PEBBLE PROJECT
ENVIRONMENTAL BASELINE DOCUMENT
2004 through 2008

CHAPTER 12.
NOISE
Bristol Bay Drainages

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ACRONYMS AND ABBREVIATIONS

ADOT&PF	Alaska Department of Transportation and Public Facilities
ANSI	American National Standards Institute
ATV	all-terrain vehicle
dB	decibel(s)
dBA	A-weighted decibel(s)
LA_{eq}	A-weighted L_{eq}
LA_{min}	A-weighted L_{min}
LA_{max}	A-weighted L_{max}
LA_{10}	A-weighted L_{10}
L_{eq}	energy-averaged equivalent sound level (see glossary)
L_{min}	minimum sound level over a preset measurement period (see glossary)
L_{max}	maximum sound level over a preset measurement period (see glossary)
L_{10}	sound level that was equaled or exceeded during 10 percent of a preset measurement period (see glossary)
µPa	microPascal(s)
Pa	Pascal(s)

12. NOISE—BRISTOL BAY DRAINAGES

12.1 Introduction

Sound is a fundamental component of daily life and the most universal method of communicating with other people. When sounds are perceived as desired, beneficial, or otherwise pleasing, they are typically considered as having a positive effect on daily life. When sound is perceived as unpleasant, unwanted, or disturbingly loud, it is considered noise.

The purpose of this chapter is to provide the results of noise-monitoring surveys performed in and around the communities of Iliamna, Newhalen, Pedro Bay, and Nondalton. The purpose of noise monitoring is to describe baseline noise levels and to characterize the existing noise environment. This chapter also provides a general understanding of noise and noise-level descriptors.

12.2 Study Objectives

The objective of the noise study is to characterize the type and magnitude of existing noise sources in the study area.

12.3 Study Area

The noise study area in the Bristol Bay drainages includes populated or noise-sensitive areas in or near the communities of Newhalen, Iliamna, Nondalton, and Pedro Bay. Figure 12-1 shows the locations of the four communities sampled for baseline noise characterization.

12.4 Previous Studies

No previous noise studies in the study area were found.

12.5 Scope of Work

The noise study is intended to meet the requirements of the guidelines from the U.S. Environmental Protection Agency and the U.S. Bureau of Mines for preparation of an analysis of affected-environment noise under the National Environmental Policy Act (NEPA). The purpose of this phase of the analysis is to characterize the existing environment. The affected environment (study area) was characterized by a series of on-site noise measurements and on-site inspections. The work was conducted by Michael Minor of Michael Minor and Associates.

12.6 Methods

This section provides an introduction to acoustics and noise-level descriptors with details of the noise-measurement program used for this analysis. Information on the measurement equipment and calibration procedures also is included.

12.6.1 Introduction to Acoustics

Sound is defined as any pressure variation that the human ear can detect, from barely perceptible sounds to sound levels that can cause hearing damage. The magnitude of the variations of the air pressure from the static, or normal, air pressure is a measure of the sound level. The number of cyclic pressure variations per second is the frequency of sound. When sounds are unpleasant, unwanted, or disturbingly loud, they tend to be classified as noise.

Compared with the static air pressure, audible-sound pressure variations range from the threshold of hearing—a very small 20 microPascals (μPa; 20 x 10^{-6} Pascals)—to 100 Pascals (Pa), a level so loud it is referred to as the threshold of pain. Because the ratio between these numbers is more than a million to one, using Pascals to describe sound levels can be awkward. The decibel (dB) measurement is a logarithmic conversion of air-pressure level variations from Pascals to a unit of measure with a more convenient numbering system. This conversion not only allows for a more convenient scale, but is also a more accurate representation of how the human ear reacts to variations in air pressure.

To better approximate the sensitivity of the human ear to sounds of different frequencies, the A-weighted decibel (dBA) scale was developed. Because the human ear is less sensitive to higher and lower frequencies, the A-weighted scale reduces the sound-level contributions of these less audible frequencies.

Human response to noise is subjective and can vary greatly from person to person. Factors that can influence individual response include the loudness, frequency, amount of background noise present before an intruding noise, and the nature of the work or activity (e.g., sleeping) that the noise affects.

A 10-dBA change in noise level is judged by most people as a doubling of sound level. The smallest change in noise level that a human ear can perceive is about 3 dBA, and increases of 5 dBA or more are usually noticeable. Normal conversation ranges between 44 and 65 dBA when speakers are 3 to 6 feet apart.

Noise levels in a quiet rural area at night are typically between 32 and 35 dBA. Nighttime noise levels in quiet urban settings range from 40 to 50 dBA. Noise levels during the day in a noisy urban area are frequently as high as 70 to 80 dBA. Noise levels above 110 dBA become intolerable and painful, while levels higher than 80 dBA over continuous periods can result in hearing loss. Constant noises tend to be less noticeable than irregular or periodic noises.

Figure 12-2 shows sound levels for some common noise sources and compares their relative loudness to that of an 80-dBA source such as a garbage disposal.

12.6.1.1 Noise Propagation

Several factors determine how sound levels reduce over distance. Under ideal conditions, a point noise source in free space will attenuate at a rate of 6 dB per doubling of distance (using the inverse square law). An ideal line source (such as constant flowing traffic on a busy highway) reduces at a rate of approximately 4.5 dB per doubling of distance. Under normal conditions, however, noise sources are usually some combination of a point source and a line source, resulting in sound attenuation which lies somewhere between the two ideal reduction factors. Other factors that affect the attenuation of sound with distance include structures, topography, foliage, ground cover, and atmospheric conditions such as wind,

temperature, and relative humidity. The following list provides some general information on the potential effects of each of the factors on sound attenuation.

- **Structures**: structures can reduce noise by physically blocking the sound transmission and, in some circumstances, can cause an increase in noise levels if the sound is reflected off the structure and transmitted to a nearby receiver location. (Locations for monitoring and for noise-sensitive land uses [i.e., people] are often referred to as "receiver locations.")
- **Topography**: topography includes hills, berms, and other surface features between the noise source and receiver location. As with structures, topography has the potential to reduce or increase sound depending on the geometry of the area.
- **Foliage**: foliage, if dense, can provide slight reductions in noise levels. The Federal Highway Administration provides for up to a 3-dBA reduction in traffic noise for locations with at least 30 feet of dense foliage that contains leaves year around.
- **Ground Cover**: the ground cover between the receiver and the noise source can have a substantial affect on noise transmission. For example, sound will travel very well across reflective surfaces such as water and pavement, but can be attenuated when the ground cover is field grass, lawns, or loose soil.
- **Atmospheric Conditions**: atmospheric conditions that can have an effect on the transmission of noise include wind, temperature, humidity, and precipitation.

12.6.1.2 Noise-level Descriptors

All noise levels presented in this chapter are stated as sound pressure levels, in terms of decibels on the A-scale (dBA). The A-scale is used in most ordinances and standards including the applicable standards selected for this project. To account for the time-varying nature of noise, several noise metrics are useful. The equivalent sound pressure level (L_{eq}) is defined as the average noise level, on an energy basis, for a stated time period (for example, hourly). When the L_{eq} was measured using the A-weighted scale, the sound level would be presented as dBA L_{eq} or as LAeq.

Other commonly used noise descriptors include the L_{max} L_{min}, and L_{xx}. L_{max} and L_{min} are the greatest and smallest, respectively, root-mean square sound levels, in dBA, measured during a specified measurement period. L_{xx} indicates the sound level equaled or exceeded "xx" percent of the time. For example, L_{10} is the sound level equaled or exceeded 10 percent of the time; therefore, during a 1-hour measurement, an L_{10} of 70 dBA means the sound level was 70 dBA or greater for 6 minutes (10 percent) during that hour. Again, for A-weighted measurements, the sound level descriptor (L_{max} L_{min}, and L_{xx}) would be preceded by "dBA" or, alternatively, "A" would be added to the descriptor (LA_{max} LA_{min}, and LA_{xx}).

Appendix 12A provides the mathematical definitions of the different noise-level descriptors with additional information on noise.

12.6.2 Noise-monitoring Methods

Noise monitoring was performed using short-term, on-site and long-term, unattended methods. All noise measurements were taken in accordance with the American National Standards Institute (ANSI) procedures for community noise measurements. All measurement locations were at least 5 feet from any

solid structure to prevent acoustical reflections and were at a height of 5 feet above the ground as required by ANSI standards.

The equipment used for short-term noise monitoring included Bruel & Kjaer Types 2239 and 2238 sound level meters. Short-term sites were monitored at least three times throughout the day for 30 minutes periods, with the exception of the winter data-collection in Nondalton. Because of equipment sensitivity to extremely cold temperatures, locations in Nondalton were monitored for 15 minutes at five different times throughout the day, evening, and nighttime.

The system used for long-term, unattended noise monitoring was a Bruel & Kjaer Type 2238 meter equipped for statistical analysis. The long-term system was contained in a weatherproof case and was battery-operated. The monitoring systems are made to blend into the surroundings so they are not noticed, because people often will vary their behavior if they know a noise-measurement device is in the area. The system stores detailed noise levels on an hourly basis over the measurement period, which can be from several hours to several days. For the monitoring in the Iliamna and Newhalen areas, the systems were left at each site for approximately 24 hours.

Short-term and long-term noise data were summarized in tables for each monitoring location based on the time of day (daytime, evening, or nighttime) and season (summer or winter). Because of the length of time over which the long-term data were gathered, these data also were graphed on an hourly basis over the entire monitoring period. The graphs include the hourly L_{eq}, the hourly L_{max}, and the hourly L_{10}.

All sound-level meters were calibrated before and after the measurement periods using a Bruel & Kjaer Type 4231 sound-level calibrator. Complete system calibration is performed annually by Bruel & Kjaer Instruments. All system calibration is traceable to the National Institute of Standards and Testing (NIST). All noise-measurement systems meet or exceed the requirements for an ANSI Type 1 noise-measurement system.

12.7 Results and Discussion

This section provides a summary of area land use and the results of the noise-monitoring sessions performed to date.

12.7.1 Study Area Land Use

Land uses in the study area include residential, commercial, and light industrial, as well as undeveloped lands. Figure 12-1 shows the locations of communities included in the study area.

Residential land use in the study area was identified in Newhalen, Iliamna, Nondalton, and Pedro Bay. There also are several single-family residences along the Newhalen River Road, north of the Iliamna Airport. The medical center for the communities of Iliamna and Newhalen is located near the post office at the intersection of Iliamna and Newhalen roads.

