ANNEX II

NOISE BASELINE REPORT FOR THE JAY PROJECT

DOMINION DIAMOND

NOISE BASELINE REPORT FOR THE JAY PROJECT

Prepared for: Dominion Diamond Ekati Corporation

Prepared by: Golder Associates Ltd.

September 2014

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Abbreviations

Abbreviation	Definition
am	ante meridiem
Dominion Diamond	Dominion Diamond Ekati Corporation
e.g.,	for example
Ekati Mine	Ekati Diamond Mine
i.e.,	that is
Jay pipe	Jay kimberlite pipe
L_{eq}	equivalent energy noise level
$L_{eq,1hr}$	equivalent energy noise level over 1-hour interval
$L_{eq,1min}$	equivalent energy noise level over 1-minute interval
$L_{eq,day}$	equivalent energy noise level over the daytime period (7:00 am to 10:00 pm)
$L_{eq,night}$	equivalent energy noise level during nighttime period (10:00 pm to 7:00 am)
LFN	low frequency noise
NAD 83	North America Datum of 1983
NWT	Northwest Territories
pm	post meridiem
Project	Jay Project
R	receptor
UTM	Universal Transverse Mercator

Units of Measure

Unit	Definition
°	degrees
°C	degrees Celsius
%	percent
dB	decibel
dBA	A-weighted decibel
dBC	C-weighted decibel
Hz	hertz
km	kilometre
km/hr	kilometres per hour
m	metre
m/s	metres per second

1 INTRODUCTION

1.1 Background and Scope

Dominion Diamond Ekati Corporation (Dominion Diamond) is a Canadian-owned and Northwest Territories (NWT) based mining company that mines, processes, and markets Canadian diamonds from its Ekati Diamond Mine (Ekati Mine). The existing Ekati Mine is located approximately 200 kilometres (km) south of the Arctic Circle and 300 km northeast of Yellowknife, NWT (Map 1.1-1).

Dominion Diamond is proposing to develop the Jay kimberlite pipe (Jay pipe) located beneath Lac du Sauvage. The proposed Jay Project (Project) will be an extension of the Ekati Mine, which is a large, stable, and successful mining operation that has been operating for 16 years. Most of the facilities required to support the development of the Jay pipe and to process the kimberlite currently exist at the Ekati Mine. The Project is located in the southeastern portion of the Ekati claim block approximately 25 km from the main facilities and approximately 7 km to the northeast of the Misery Pit, in the Lac de Gras watershed (Map 1.1-2).

This Noise Baseline Report is one component of a comprehensive baseline program being completed to document the natural and socio-economic environments in the vicinity of the proposed Project. This report describes characteristics and existing conditions of noise for the Project area. The baseline information will be used for the evaluation of Project effects on ambient noise levels (including wildlife and human receptors) and will help to identify mitigation and protective actions that could be implemented to avoid or reduce potential adverse effects to the existing environment. The following report summarizes data collected during the 2013 baseline survey.

LEGEND

- JAY PROJECT
- EXISTING MINE OR PROJECT
- TERRITORIAL CAPITAL
- POPULATED PLACE
- HIGHWAY
- ALL-SEASON ROAD
- WINTER ROAD
- TIBBITT TO CONTWOYTO WINTER ROAD
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- TERRITORIAL/PROVINCIAL BOUNDARY
- TREELINE
- WATERCOURSE
- WATERBODY

150 0 150

SCALE 1:6,000,000 KILOMETRES

REFERENCE

WATER OBTAINED FROM ATLAS OF CANADA
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
PROJECTION: CANADA LAMBERT CONFORMAL CONIC

DOCUMENT

NOISE BASELINE REPORT

PROJECT

DOMINION DIAMOND

JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

LOCATION OF THE JAY PROJECT

Golder Associates

PROJECT	13-1328-0041		FILE No. B_JC_Noise_002_GIS	
DESIGN	ANK	29/01/14	SCALE AS SHOWN	REV. 0
GIS	ANK	09/09/14		
CHECK	CG	09/09/14		
REVIEW	SM	09/09/14		

