise contour bands are presented.