The community of Newhalen is virtually all residential and provides schooling for the area. Iliamna is mostly residential and has the main general store serving both communities. During summer months, Iliamna is a base for sportfishing and there are several floatplane flights daily, beginning around 5:00 to 6:00 a.m. each morning.

Pedro Bay is located at the eastern end of Iliamna Lake. This small community has its own school system, and all supplies are flown in from Iliamna, as there is no road connection to Iliamna. The community is virtually all residential; however, like Iliamna, it also is a base for sportfishing during summer months and has several floatplane flights daily. Power for Pedro Bay is supplied by a large diesel-fueled generating facility located in a metal building near the school.

Nondalton, like Pedro Bay, has no permanent road connection to Iliamna; therefore, supplies for this community also are flown in daily from Iliamna and Anchorage. There is no community power generation in the village. During winter, the Newhalen River freezes, providing an ice road to the Newhalen River Road south to Iliamna. This road, however, is mainly for residents' use and is not generally used for supplies. A small fishing camp is located at the end of Newhalen River Road, across the river and slightly south of Nondalton.

Figures 12-3 through 12-6 provide a general identification of noise sensitive land uses in these four communities and the possible road corridor. Other information on general land use may be found in Chapter 18.

12.7.2 Noise-monitoring Results

Ambient noise levels were measured at 15 locations in the study area: three locations in Iliamna, two in Newhalen, one near the post office and medical building between Iliamna and Newhalen, one by the Iliamna airport, two north of the airport along Newhalen River Road, four in Pedro Bay, and two in Nondalton (Figures 12-3 through 12-6). Overall, the measured noise levels in all four communities and along the connecting roadways are very similar to noise data taken in other parts of Alaska and are in the range expected for rural areas with low population. This section provides details on the noise-monitoring sessions, including the measured noise levels and dominant noise sources at each site. Table 12-1 summarizes the monitoring locations and the types of monitoring performed at each location.

12.7.2.1 Site M1: North Newhalen River Road

Site M1 was located at the north end of Newhalen River Road. The road dead-ends near the winter river-crossing location, north of the proposed location for an Alaska Department of Transportation and Public Facilities (ADOT&PF) bridge close to a fishing camp. The meter was set up at a site overlooking the river with a clear view of a group of homes approximately 1.5 miles south of Nondalton. Photo 12-1 shows the sound-level meter with the homes visible in the distance across the river.

Major noise sources at this site were occasional aircraft flyovers, occasional vehicle traffic including snow machines during winter and all-terrain vehicles (ATVs) during summer, birds, and wind.

Site M1 was a short-term noise-monitoring location. The winter monitoring sessions occurred on March 7 and 8, 2005, and the summer sessions occurred on August 9 and 10, 2005. Overall, measured noise levels ranged from 34 to 43 dBA L_{eq}, with periodic quiet periods where noise levels were below 30 decibels. Maximum noise levels as high as 81 dBA L_{max} were recorded during pass-bys of ATVs and other vehicles. Table 12-2 provides a summary of the measured noise levels at Site M1.

12.7.2.2 Site M2: Central Newhalen River Road

Site M2 was located near the northernmost permanent residential land use on the Newhalen River Road (inset on Figure 12-3). This location also was selected to represent noise levels at residential areas near a possible DOT crossing of the Newhalen River.

Major noise sources at this site were occasional aircraft flyovers, occasional vehicle traffic including snow machines during winter and ATVs during summer, birds, and wind. There is a community power generation facility within the community of Newhalen.

Site M2 was a short-term noise-monitoring location. The winter monitoring sessions occurred on March 7, 2005, and the summer sessions occurred on August 9 and 10, 2005. Measured noise levels ranged from 37 to 54 dBA L_{eq}. As with most sites, there were periodic quiet periods where noise levels were in the low, 20 to 30 decibels, range. Maximum noise levels as high as 77 dBA L_{max} were recorded during vehicle pass-bys. Table 12-3 provides a detailed summary of the measured noise levels at Site M2.

12.7.2.3 Site M3: Iliamna Airport near Iliamna Air Taxi Terminal

Site M3 was located at the Iliamna Airport on Newhalen River Road near the entrance to the Iliamna Air Taxi passenger terminal (Figures 12-3 and 12-4). There are several light to medium industrial land uses near this site, including what appeared to be a machine shop, gas station, and the ADOT&PF shop and maintenance facility located nearby on Iliamna Road. There is no community power generation within the community of Iliamna.

Major noise sources at this site include fixed-wing aircraft takeoffs, landings, and flyovers; helicopter traffic; and vehicle traffic including snow machines during winter and ATVs during summer. The nearby industrial operations also are substantial contributors to the noise levels in this area. Photo 12-2 shows the sound-level meter with industrial land use in the background.

Site M3 was monitored short-term during daytime, evening, and nighttime hours. The winter monitoring was performed on March 7 and 8, 2005, with the summer monitoring performed on August 9 and 10, 2005. Overall noise levels ranged from 37 to 61 dBA L_{eq}. Maximum noise levels at this site during aircraft activity were measured and ranged from 88 to 97 dBA L_{max}, with the loudest noise levels during aircraft takeoff. Table 12-4 provides a detailed summary of the measured noise levels at Site M3.

12.7.2.4 Site M4: Post Office and Community Medical Clinic

Monitoring Site M4 was located in an open area near the post office parking lot in Iliamna (Figures 12-3 and 12-4). This site is directly across Newhalen Road from the community medical clinic. Site M4 was monitored using an unattended semi-permanent noise-monitoring station. Winter noise levels were measured over a 23-hour period, beginning at 3:00 p.m. on March 7 and ending at 2:00 p.m. on March 8, 2005. Summer noise monitoring was performed for 25 hours from 1:00 p.m. on August 9 to 2:00 p.m. on August 10, 2005. The noise-monitoring terminal, difficult to see because it is painted flat black, is shown on Photo 12-3 with the post office in the background.

Major noise sources at this location included vehicle traffic to and from the post office, traffic on Iliamna and Newhalen roads, aircraft overflights, and other sources such as snow machines (winter) and ATVs

(summer). Noise from floatplanes operating from Slop Bucket and Iliamna lakes was clearly audible at this site during the summer fishing season.

The winter noise levels are shown on Figure 12-7, with the summer data plotted on Figure 12-8. The plots contain the hourly L_{eq}, L_{10}, and L_{max}, all given in dBA. In addition, a detailed summary of the measured noise levels is given in Table 12-5 for easy comparison with the other noise-level data measured in the study area. Energy-averaged noise levels over the entire measurement periods were 50 dBA L_{eq} during the winter and 51 dBA L_{eq} during the summer. Overall, the winter and summer noise levels were similar, except for a noticeably higher typical maximum noise level during daytime hours. Energy-averaged noise levels in summer ranged from 27 to 59 dBA L_{eq}, with a maximum reading of 84 dBA L_{max}. Energy-averaged noise levels in winter ranged from 32 to 60 dBA L_{eq}, with a maximum reading of 91 dBA L_{max}.

12.7.2.5 Site M5: North Newhalen

Noise-measurement Site M5 was in the community of Newhalen, on the northern end of the village near several single-family residences (Figure 12-4). This was a short-term noise-measurement site with summer data taken on August 9 and 10, 2005, and the winter data taken on March 8, 2005. Photos 12-4 and 12-5 show the monitoring location and some of the homes near the measurement site.

Major noise sources at this site included occasional aircraft flyovers; vehicle traffic to and from the village, including snow machines during winter and ATVs during summer; general residential activities; birds; and wind.

Overall, noise levels ranged from 33 to 48 dBA L_{eq}. As with most sites, there were periodic quiet periods where noise levels were in the low, 20 to 30 decibels, range. Maximum noise levels as high as 70 dBA L_{max} were recorded. Table 12-6 provides a detailed summary of the measured noise levels at Site M5.

12.7.2.6 Site M6: Newhalen School

Measurement Site M6 was located in front of the Newhalen School (Figure 12-4). This was a long-term noise-measurement site, monitored using an unattended semi-permanent noise-monitoring station. Winter noise levels were measured over a 23-hour period beginning at 4:00 p.m. on March 8 and ending at 3:00 p.m. on March 9, 2005. Summer noise levels were monitored for 31 hours from 2:00 p.m. on August 10 till 9:00 p.m. on August 11, 2005.

Major noise sources at this site included occasional aircraft flyovers, vehicle traffic, students and faculty at the school, snow machines during winter and ATVs during summer, birds, and wind.

Hourly measured noise levels were plotted on two graphs. The winter noise levels are shown on Figure 12-9, with the summer data plotted on Figure 12-10. The plots show the hourly L_{eq}, L_{10}, and L_{max}, all given in dBA. Energy-averaged L_{eq} noise levels over the entire measurement periods were 58 dBA L_{eq} during the winter and 54 dBA L_{eq} during the summer. Winter noise levels ranged from 51 to 63 dBA L_{eq}, with a maximum reading of 91 dBA L_{max}. Summer noise levels ranged from 40 to 59 dBA L_{eq}, with a maximum reading of 88 dBA L_{max}. The lower noise levels during summer are likely because school was not in session at that time. Table 12-7 provides a detailed summary of the measured noise levels at Site M6.

12.7.2.7 Site M7: Roadhouse Bed and Breakfast

Noise-measurement Site M7 was at the Roadhouse Bed and Breakfast and single-family residences located on Iliamna Road, east of the post office (Figure 12-3). The meter was placed in the front yard near the main entrance of the bed and breakfast, which is set back several hundred feet from the roadway. During the winter measurement session, this location was monitored using an unattended semi-permanent noise-monitoring station for 14 hours beginning at 6:00 p.m. on March 9 and ending at 8:00 a.m. on March 10, 2005. The summer data were measured between August 8 and August 10, 2005, using the short-term, hand-held measurement system.

Noise sources included general residential activities, aircraft overflights, floatplanes in summer, traffic on Iliamna Road, and snow machines (winter) and ATVs (summer). Noise levels during the winter session ranged from 30 to 42 dBA L_{eq}, with a maximum reading of 66 dBA L_{max}. Figure 12-11 is a plot of the winter data over the 14-hour measurement period. Summer noise levels ranged from 36 to 48 dBA L_{eq}, with a maximum level of 84 dBA L_{max}. Table 12-8 provides a detailed summary of the measured noise levels at Site M7.