MAP 1.1-1

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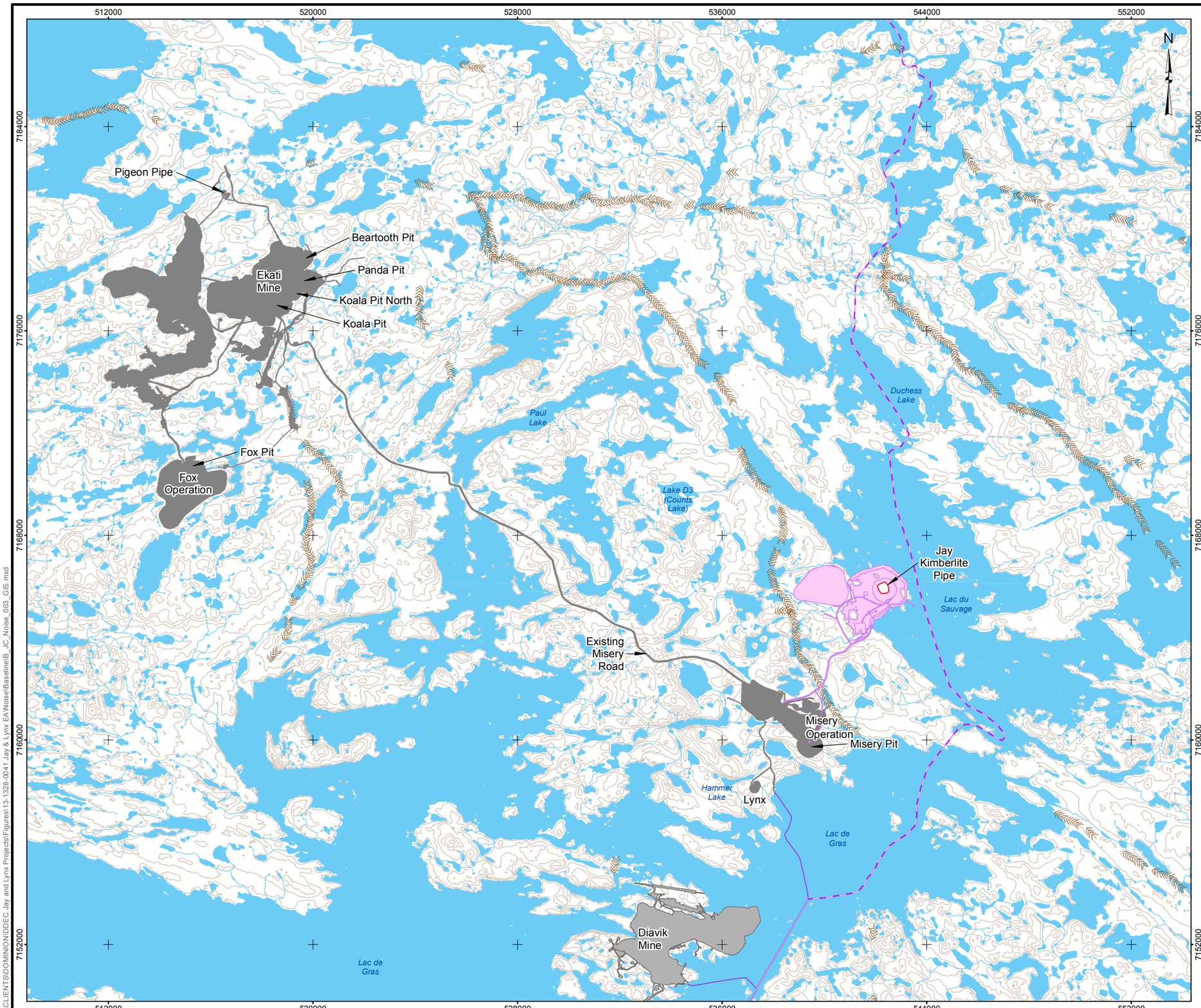

LEGEND

- EKATI MINE FOOTPRINT
- DIAVIK MINE FOOTPRINT
- PROPOSED JAY FOOTPRINT
- KIMBERLITE PIPE
- WINTER ROAD
- TIBBITT TO CONTWOYTO WINTER ROAD
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- ELEVATION CONTOUR (10 m INTERVAL)
- ESKER
- WATERCOURSE
- WATERBODY

REFERENCE

CANVEC © NATURAL RESOURCES CANADA, 2012
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

NOISE BASELINE REPORT

3 0 3
SCALE 1:150,000 KILOMETRES

PROJECT
DOMINION DIAMOND
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

EKATI PROPERTY MAP

Golder Associates

PROJECT		13-1328-0041	FILE No. B_JC_Noise_003_GIS	
DESIGN	SM	12/08/14	SCALE AS SHOWN	REV 0
GIS	ANK	12/09/14	MAP 1.1-2	
CHECK	CG	12/09/14		
REVIEW	SM	12/09/14		

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1.2 Study Area and Receptors

The NWT does not have specific environmental noise regulations and does not provide guidance or methods for conducting noise monitoring or noise measurements for the mining industry. Golder Associates Ltd. referred to guidance from the Alberta Energy Regulator *Directive 038: Noise Control* (EUB 2007); hereinafter referred to as Directive 038. Directive 038 specifies that potential noise impacts be assessed at the nearest or most impacted dwelling within 1.5 km of the development boundary, or at 1.5 km from the development boundary in the absence of any such dwellings. There are no occupied dwellings within 1.5 km of the Project; therefore, the objective of this baseline noise study is to establish existing noise levels at unoccupied locations approximately 1.5 km from the proposed Project footprint boundary, including the proposed extraction pit, storage area, and haul road.