12.7.2.8 Site M8: Iliamna General Store and Vicinity

Noise-measurement Site M8 was near the Iliamna general store on the Iliamna Village Spur (Figure 12-3). The meter was placed between the store and the residential area adjacent to the store. Noise monitoring at this location reflects ambient noise levels for the store area. The noise-monitoring site was across the street from Gram's Bed and Breakfast and near the Rainbow King Lodge, so the measured noise levels at this site also are representative of ambient noise at these two noise-sensitive locations. The winter measurements were taken on March 8 and 9, 2005, with the summer measurements performed on August 10, 2005.

Major noise sources at this site include general residential and commercial activity, occasional aircraft flyovers, vehicle traffic including snow machines during winter and ATVs during summer, birds, and wind. This location also serves as a gathering point for many local residents during evening hours, and there is a basketball court for summer play. Photo 12-6 shows the sound-level meter location with the store located in the background.

Overall, noise levels near the store and nearby residential areas ranged from 32 to 62 dBA L_{eq}. During nighttime hours when the store was closed, noise levels decreased to between 32 and 38 dBA L_{eq}. Maximum noise levels as high as 81 dBA L_{max} were recorded. Table 12-9 provides a detailed summary of the measured noise levels at Site M8.

12.7.2.9 Site M9: Iliamna Lake

Site M9 was located near the lake front (Figure 12-3), close to the mooring location in Slop Bucket Lake for the floatplanes used for summertime fishing excursions. The meter was located at the intersection of Iliamna Village Spur and Slop Bucket roads. Winter data were taken on March 9, 2005, and the summer data were taken on August 10, 2005.

Major noise sources during summer months at this site included floatplane takeoffs and landings, fishing boats, people swimming from the docks, general lakeside activities, residential activities, birds, and wind.

Noise sources during the winter include vehicle traffic, snow machines, and noise from general residential activities. Photo 12-7 shows the location of the sound-level meter at this site.

Noise levels ranged from 36 to 61 dBA L_{eq} during the different measurement sessions. Maximum noise levels ranged as high as 88 dBA from normal vehicles, ATVs, and snow machines. During the takeoff of a floatplane, noise levels along the lake shoreline were measured at 75 to 103 dBA L_{max}. Table 12-10 provides a detailed summary of the measured noise levels at Site M9.

12.7.2.10 Site M10: Pedro Bay on Iliamna Lake

Due to travel restrictions, noise monitoring was preformed only during daytime and evening hours at the Pedro Bay Sites. Nighttime noise levels were estimated based on the expected level of activity and measured noise levels. This is the case for sites M10 through M13.

Site M10 was located near the shore of Iliamna Lake in the community of Pedro Bay (Figure 12-5). This location is at a fishing camp and residential area used primarily during summer. This is also a location where floatplanes are used for summertime fishing trips. Photo 12-8 shows a view of two floatplanes at the site during the summertime monitoring sessions.

Major noise sources at this site included floatplanes, fishing boats, ATVs, general beach-type activities, occasional vehicle traffic, and birds during summer months. During the winter, main noise sources included occasional vehicle traffic and snow machines.

Site M10 was a short-term noise-monitoring location. The winter noise-monitoring session was on March 8, 2005, and the summer session was on August 11, 2005. Measured noise levels ranged from 32 to 49 dBA L_{eq}, with periodic quiet periods when noise levels were below the 30-decibel range. Maximum noise levels as high as 77 dBA L_{max} were measured at this location during vehicle pass-bys. Noise levels during takeoff by floatplanes would be expected to range from 90 to 100 dBA or greater near the cabins on the waterfront. There was no floatplane activity, however, during the monitoring sessions at this location. Table 12-11 provides a detailed summary of the measured noise levels at Site M10.

12.7.2.11 Site M11: Pedro Bay Tribal Center

Measurement Site M11 was on the hill behind the Pedro Bay Tribal Center (Figure 12-5). M11 was a short-term noise-measurement site. The winter monitoring session was on March 8, 2005, and the summer session was on August 11, 2005.

Main noise sources included activities at the tribal center, vehicle traffic, and other general activities. The maintenance facility for the Pedro Bay community is located near the tribal center and also contributed some noise at this monitoring location. Photo 12-9 shows the tribal center.

Overall, noise levels ranged from 32 to 49 dBA L_{eq}, with periodic quiet periods when noise levels were below the 30-decibel range. Maximum noise levels as high as 76 dBA L_{max} were recorded at this location during vehicle pass-bys. Table 12-12 provides a detailed summary of the measured noise levels at Site M11.

12.7.2.12 Site M12: Pedro Bay School

Site M12 was a short-term noise-monitoring location on the Pedro Bay school-grounds near the main entrance to the school (Figure 12-5). Main noise sources included activities at the school, vehicle traffic, and other general activities. Just behind the school is the power-generation facility for the Pedro Bay community, which consists of multiple diesel-engine-powered generators that were audible at the school and contributed noise to the readings at this monitoring location. Photo 12-10 shows the side of the school with the noise meter in the distance.

The winter monitoring session was on March 8, 2005, and the summer session was on August 11, 2005. Measured noise levels ranged from 32 to 49 dBA L_{eq}. Minimum noise levels at this location were governed by the operation of the power-generation facility, which maintained noise levels in the low, 30-decibel range. The maximum noise level of 84 dBA L_{max} was measured during a pass-by of a loud vehicle. Table 12-13 provides a detailed summary of the measured noise levels at Site M12.

Noise-level readings were taken at two locations near the power generator. One reading was taken at the edge of the school-grounds, and a second reading was taken directly in front of the power-generation building, approximately 50 feet from the building. Photos 12-11 and 12-12 show the power-plant building and the two monitoring locations where noise readings from the power plant were taken.

Noise levels at the edge of the school-grounds ranged from 36 to 40 dBA L_{eq}, with minimum levels of 33 dBA. In front of the generator building, noise levels ranged from 43 to 45 dBA L_{eq}, with a minimum noise level of 41 dBA. At the time of the measurement, only one of the three generators was in operation, as only one exhaust stack was open. Noise levels would increase by 3 dBA if two generators were in operation simultaneously.

12.7.2.13 Site M13: Southern Pedro Bay

Noise-monitoring Site M13 was located south of the core of Pedro Bay near a bridge and close to several residences (Figure 12-5). This was a short-term noise-measurement site. Main noise sources in the area included vehicle traffic, aircraft, and general residential activities.

The winter monitoring session was on March 8, 2005, and the summer session was on August 11, 2005. Measured noise levels ranged from 32 to 49 dBA L_{eq}, with periodic quiet periods where noise levels were below the 30-decibel range. Maximum noise levels as high as 76 dBA L_{max} from vehicle pass-bys also occurred at this location. Table 12-14 provides a detailed summary of the measured noise levels at Site M13.

12.7.2.14 Site M14: Nondalton, June Tracy's Bed and Breakfast

Site M14 in Nondalton was on June Tracy's property near the waterfront (Figure 12-6). The noise data were collected on February 22 and 23, 2007. Due to extremely cold temperatures, the measurement sessions were limited to 15 minutes instead of the normal 30 minutes. Monitoring was performed two times during daytime hours (7:00 a.m. to 7:00 p.m.), once during evening hours (7:00 p.m. to 10:00 p.m.), and twice during nighttime hours (10:00 p.m. to 7:00 a.m.). No summer noise-measurement session was performed at this site.

Major noise sources included local traffic, aircraft overflights, generators, and some general residential construction.

Measured noise levels ranged from below 20 to 38 dBA L_{eq}. Maximum noise levels ranged from 58 to 66 dBA L_{max} and were the result of ice breaking on Six Mile Lake, vehicles pass-bys, and residential activities. Minimum noise levels typically ranged between 20 and 26 dBA L_{min}, and were due to generators running in the distance and movement of the ice on the lake. Table 12-15 provides a detailed summary of the measured noise levels at Site M14.

12.7.2.15 Site M15: Central Nondalton, Main Street (Lower Road)

Noise-monitoring Site M15 was on Main Street in Nondalton, approximately 500 feet from the lake shore and 475 feet from Site M14 (Figure 12-6). As with Site M14, the measurement sessions were conducted only in winter and were limited to 15 minutes due to cold temperatures. This site also was monitored twice during daytime and nighttime hours, and once during evening hours.

Measured noise levels ranged from below 45 to 51 dBA L_{eq}. Maximum noise levels ranged from 67 to 74 dBA L_{max}. The L_{max} noise levels were due to vehicles pass-bys and residential activities. Minimum noise levels typically ranged between 20 and 34 dBA L_{min} and were due to generators. Table 12-16 provides a detailed summary of the measured noise levels at Site M15.

12.8 Summary

Overall, noise levels in the study area ranged from below 30 dBA L_{eq} to 63 dBA L_{eq}. Noise levels north of the Iliamna Airport ranged from 34 to 54 dBA L_{eq}, with ambient noise near the airport ranging from 37 to 61 dBA L_{eq}. The measured noise levels at the Iliamna post office, near the community medical center, ranged from 27 to 60 dBA L_{eq}. Noise levels near the Iliamna general store and along the shore of Iliamna Lake ranged from 32 to 62 dBA L_{eq}, with the highest averaged noise levels measured near the general store.

Noise levels in Newhalen ranged from 33 to 63 dBA L_{eq}, with the highest levels near the school. In Pedro Bay, noise levels ranged between 32 and 49 dBA L_{eq}. Measured winter noise levels in Nondalton ranged from below 30 to 51 dBA L_{eq}.

Overall, the measured noise levels in all four communities and along the connecting roadways are very similar to noise data taken in other parts of Alaska and are in the range expected for rural areas with low population. Major noise sources included floatplanes, fixed-wing aircraft, helicopters, vehicle traffic including snow machines during winter and ATVs during summer, general construction and maintenance, residential and community activities, birds, and wind. Some of the highest noise levels measured were the separate reference measurements of takeoffs by floatplanes, which ranged from 90 to over 100 dBA L_{max} along the waterfront in Iliamna.

12.9 References

Beranek, Leo L. 1988. Noise and Vibration Control. Revised edition. Cambridge, Massachusetts: Institute of Noise Control Engineering.

U.S. Environmental Protection Agency, Office of Noise Abatement and Control (USEPA). 1971. Transportation Noise and Noise from Equipment by Internal Combustion Engines. Washington DC. December.

12.10 Glossary

L_{eq} (equivalent continuous sound level). The constant sound level in dBA that, lasting for a time, T, would have produced the same energy in the same time period T as an actual A-weighted noise event.

$$L_{eq} = 10\text{Log}_{10} \frac{1}{T} \int_0^T \left(\frac{p(t)}{p_o}\right)^2 dt$$

L_{max} (MaxL; maximum A-weighted root-mean square sound level). The greatest root-mean square (RMS) sound level, in dBA, measured during the preset measurement period.

L_{min} (MinL; minimum A-weighted RMS sound level). The lowest RMS sound level, in dBA, measured during the preset measurement period.

L_{xx} (statistical noise-level descriptor). The sound level that was equaled or exceeded during XX percent of the measurement period. For example: during a 1-hour measurement, an L_{10} of 65 dBA means the sound level was 65 dBA or more for 6 minutes (10 percent) of that hour.

TABLES

TABLE 12-1
Noise-monitoring Site Descriptions

Site Number	Description	Winter Session	Summer Session	Monitoring Type [a]
M1	**North Newhalen River Road**—near the north end of Newhalen River Road near the fishing camp and winter river-crossing area	Yes	Yes	Short-term
M2	**Central Newhalen River Road**—north of Iliamna Airport at the northernmost occupied residence on the Newhalen River Road	Yes	Yes	Short-term
M3	**Iliamna Airport**—near Iliamna Air Taxi terminal	Yes	Yes	Short-term
M4	**Post Office and Community Medical Clinic**—intersection of Iliamna Road and Newhalen Road	Yes	Yes	Long-term
M5	**North Newhalen**—residential area just off Newhalen Road	Yes	Yes	Short-term
M6	**Newhalen School**—in front of the school near Newhalen Road	Yes	Yes	Long-term
M7	**Roadhouse Bed and Breakfast** and single-family residence on Iliamna Road	Yes	Yes	Long-term (winter) Short-term (summer)
M8	**Iliamna General Store and Vicinity**—on Iliamna Village Spur close to several residential buildings	Yes	Yes	Short-term
M9	**Iliamna Lake**—near the docks at Slop Bucket Road and Iliamna Village Spur close to floatplane moorage	Yes	Yes	Short-term
M10	**Pedro Bay on Iliamna Lake**—along the lake shore next to several cabins used for fishing trips and where several floatplanes were moored	Yes	Yes	Short-term
M11	**Pedro Bay Tribal Center**—behind Tribal Center, up the hill	Yes	Yes	Short-term
M12	**Pedro Bay School**—on school-grounds near main school entrance, additional readings taken behind school at power plant	Yes	Yes	Short-term
M13	**Southern Pedro Bay**—south end of East Bay Road near residential areas south of core area	Yes	Yes	Short-term
M14	**Nondalton, June Tracy's Bed and Breakfast**—near shore of Six Mile Lake	Yes	No	Short-term
M15	**Central Nondalton, Main Street (Lower Road)**—500 feet from shore of Six Mile Lake	Yes	No	Short-term

Notes:

a. Short-term sites were monitored at least three times throughout the day for 30 minutes periods, with the exception of the winter data in Nondalton. Because of equipment sensitivity to extremely cold temperatures, locations in Nondalton were monitored for 15 minutes at five different times throughout the day, evening, and nighttime. Long-term sites were monitored continuously for at least 23 hours, except Site M7, which was monitored for 14 hours that included daytime, evening, and nighttime.

TABLE 12-2
M1 North Newhalen River Road, Measured Noise Levels (in dBA)

	Daytime Levels [a]				Evening Levels [b]				Nighttime Levels [c]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer	41	45	63	24	42	48	78	—[d]	43	50	81	—[d]
Winter	38	41	65	—[d]	36	38	56	—[d]	34	38	69	—[d]

Notes:

a. Daytime is 7:00 a.m. to 7:00 p.m.

b. Evening is 7:00 p.m. to 10:00 p.m.

c. Nighttime is 10:00 p.m. to 7:00 a.m.

d. Minimum short-term noise level of 30 dBA or less.

TABLE 12-3
M2 Central Newhalen River Road, Measured Noise Levels (in dBA)

	Daytime Levels [a]				Evening Levels [b]				Nighttime Levels [c]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer	54	58	77	29	40	43	61	23	42	45	58	—[d]
Winter	45	50	73	—[d]	37	41	70	—[d]	39	44	70	—[d]

Notes:

a. Daytime is 7:00 a.m. to 7:00 p.m.

b. Evening is 7:00 p.m. to 10:00 p.m.

c. Nighttime is 10:00 p.m. to 7:00 a.m.

d. Minimum short-term noise level of 30 dBA or less.

TABLE 12-4
M3 Iliamna Airport near Iliamna Air Taxi Terminal, Measured Noise Levels (in dBA)

	Daytime Levels [a]				Evening Levels [b]				Nighttime Levels [c]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer	57	62	97	39	47	55	67	—[d]	37	44	70	29
Winter	61	66	88	35	56	60	80	—[d]	52	57	69	—[d]

Notes:

a. Daytime is 7:00 a.m. to 7:00 p.m.

b. Evening is 7:00 p.m. to 10:00 p.m.

c. Nighttime is 10:00 p.m. to 7:00 a.m.

d. Minimum short-term noise level of 20 dBA or less.

TABLE 12-5
M4 Iliamna Post Office and Community Medical Clinic, Measured Noise Levels (in dBA)

	Daytime Levels [b]				Evening Levels [c]				Nighttime Levels [d]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer [a]	44-60	48-62	65-84	21-22	46-52	51-56	70-78	21	27-51	25-53	52-79	—[e]
Winter [a]	48-60	50-58	70-91	—[e]-37	46	45-50	66-74	—[e]	32-46	32-49	53-68	—[e]

Notes:

a. Range of noise levels from 23- and 25-hour monitoring sessions plotted on Figures 12-7 and 12-8, respectively.

b. Daytime is 7:00 a.m. to 7:00 p.m.

c. Evening is 7:00 p.m. to 10:00 p.m.

d. Nighttime is 10:00 p.m. to 7:00 a.m.

e. Minimum noise level of 20 dBA or less.

TABLE 12-6
M5 North Newhalen, Measured Noise Levels (in dBA)

	Daytime Levels [a]				Evening Levels [b]				Nighttime Levels [c]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer	48	52	70	—[d]	41	53	27	—[d]	37	43	66	29
Winter	42	46	70	29	42	46	68	32	33	36	57	—[d]

Notes:

a. Daytime is 7:00 a.m. to 7:00 p.m.

b. Evening is 7:00 p.m. to 10:00 p.m.

c. Nighttime is 10:00 p.m. to 7:00 a.m.

d. M**i**nimum short-term noise level of 30 dBA or less.

TABLE 12-7
M6 Newhalen School, Measured Noise Levels (in dBA)

	Daytime Levels [b]				Evening Levels [c]				Nighttime Levels [d]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer [a]	40-59	44-65	63-88	26-29	50-59	55-63	78-88	27-28	40-57	36-60	65-85	26-29
Winter [a]	53-59	53-63	73-89	30-36	55-61	57-64	78-87	33-39	51-63	54-65	69-91	31-46

Notes:

a. Range of noise levels from 23-hour (summer) and 31-hour (winter) monitoring sessions plotted on Figures 12-10 and 12-9, respectively.

b. Daytime is 7:00 a.m. to 7:00 p.m.

c. Evening is 7:00 p.m. to 10:00 p.m.

d. Nighttime is 10:00 p.m. to 7:00 a.m.

TABLE 12-8
M7 Roadhouse Bed and Breakfast, Measured Noise Levels (in dBA)

	Daytime Levels [b]				Evening Levels [c]				Nighttime Levels [d]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer	48	54	84	21	40	42	73	24	36	39	66	—[e]
Winter [a]	30-42	34-43	43-66	—[e]	32-42	32-35	55-66	—[e]	30-39	—[e]-42	43-64	—[e]

Notes:

a. Winter data are the range of noise levels from 15-hour monitoring session plotted on Figure 12-11.
b. Daytime is 7:00 a.m. to 7:00 p.m.
c. Evening is 7:00 p.m. to 10:00 p.m.
d. Nighttime is 10:00 p.m. to 7:00 a.m.
e. Minimum noise level of 30 dBA or less.

TABLE 12-9
M8 Iliamna General Store and Vicinity, Measured Noise Levels (in dBA)

	Daytime Levels [a]				Evening Levels [b]				Nighttime Levels [c]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer	55	60	76	27	56	60	81	33	38	43	67	31
Winter	62	66	81	33	54	57	77	—[d]	32	34	52	—[d]

Notes:

a. Daytime is 7:00 a.m. to 7:00 p.m.
b. Evening is 7:00 p.m. to 10:00 p.m.
c. Nighttime is 10:00 p.m. to 7:00 a.m.
d. Minimum short-term noise level of 30 dBA or less.

TABLE 12-10
M9 Iliamna Lake, Measured Noise Levels (in dBA)

	Daytime Levels [a]				Evening Levels [b]				Nighttime Levels [c]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer	61	63	88	32	57	61	78	31	41	43	103[e]	37
Winter	42	45	77	—[d]	36	39	68	—[d]	41	43	72	—[d]

Notes:

a. Daytime is 7:00 a.m. to 7:00 p.m.
b. Evening is 7:00 p.m. to 10:00 p.m.
c. Nighttime is 10:00 p.m. to 7:00 a.m.
d. Minimum short-term noise level of 30 dBA or less.
e. L_{max} of 103 dBA was during a floatplane takeoff at approximately 6:30 a.m.

TABLE 12-11
M10 Pedro Bay on Iliamna Lake, Measured Noise Levels (in dBA)

	Daytime Levels [a]				Evening Levels [b]				Nighttime Levels [c]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer	49	51	76	30	42	46	68	—[d]	36	39	50	—[d]
Winter	42	45	77	28	38	41	68	—[d]	32	35	50	—[d]

Notes:

a. Daytime is 7:00 a.m. to 7:00 p.m.

b. Evening is 7:00 p.m. to 10:00 p.m.

c. Nighttime noise levels derived from daytime/evening levels and noise levels from similar areas between 10:00 p.m. & 7:00 a.m.

d. Minimum short-term noise level of 30 dBA or less.