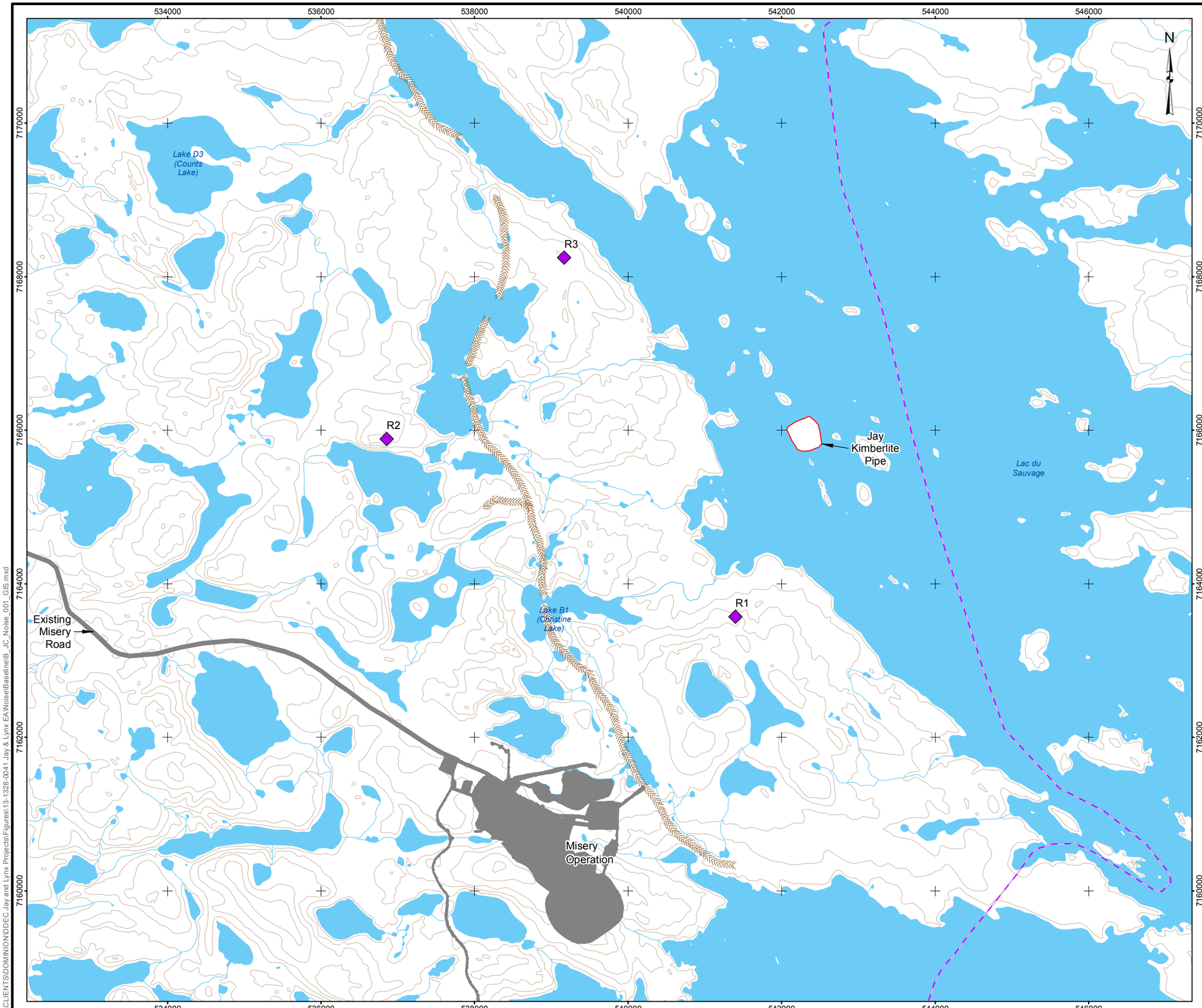
The closest industrial development, the Misery site, is located approximately 6 km from the Jay pipe. The baseline noise levels were measured and established for three receptors located in the area of the Jay pipe.

Baseline noise was monitored to determine existing noise levels approximately 1.5 km from the future site of the Project. Monitoring locations were selected to the southwest (Receptor [R] 1), west (R2), and north (R3) of the Jay pipe (Table 1.2-1 and Map 1.2-1). The Jay pipe will be located on the west side of Lac du Sauvage; therefore, it was considered unnecessary to characterize existing noise levels to the east of the Project as dwellings are not expected to be located within 1.5 km of the eastern boundary.

Table 1.2-1 Receptor Locations

Receptor	Location Description	Universal Transverse Mercator (Zone 12 W, NAD83)	
		Easting (m)	Northing (m)
R1	located approximately 1.5 km southwest of the Jay pipe and northeast of the Misery Pit	541399	7163572
R2	located approximately 1.5 km northwest of the proposed haul road connecting the Jay pipe with the Misery Haul Road, west of the proposed Jay pipe waste rock storage area	536854	7165887
R3	located approximately 1.5 km north of the proposed Jay pipe waste rock storage area	539169	7168249

W = west; NAD 83 = North American Datum of 1983; m = metre; km = kilometre.



LEGEND

- EKATI MINE FOOTPRINT
- KIMBERLITE PIPE
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- ELEVATION CONTOUR (10 m INTERVAL)
- ESKER
- WATERCOURSE
- WATERBODY
- NOISE RECEPTOR

REFERENCE

CANVEC © NATURAL RESOURCES CANADA, 2012
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

NOISE BASELINE REPORT

1 0 1
SCALE 1:50,000 KILOMETRES

PROJECT
DOMINION DIAMOND™
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
LOCATION OF BASELINE NOISE RECEPTORS

Golder Associates

PROJECT	13-1328-0041		FILE No. B_JC_Noise_001_GIS	
DESIGN	TN	20/01/14	SCALE AS SHOWN	REV 0
GIS	ANK	09/09/14		
CHECK	CG	09/09/14	MAP 1.2-1	
REVIEW	SM	09/09/14		

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2 METHODS

2.1 Monitoring Methods

The baseline noise monitoring program was conducted between July 26 and July 28, 2013, in general accordance with Directive 038. Noise was monitored for at least 24 hours at each receptor. A 24-hour survey allows for the collection of sufficient information to characterize the local variability of noise levels over the daytime and nighttime periods.