TABLE 12-12
M11 Pedro Bay Tribal Center, Measured Noise Levels (in dBA)

	Daytime Levels [a]				Evening Levels [b]				Nighttime Levels [c]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer	49	51	76	26	42	44	69	27	36	39	50	—[d]
Winter	38	40	68	—[d]	36	38	68	—[d]	32	35	50	—[d]

Notes:

a. Daytime is 7:00 a.m. to 7:00 p.m.

b. Evening is 7:00 p.m. to 10:00 p.m.

c. Nighttime noise levels derived from daytime/evening levels and noise levels from similar areas between 10:00 p.m. & 7:00 a.m.

d. Minimum short-term noise level of 30 dBA or less.

TABLE 12-13
M12 Pedro Bay School-grounds, Measured Noise Levels (in dBA)

	Daytime Levels [a]				Evening Levels [b]				Nighttime Levels [c]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer	36	40	65	33	49	53	84	34	36	39	50	32
Winter	46	51	77	35	36	38	68	32	32	35	50	32

Notes:

a. Daytime is 7:00 a.m. to 7:00 p.m.

b. Evening is 7:00 p.m. to 10:00 p.m.

c. Nighttime noise levels derived from daytime/evening levels and noise levels from similar areas between 10:00 p.m. & 7:00 a.m.

TABLE 12-14
M13 Southern Pedro Bay, Measured Noise Levels (in dBA)

	Daytime Levels [a]				Evening Levels [b]				Nighttime Levels [c]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer	49	53	79	21	49	57	74	23	36	39	50	—[d]
Winter	32	34	59	—[d]	36	38	68	—[d]	32	35	50	—[d]

Notes:

a. Daytime is 7:00 a.m. to 7:00 p.m.

b. Evening is 7:00 p.m. to 10:00 p.m.

c. Nighttime noise levels derived from daytime/evening levels and noise levels from similar areas between 10:00 p.m. and 7:00 a.m.

d. Minimum short-term noise level of 30 dBA or less.

TABLE 12-15
M14 Nondalton at June Tracy's Bed and Breakfast, Measured Noise Levels (in dBA)

	Daytime Levels [a]				Evening Levels [b]				Nighttime Levels [c]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer [d]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Winter	—[e]-38	35-41	61-66	—[e]-25	40	39	69	26	33-37	29-35	63-58	20-23

Notes:

a. Daytime is 7:00 a.m. to 7:00 p.m.

b. Evening is 7:00 p.m. to 10:00 p.m.

c. Nighttime is 10:00 p.m. to 7:00 a.m.

d. Summer monitoring was not performed in Nondalton.

e. Minimum short-term noise level of 30 dBA or less.

TABLE 12-16
M15 Central Nondalton, Main Street (Lower Road), Measured Noise Levels (in dBA)

	Daytime Levels [a]				Evening Levels [b]				Nighttime Levels [c]			
	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}	L_{eq}	L_{10}	L_{max}	L_{min}
Summer [d]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Winter	48-51	51-58	70-72	34	46	50	69	20	45-46	42-45	67-74	22-24

Notes:

a. Daytime is 7:00 a.m. to 7:00 p.m.

b. Evening is 7:00 p.m. to 10:00 p.m.

c. Nighttime is 10:00 p.m. to 7:00 a.m.

d. Summer monitoring was not performed in Nondalton.

FIGURES

155°24'0"W 155°12'0"W 155°0'0"W 154°48'0"W 154°36'0"W 154°24'0"W 154°12'0"W 154°0'0"W 153°48'0"W 153°36'0"W

N.60°12'0"

N.60°0'0"

N.59°48'0"

N.59°36'0"

Lake Clark

Nondalton

Iliamna

Newhalen

Pedro Bay

Bristol Bay
Drainages Study

Cook Inlet
Drainages Study

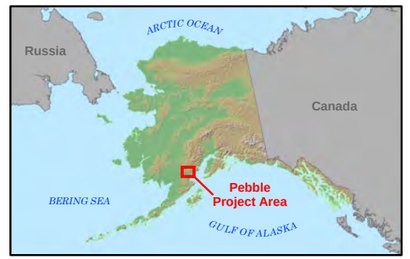
Iliamna Lake

Cook Inlet

Figure 12-1
Noise Study Communities
Bristol Bay Drainages

Legend

- Noise Study Community
- General Deposit Location
- Bristol Bay / Cook Inlet Drainage Divide



0 5 10 15 Miles

0 5 10 15 20 Kilometers

Scale 1:350,000

N

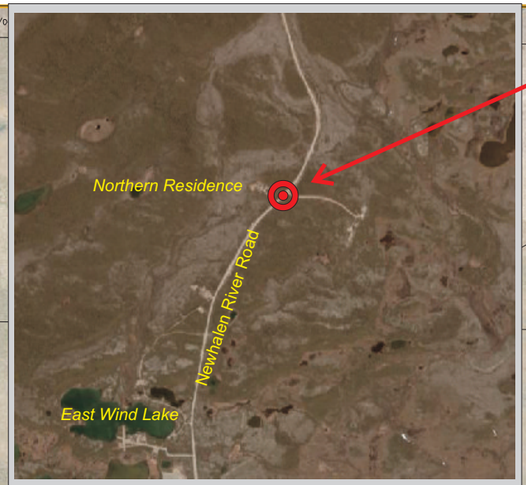
Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: RDI_PLP_Noise_D01.mxd	Date: June 14, 2010
Version 1	Author: PLP-JG

Noise Source or Activity	Sound Level (dBA)	Subjective Impression	Relative Loudness (human judgment of different sound levels)
Jet aircraft takeoff from carrier (50 feet)	140	Threshold of pain	64 times as loud
50-horse power siren (100 feet)	130		32 times as loud
Loud rock concert near stage, Jet takeoff (200 feet)	120	Uncomfortably loud	16 times as loud
Float plane takeoff (100 feet)	110		8 times as loud
Jet takeoff (2,000 feet)	100	Very loud	4 times as loud
Heavy truck or motorcycle (25 feet)	90		2 times as loud
Garbage disposal (2 feet) **Pneumatic drill (50 feet)**	80	**Moderately loud**	**Reference loudness**
Vacuum cleaner (10 feet), Passenger car at 65 mph (25 feet)	70		1/2 as loud
Typical office environment	60		1/4 as loud
Light auto traffic (100 feet)	50	Quiet	1/8 as loud
Bedroom or quiet living room Bird calls	40		1/16 as loud
Quiet library, soft whisper (15 feet)	30	Very quiet	
High quality recording studio	20		
Acoustic Test Chamber	10	Just audible	
	0	Threshold of hearing	

Sources: Beranek (1988) and U.S. EPA (1971).

FIGURE 12-2
Typical Noise Sources and Human Subjective Impression



This inset shows Newhalen River Road north of the Iliamna Airport and is not at the scale of the map.

M2: Central Newhalen River Road (northern residential land use)

M3: Iliamna Airport near Iliamna Air Taxi Terminal

M4: Post Office and Community Medical Clinic

M7: Roadhouse Bed and Breakfast

M8: Iliamna General Store and Vicinity

M9: Iliamna Lake (close to float planes)

Figure 12-3
Iliamna Noise Monitoring Locations

Noise Monitoring Site

0 600 1200 1800
Scale in Feet

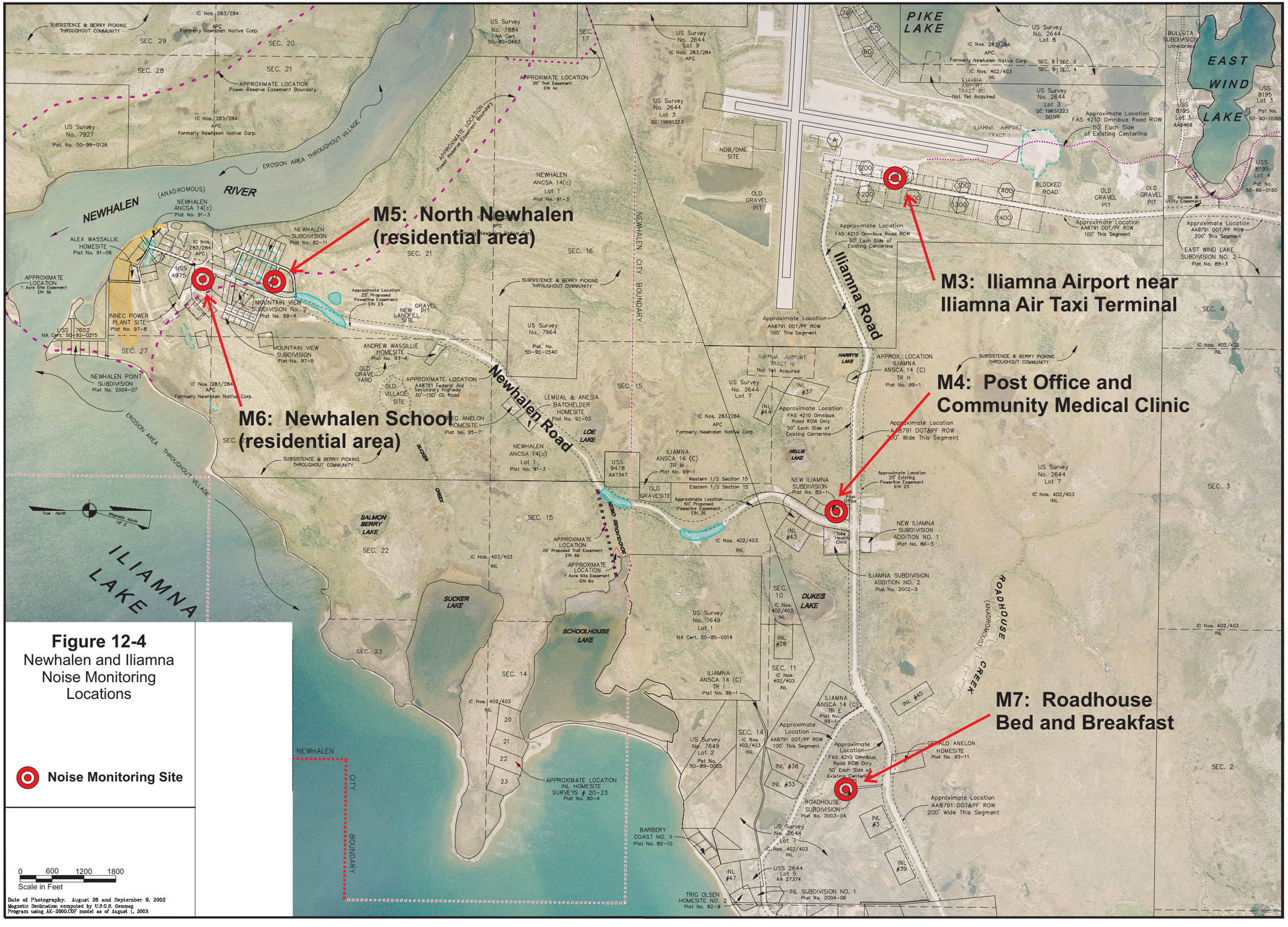


Figure 12-4
Newhalen and Iliamna Noise Monitoring Locations

Figure 12-5
Pedro Bay Noise
Monitoring Locations

Noise Monitoring Site

M10: Pedro Bay on Iliamna Lake
(fishing cabins near float plane launch area)

M11: Pedro Bay Tribal Center
(Behind building, up hill near residence)

M12: Pedro Bay School
(on grounds near main entrance)

M13: Southern Pedro Bay
(residences south of the main town)

Power Plant Location
(directly behind the school)

KNUTSON BAY (ILIAMNA LAKE)
KNUTSON RIVER (ANADROMOUS)
PEDRO MOUNTAIN
PEDRO BAY (ILIAMNA LAKE)
BARNEY'S BAY
SNOW BAY
FOXY LAKE
FISH POND
PETERS CREEK (ANADROMOUS)
PEDRO CREEK (ANADROMOUS)
MINK CREEK
RUSSIAN CREEK (ANADROMOUS)
DRY LAKE
HIGH CLIFF LAKE
DUMBELL LAKE

APPROXIMATE LOCATION ILIAMNA – PILE BAY TRAIL RS 2477
ANCSA 14(c) KNUTSON BAY TRAIL Plat. No. 92-10 State in Trust Bk. 23 Pgs. 331-334 8/13/96
ANCSA 14(c) TR 2 Plat. No. 92-10
ANCSA 14(c) TR 1 Plat. No. 92-10
ANCSA 14(c) TR 3 Plat. No. 92-10
ANCSA 14(c) TR 4 Plat. No. 92-10
ANCSA 14(c) TR 5 Plat. No. 92-10 State in Trust Bk. 23 Pgs. 331-334 8/13/96
ANCSA 14(c) TR 6 Plat. No. 92-10
ANCSA 14(c) TR 7 Plat. No. 92-10 OLD GRAVEL PIT
ANCSA 14(c) DUMBELL LAKES TRAIL Plat. No. 92-10 State in Trust Bk. 23 Pgs. 331-334 8/13/96
ANCSA 14(c) BOAT YARD ROAD Plat. No. 92-10 State in Trust Bk. 23 Pgs. 331-334 8/13/96
AVALANCHE ZONE
GRAVEL PIT
AIRPORT EQUIPMENT STORAGE BUILDING
EROSION AREA
PEDRO BAY AIRPORT TRACT I
TRACT I
TRACT II
TRACT IIA
TRACT IIB
TRACT IV
Proposed Landfill/ Septage Disposal Site Easement
HUNTING AND SUBSISTENCE AREA
ENTIRE BAY FISHING AND SUBSISTENCE AREA
APPROXIMATE LOCATION ILIAMNA – PILE BAY TRAIL RS 2477
APPROXIMATE LOCATION Power Esmt. 20' ADL 223540
PROPOSED CARL JENSEN SUBDIVISION ADDITION No. 2 (UNRECORDED)
HEDLUND SUBDIVISION Plat. No. 87-6
TANTAMOUNT BAY SUBDIVISION Plat. No. 87-4
BIG HILL SUBDIVISION Plat. No. 93-8
VICTOROFF SUBDIVISION Plat. No. 96-1
PEDRO BAY PROPOSED RIGHT-OF-WAY Plat. No. 96-8
PEDRO BAY SCHOOL SITE AND SCHOOL SITE ADDITION Plat. Nos. 92-12 & 92-13
KOLYAHA SUBDIVISION Plat. No. 95-6
RUSSIAN CREEK SUBDIVISION Plat. No. 93-5
Subdivided by Metes and Bounds Bk. 19, Pg. 606-607 8/13/96
50' Road Easement Bk.29,Pg.298
50' Road Easement Bk.29,Pg.312
50' Road Easement Bk.29,Pg.310
50' Road Easement Bk.29,Pg.303
50' Road Easement 2001-00356-0 9/25/01
OLD GRAVESITES
OCCUPIED HOME
FISH DRY RACKS
SHELL ISLAND NA Cert. 50-90-0212
USS 7333 NA Cert. 50-98-0088
USS 5201 Lot 1 NA Cert. 50-83-0227
USS 6175 Lot 1 NA Cert. 50-83-0114
USS 6175 Lot 2 NA Cert. 50-85-0026
USS 6174 NA Cert. 50-81-0156
USS 6184 NA Cert. 50-86-0398
USS 8508 NA Cert. 50-91-0627
USS 7524 NA Cert. 50-90-0301 Lot 1
USS 4883 Pat. No. 50-72-0468
USS 5577 Lot 1
USS 5201 Lot 2 Pat. No. 50-82-0138
USS 7525 Lot 3 NA Cert. 50-89-0596
USS 7525 Lot 4 NA Cert. 50-91-0004
USS 7525 Lot 1 NA Cert. 50-89-0630
USS 7525 Lot 2 NA Cert. 50-89-0630
USS 6158 Lot 1 NA Cert. 50-90-0085
USS 6158 Lot 2 NA Cert. 50-86-0457
USS 5552 Pat. No. 50-72-0086
USS 7889 NA Cert. 50-90-0424
USS 12190 A57267
USS 7962
USS 2302
USS 7353
USS 6160
USS 5577
USS 117
Pat. Nos. 50-90-0671/0672 PBC
Pat. Nos. 50-92-0736/0737 PBC
IC Nos. 359/360 PBC
SEC. 1
SEC. 2
SEC. 3
SEC. 4
SEC. 5
SEC. 6
SEC. 7
SEC. 8
SEC. 9
SEC. 11
SEC. 25
SEC. 26
SEC. 28
SEC. 29
SEC. 30
SEC. 31
SEC. 32
SEC. 33
SEC. 34
SEC. 35
SEC. 36
T. 4 S.
T. 5 S.
R. 29 W.
R. 28 W.
Magnetic North 18° E
True North
0 600 1200 1800
Scale in Feet

SECTION A

SECTION B

M1: North Newhalen River Road

M15: Main Street (Lower Road)

M14: June Tracy's Bed and Breakfast (near shoreline of Six Mile Lake)

NEWHALEN RIVER (ANADROMOUS)

SIXMILE LAKE

NONDALTON CITY BOUNDARY

Lake Clark National Park and Preserve

Approximate Location AA 8791 DOT&PF ROW 200' Wide This Segment

Approximate Location Underground Power Cable

Approximate Location – Submarine Power Transmission Cable

BOAT STORAGE AREA

FISH DRY RACKS

BOAT LANDING

Old Grave site

Sewage Lagoon

NEW HUD HOUSING AREA

LAKE VIEW SUBDIVISION Plat No. 97-3

Erosion Area

NONDALTON AIRPORT

Building Landfill

Airport Equipment Area

BIG CREEK

Wood Cutting Area

OLD GRAVEL EXTRACTION AREA

Dedicated Road ROW City of Nondalton

Trustee Deed to City of Nondalton Bk. 12, Pgs. 730-731 9/3/85

To Iliamna

0 400 800 1200

Scale in Feet

Date of Photography: September 21, 2002

Magnetic Declination computed by U.S.G.S. Geomag Program using AK-2000.COF model as of August 1, 2003.

Figure 12-6
Nondalton and Vicinity
Noise Monitoring Locations

Noise Monitoring Site

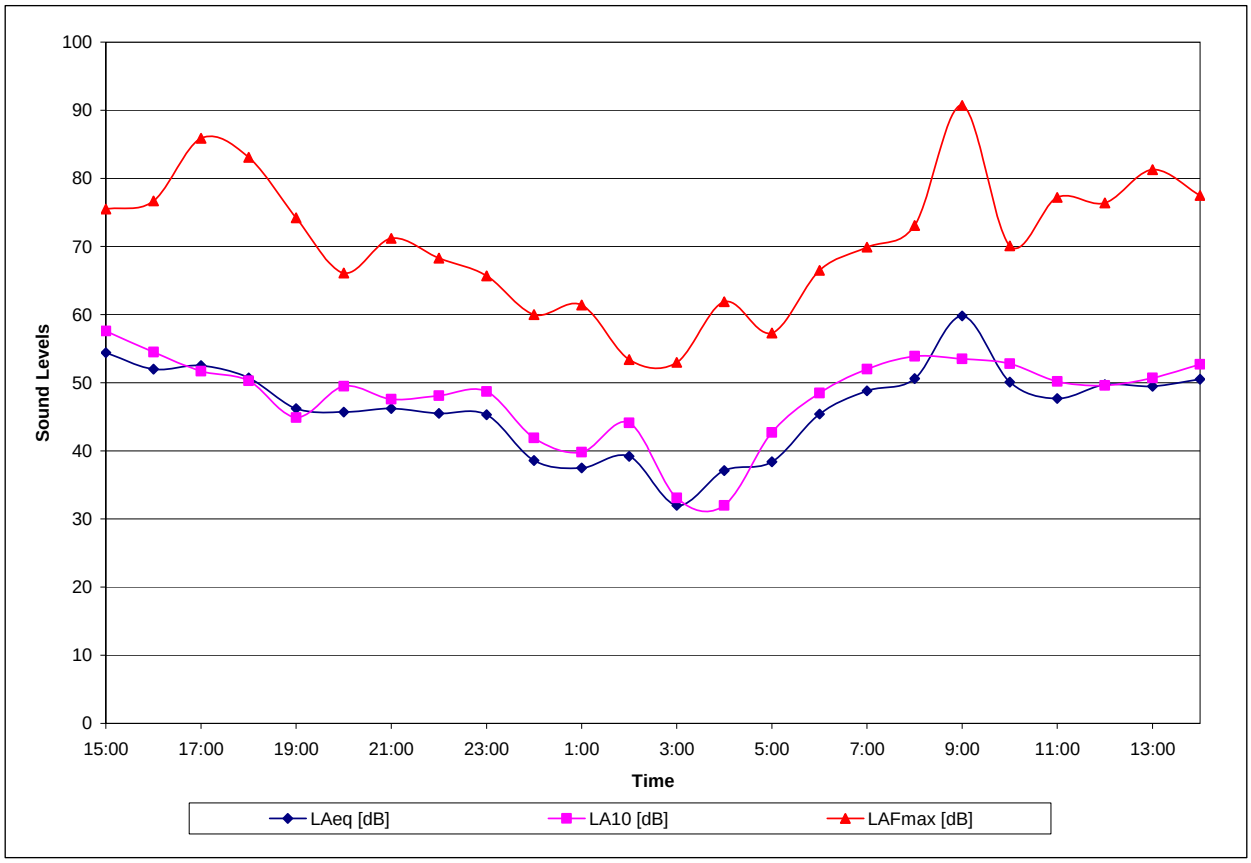


FIGURE 12-7
Site M4—Iliamna Post Office and Community Medical Clinic, Winter Hourly Noise Levels