At each receptor location, a Model 2250 Brüel and Kjær Type I integrating sound level meter was used to collect noise measurements and to record audible sound for the entire duration of monitoring.

Data parameters recorded during the baseline monitoring included:

- equivalent energy noise level over a one-minute period ($L_{eq,1min}$) in A-weighted decibels (dBA); and,
- one-third-octave band L_{eq} values over a one-minute period in unweighted decibels (dB).

Each meter used during the survey was calibrated with a Brüel and Kjær Type 4231 calibrator, immediately before and after each monitoring period, to confirm that the sound meter's variance was within 0.5 dB. The calibrator has an estimated uncertainty of referenced sound pressure level of plus or minus (±) 0.12 dB at a 99 percent (%) confidence level. The calibration data were logged by the meter and calibration results were recorded in the field notes. The recordings of calibration signals are documented in the Calibration Record of Baseline Noise Measurements (Appendix A).

Directive 038 requires that monitoring be conducted under meteorological conditions acceptable for noise measurement, which includes restrictions on maximum wind speed and the absence of active precipitation (EUB 2007). During the survey, weather data were collected using Nielsen-Kellerman Kestrel 4500 pocket weather meters deployed near the noise monitoring sites. The weather meters were set up to record wind speed, wind direction, temperature, barometric pressure, and relative humidity data every two minutes. Data from the weather meters were used to screen the collected baseline data based on the weather condition requirements outlined in Directive 038. In addition, direct observations and field notes regarding precipitation, cloud cover, wind direction, and audible noise sources were prepared by members of the survey team and used in the data analysis.

2.2 Data Analysis

Data collected and recorded at each receptor location were downloaded to a computer for analysis with the Bruel and Kjaer 7820 Evaluator software. Following the requirements of Directive 038, the collected data were analyzed for broadband noise and the presence of potential low frequency noise (LFN) issues.

2.2.1 Broadband Analysis

Directive 038 requires noise data to be collected under appropriate weather conditions including the absence of precipitation (i.e., no snow, water, or ice ground cover) and wind speeds below a specified maximum speed. The survey was conducted during the summer and, therefore, the ground surface was not covered by snow or ice. Because the Project is at a remote location surrounded by the tundra and not exposed to heavy human development (industry), no specific anthropogenic noise sources were identified. Following the guidance of Directive 038, a maximum wind speed of 15 km per hour (km/hr) (4.17 metres per second [m/s]) was used as the acceptable limit for further analysis. Data collected when wind speed was less than 15 km/hr was considered valid. The 15 km/hr limit allowed for the removal of periods of high wind resulting in potential increased noise levels due to wind-induced noise.

Noise data containing recordings of anomalous or abnormal noise sources that were not representative of the existing acoustical environment were also removed as invalid. Anomalous or abnormal noise sources that were identified and subsequently removed included the following:

- localized technician activities;
- rain, thunder, and wind;
- wildlife in the proximity of the monitoring equipment; and,
- helicopter flyovers.

During the analysis of the data, specific anomalous noise events were identified mainly by listening to the sound recordings. Other indicators used to identify sources of noise were time of day and field observations. Hourly noise levels ($L_{eq,1hr}$) were calculated for each hour of monitoring based on the valid one-minute data. The valid hourly data were used to calculate daytime equivalent energy noise levels ($L_{eq,day}$) and nighttime equivalent energy noise levels ($L_{eq,night}$) for each location. Daytime was defined as the period between 7:00 am to 10:00 pm, and nighttime as the period between 10:00 pm to 7:00 am, in accordance with *Directive 038: Noise Control* (EUB 2007).

2.2.2 Low Frequency Noise Analysis

To measure the presence or absence of LFN at each receptor, the 1/3-octave band noise levels corresponding to the valid one-minute data samples (i.e., those deemed valid during the broadband analysis) were analyzed. The 1/3-octave band spectra corresponding to each valid minute were energy averaged to obtain a single 1/3-octave band spectrum for the daytime period, and a single 1/3-octave band spectrum for the nighttime period.

Directive 038 provides two LFN identification criteria that must be used to evaluate potential LFN issues. The first criterion involves the comparison of the dBA and C-weighted decibel (dBC) levels. To obtain dBA and dBC levels, the A-weighting network and C-weighting network were separately applied to the unweighted daytime and nighttime 1/3-octave band spectra. The dBA results were then subtracted from the dBC results to obtain a value suitable for comparison to the LFN criteria outlined in Directive 038.

The second criterion that Directive 038 uses to identify an LFN issue is the presence of a distinct tonal component below 250 hertz (Hz). In accordance with the Directive 038 tone criteria, the daytime and nighttime 1/3-octave band spectra were used to check for the presence of a tone below 250 Hz.

3 RESULTS

3.1 Receptor 1 Site

3.1.1 Broadband Noise Results

The R1 site was located on top of an elevated plateau covered by vegetation typical of tundra (i.e., low vegetation). In addition, the ground surface near R1 was covered by scattered rocks. A photograph of the area surrounding the sound level meter and the weather station at the R1 site is provided in Photo 3.1-1. The noise levels at R1 were influenced primarily by noise generated by wind in vegetation and distant waves on the nearby lake.

Invalid noise events removed from the monitored data included technician activities, rain, periods of high wind speeds, and helicopter flyovers. Unfiltered one-minute noise levels ($L_{eq,1min}$) recorded at R1 are shown in Figure 3.1-1. Values of wind speed and wind direction recorded at the R1 site are presented in Figure 3.1-2. Temperature and relative humidity recorded at R1 are shown in Figure 3.1-3.

Photo 3.1-1 Sound Level Meter Deployed at the Receptor 1 Site

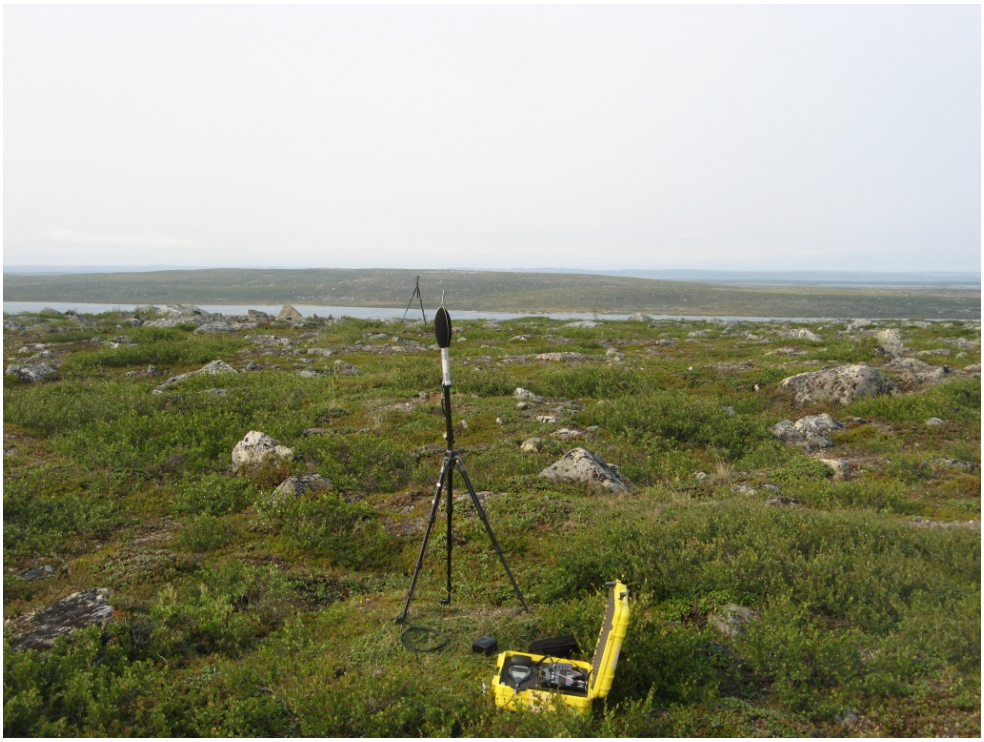
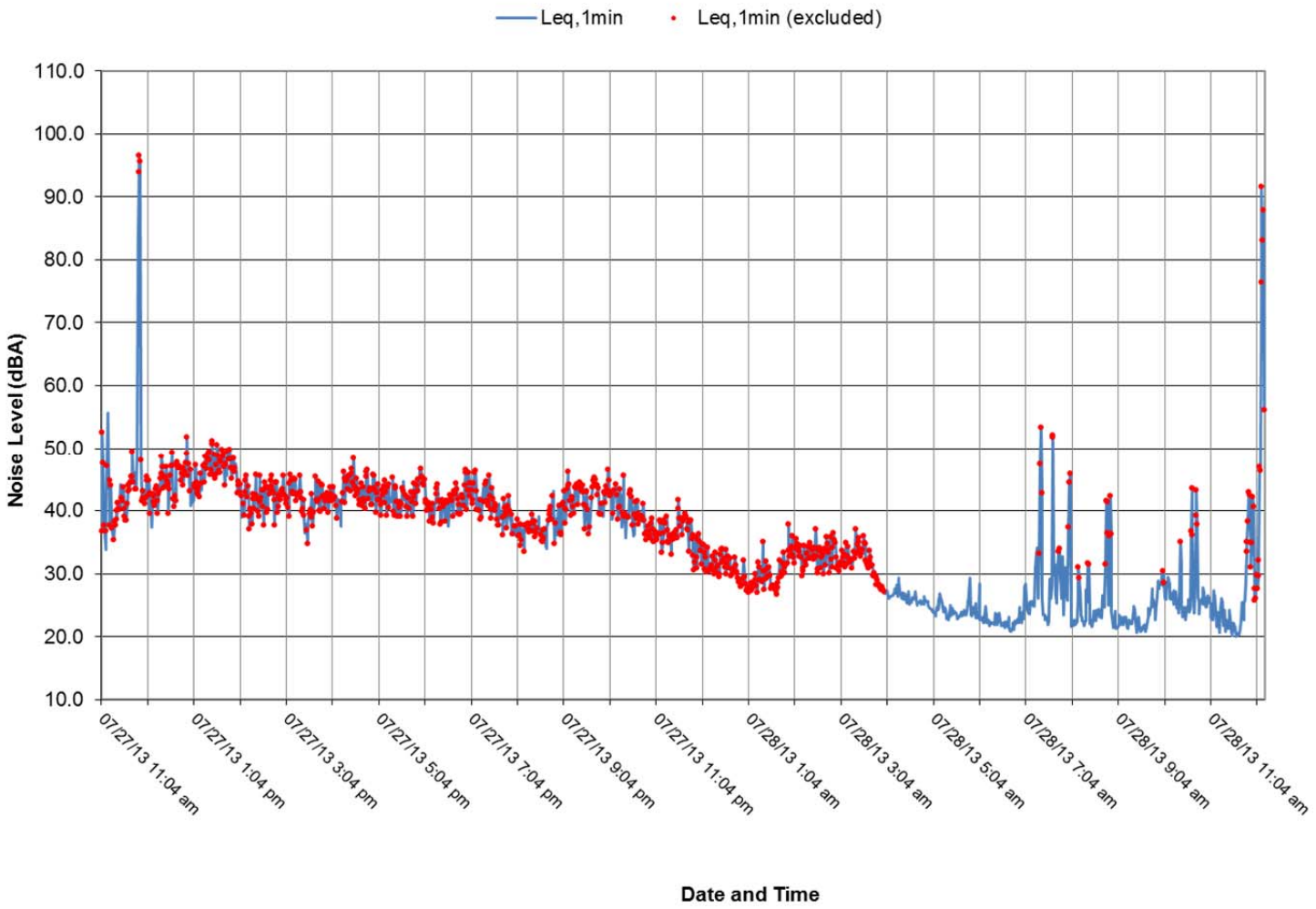
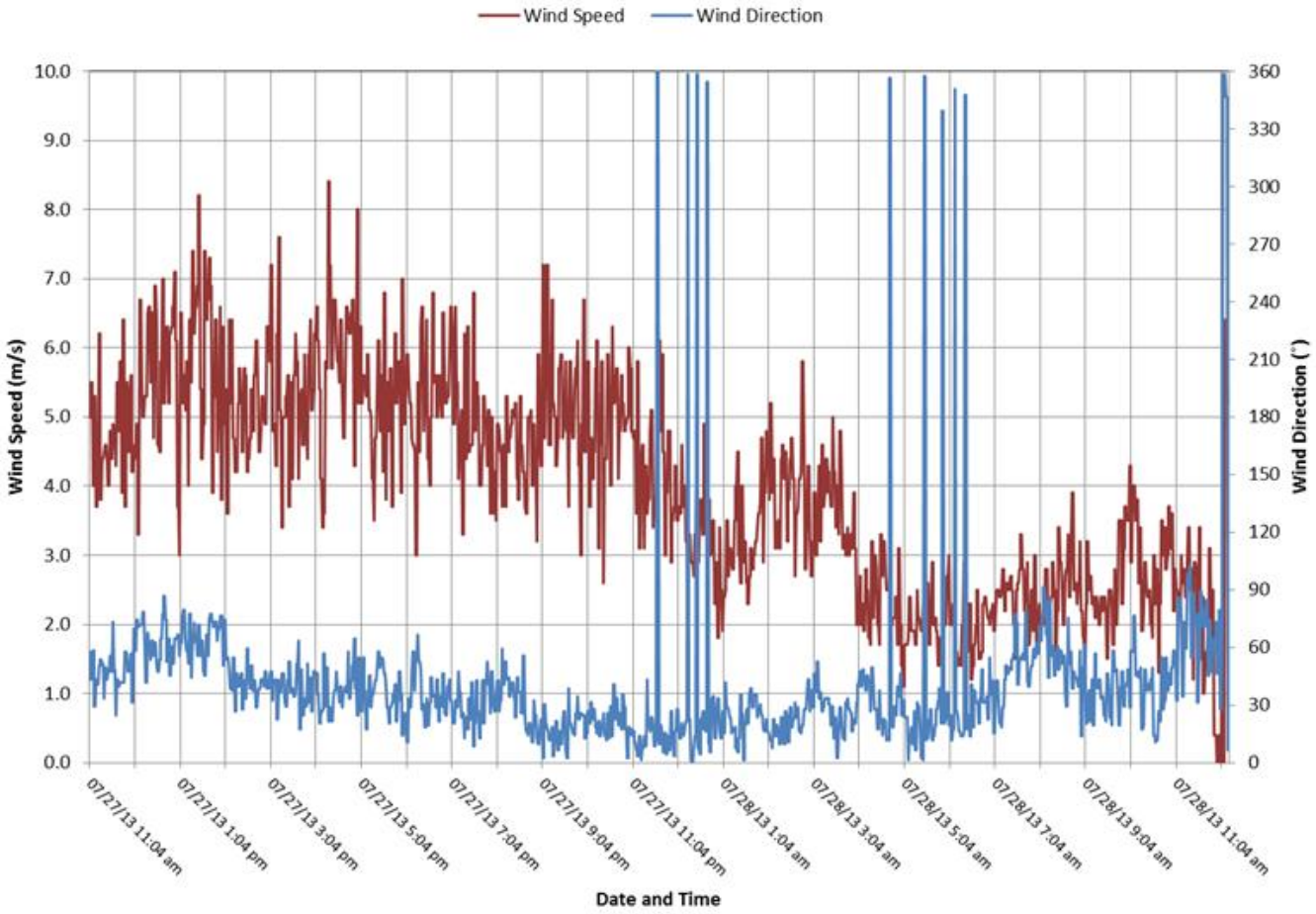