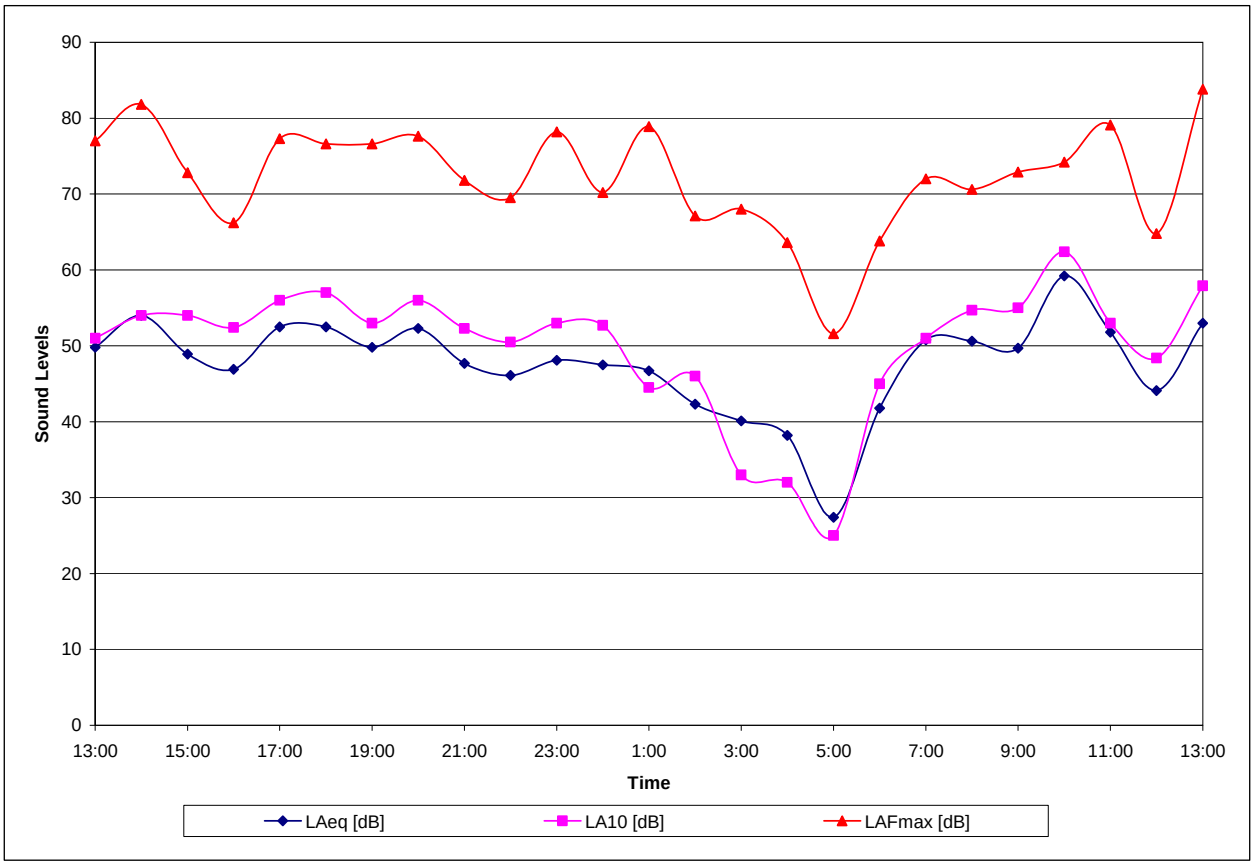


FIGURE 12-8
Site M4—Iliamna Post Office and Community Medical Clinic, Summer Hourly Noise Levels