Figure 3.1-1 One-Minute Noise Data for the Receptor 1 Site



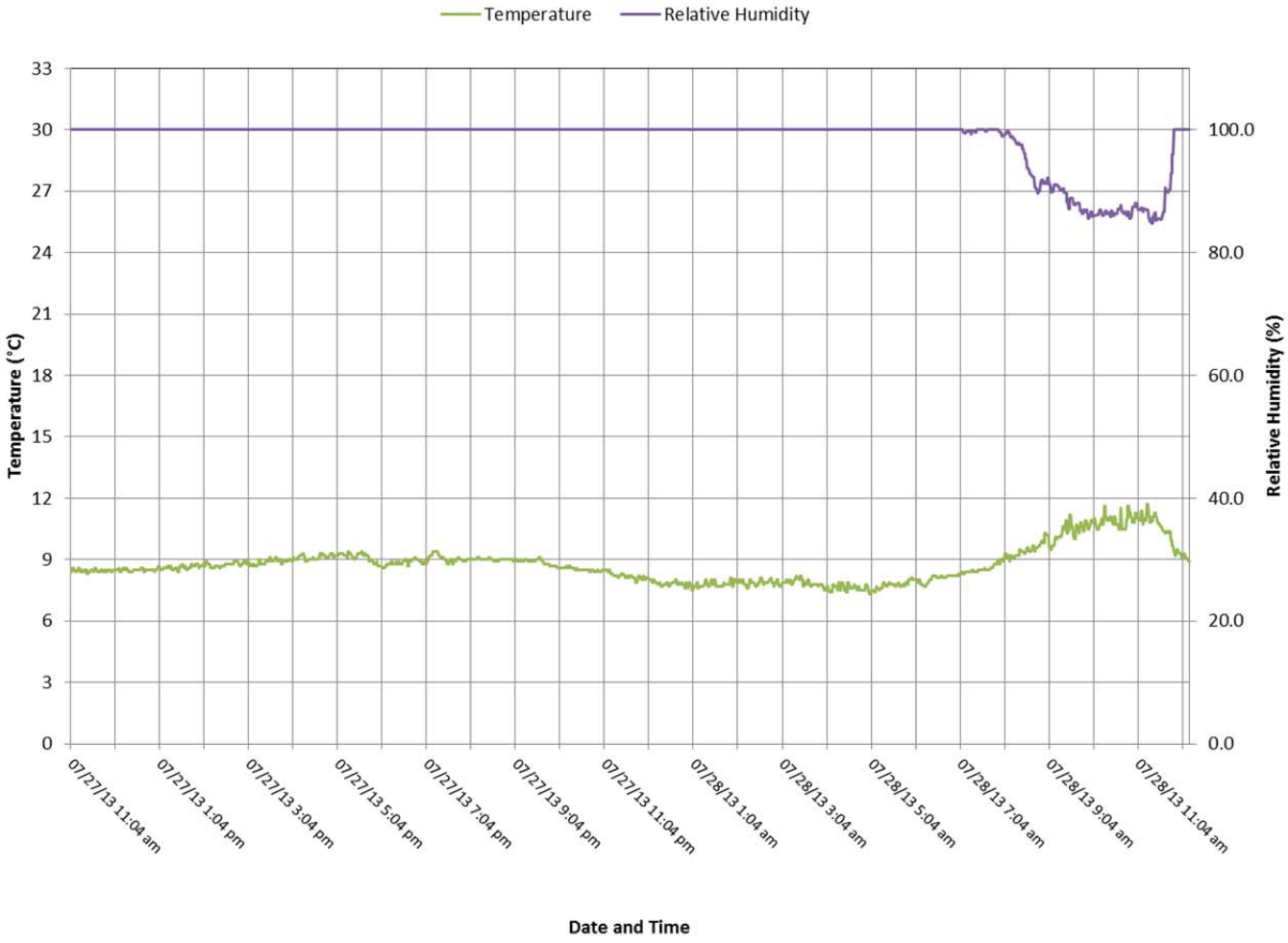
Leq,1min = equivalent energy noise level over one-minute interval; dBA = A-weighted decibel.

Figure 3.1-2 Wind Speed and Direction Data for the Receptor 1 Site



m/s = metres per second; ° = degrees.

Figure 3.1-3 Temperature and Humidity Data for the Receptor 1 Site



°C = degrees Celsius; % = percent.

The results of the screening analysis of the data obtained during the noise survey at the R1 site are presented in Table 3.1-1. The valid hours and corresponding $L_{eq, day}$ and $L_{eq,night}$ are presented only for hours containing more than 30 valid minutes.

Table 3.1-1 Filtered One-Hour Noise Data for the Receptor 1 Site

Date	Start Hour	$L_{eq, 1hr}$(dBA)[(a)]
07/27/13	11:00 am	Not Valid
07/27/13	12:00 pm	Not Valid
07/27/13	1:00 pm	Not Valid
07/27/13	2:00 pm	Not Valid
07/27/13	3:00 pm	Not Valid
07/27/13	4:00 pm	Not Valid
07/27/13	5:00 pm	Not Valid
07/27/13	6:00 pm	Not Valid
07/27/13	7:00 pm	Not Valid
07/27/13	8:00 pm	Not Valid
07/27/13	9:00 pm	Not Valid
07/27/13	10:00 pm	Not Valid
07/27/13	11:00 pm	Not Valid
07/28/13	12:00 am	Not Valid
07/28/13	1:00 am	Not Valid
07/28/13	2:00 am	Not Valid
07/28/13	3:00 am	Not Valid
07/28/13	4:00 am	26
07/28/13	5:00 am	24
07/28/13	6:00 am	23
07/28/13	7:00 am	28
07/28/13	8:00 am	24
07/28/13	9:00 am	24
07/28/13	10:00 am	26
07/28/13	11:00 am	24
07/28/13	12:00 pm	Not Valid
$L_{eq,day}$ (dBA)	**7:00 am to 10:00 pm**	**25**
$L_{eq, night}$ (dBA)	**10:00 pm to 7:00 am**	**25**

a) Calculated based on valid 1-minute data.