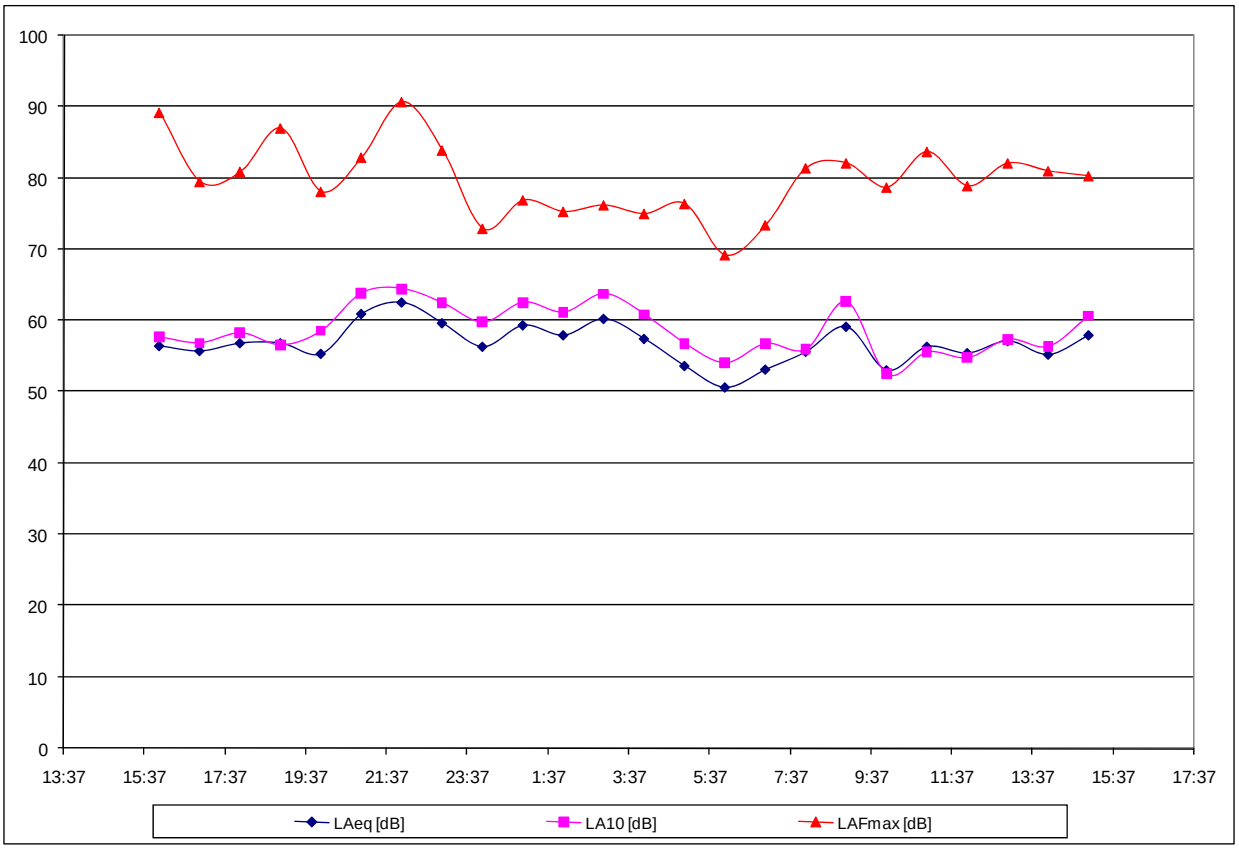


FIGURE 12-9
Site M6—Newhalen School, Winter Hourly Noise Levels

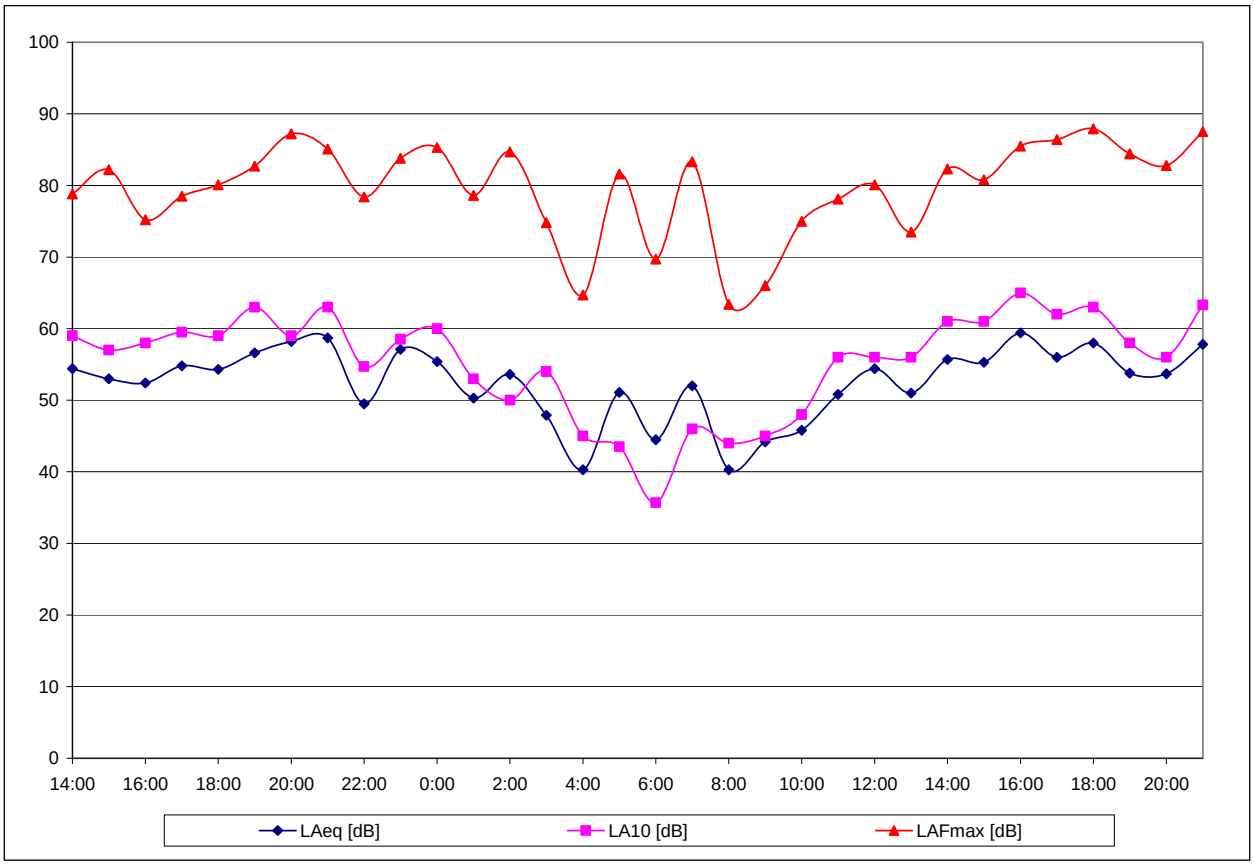


FIGURE 12-10
Site M6—Newhalen School, Summer Hourly Noise Levels

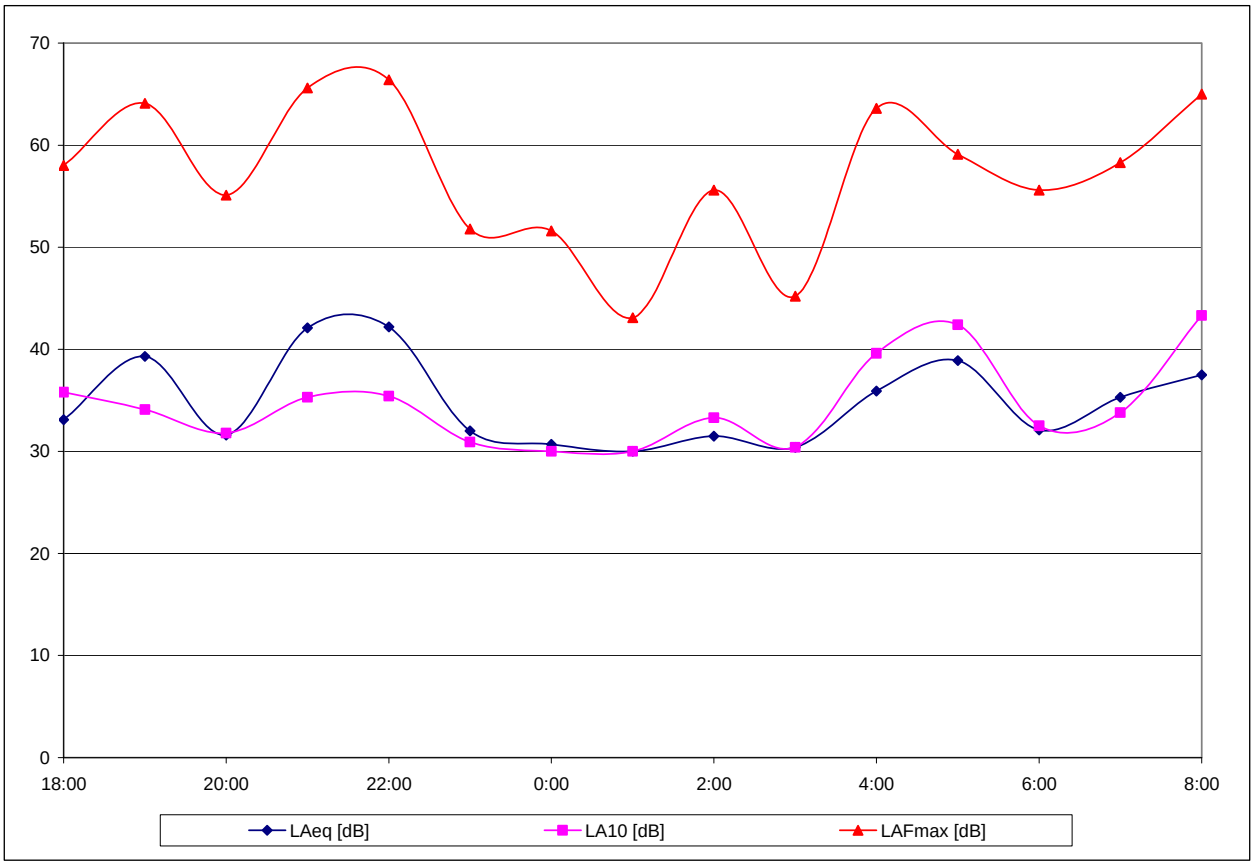


FIGURE 12-11
Site M7—Roadhouse Bed and Breakfast, Winter Hourly Noise Levels

PHOTOGRAPHS

PHOTO 12-1: M1 Noise Monitoring Site—North Newhalen River Road

PHOTO 12-2: M3 Noise Monitoring Site—Iliamna Airport Near Iliamna Air Taxi Terminal

PHOTO 12-3: M4 Noise Monitoring Site—Post Office and Community Medical Clinic

PHOTO 12-4: M5 Noise Monitoring Site—North Newhalen

PHOTO 12-5: M5 Noise Monitoring Site—North Newhalen
(view from behind sound level meter, meter location shown on Figure 12-4)

PHOTO 12-6: M8 Noise Monitoring Site—Iliamna General Store

PHOTO 12-7: M9 Noise Monitoring Site—Iliamna Lake

PHOTO 12-8: M10 Noise Monitoring Site—Pedro Bay on Iliamna Lake
(view from behind sound level meter, meter placed on the beach)

PHOTO 12-9: Pedro Bay Tribal Center near M11 Noise Monitoring Site

PHOTO 12-10: M12 Noise Monitoring Site—Pedro Bay School

PHOTO 12-11: M12 Noise Monitoring Site—Pedro Bay Power Plant as Viewed from Schoolground Play Area

PHOTO 12-12: M12 Noise Monitoring Site—Pedro Bay Power Plant 50-foot Reference Measurement Location

APPENDIX

APPENDIX 12A

Detailed Introduction to Acoustics

Detailed Introduction to Acoustics

Sound is defined as any pressure variation that the human ear can detect, from barely perceptible sounds to sound levels that can cause hearing damage. The magnitude of the variations of the air pressure from the static, or normal, air pressure is a measure of the sound level. The number of cyclic pressure variations per second is the frequency of sound. When sounds are unpleasant, unwanted, or disturbingly loud, they often are classified as noise.

Compared with the static air pressure, audible sound-pressure variations range from the threshold of hearing—a very small 20 microPascals (μPa; 20 x 10^{-6} Pascals)—to 100 Pascals (Pa), a level so loud it is referred to as the threshold of pain. Because the ratio between these numbers is more than a million to one, using Pascals to describe sound levels can be awkward. The decibel (dB) measurement is a logarithmic conversion of air-pressure level variations from Pascals to a unit of measure with a more convenient numbering system. This conversion not only allows for a more convenient scale, but is also a more accurate representation of how the human ear reacts to variations in air pressure.

The smallest noise-level change that can be detected by the human ear is approximately 3 dB. A doubling in the static air pressure amounts to a change of 6 dB, and an increase of 10 dB is roughly equivalent to a doubling in the perceived sound level. Under free-field conditions, where there are no reflections or additional attenuation, sound is known to decrease at a rate of 6 dB for each doubling of distance. This is commonly known as the inverse square law. For example, a sound level of 70 dB at a distance of 100 feet would decrease to 64 dB at 200 feet and to 58 dB at 400 feet. The mathematical definition of sound pressure level in dB is provided below:

> The sound pressure level (L_P) in dB is 20 times the log of the ratio of the measured pressure, P, to the static pressure, Po, where Po is 20 μPa:

In acoustic measurements where the primary concern is the effect on humans, the sound readings are sometimes compensated by an A-weighted filter. The A-weighted filter accounts for people's limited hearing response in the upper and lower frequency bands. Sound-pressure level measurements made using the A-weighted filter are denoted as dBA. For low-frequency and impulsive noises, such as blasting and helicopters, a C-weighted filter is normally used. The C-weighted filter helps to account for the short time period and low-frequency energy of impulsive noises.

Following are the definitions of additional noise-measurement descriptors:

L_{dn} (day-night average sound level). A 24-hour equivalent continuous level in dBA where 10 dB is added to nighttime (10:00 p.m. to 7:00 a.m.) noise levels.

L_{eq} (equivalent continuous sound level). The constant sound level in dBA that, lasting for a time, T, would have produced the same energy in the same time period T as an actual A-weighted noise event.

$$L_{eq} = 10\mathrm{Log}_{10}\ \frac{1}{T}\int_0^T\left(\frac{p(t)}{p_o}\right)^2 dt$$

L_{max} (MaxL; maximum A-weighted root-mean square sound level). The greatest root-mean square (RMS) sound level, in dBA, measured during the preset measurement period.

L_{min} (MinL; minimum A-weighted RMS sound level). The lowest RMS sound level, in dBA, measured during the preset measurement period.

L_{PA} (A-weighted sound-pressure level). The sound pressure in dB is 20 times the log of the ratio of the measured A-weighted pressure, P_A, to the static pressure, P_O, where P_O is 20 μPa.

$$L_{PA} = 20\mathrm{Log}_{10}\left(\frac{p_A}{p_0}\right) dBA \quad re\ 20uPa$$

L_{peak} (MaxP; maximum A-weighted sound level). The greatest continuous sound level, in dBA, measured during the preset measurement period.

L_{xx} (statistical noise-level descriptor). The sound level that was equaled or exceeded during XX percent of the measurement period. For example: during a 1-hour measurement, an L_{10} of 65 dBA means the sound level was 65 dBA or more for 6 minutes (10 percent) of that hour.

SEL (sound exposure level). That constant level in dBA that, lasting for 1 second, has the same amount of acoustic energy as a given A-weighted noise event lasting for a period of time T. This measurement is most commonly used for airport noise.