Leq,1hr = equivalent energy noise level over 1 hour interval; dBA = A-weighted decibel; Leq,day = equivalent energy noise level over the daytime period (7:00 am to 10:00 pm); Leq,night = equivalent energy noise level during nighttime period (10:00 pm to 7:00 am); am = ante meridiem; pm = post meridiem.

A detailed count of the recorded noise data for the R1 site and information regarding rejected data (i.e., data removed from analysis due to either unfavourable weather conditions or abnormal noise events) is presented in Table 3.1-2. The amount of valid minutes for both periods exceeded 180 minutes at the receptor. Therefore, the results of the survey are considered valid based on requirements outlined in Directive 038.

Table 3.1-2 Overview of the Recorded and Rejected Minutes at the Receptor 1 Site

Period	Total Number of Minutes	Number of Valid Minutes	Number of Rejected Minutes
Daytime (7:00 am to 10:00 pm)	970	259	711
Nighttime (10:00 pm to 7:00 am)	540	190	348

3.1.2 Low Frequency Noise Results

The results of the LFN analysis at R1 are presented in Table 3.1-3. Based on the results, the difference between dBC and dBA noise levels exceeded the threshold of 20 dB during the daytime period. However, a distinctive tone was not identified in the spectrum of the recorded sound. During the nighttime, the dBC minus dBA difference was below 20 dB and there was no distinctive low frequency tone present. Therefore, based on the Directive 038, there is no potential for LFN issues at the R1 site.

Table 3.1-3 Low Frequency Noise Analysis Results for the Receptor 1 Site

Period	dBC minus dBA	Number of Tones Below 250 Hz	Potential Low Frequency Issue
Daytime (7:00 am to 10:00 pm)	23.9	0	No
Nighttime (10:00 pm to 7:00 am)	19.6	0	No

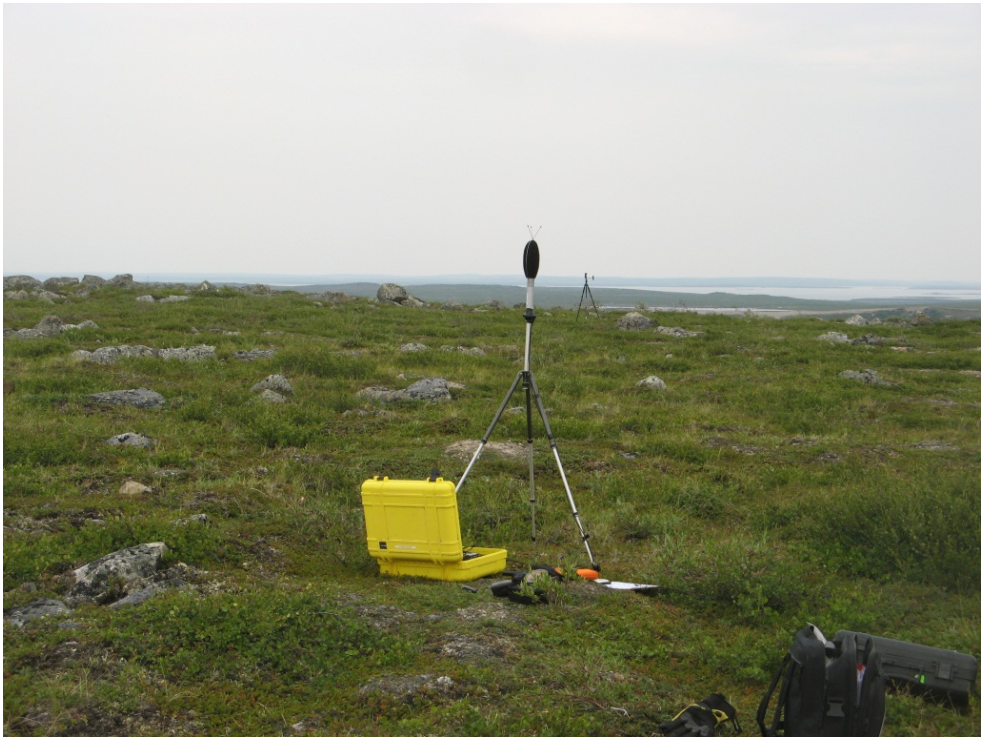
dBC = C-weighted decibel; dBA = A-weighted decibel; Hz = hertz; am = ante meridiem; pm = post meridiem.

3.2 Receptor 2 Site

3.2.1 Broadband Noise Results

The R2 Site was located on top of an elevated plateau covered by vegetation typical of tundra (i.e., low vegetation). In addition, the ground surface near the R2 site was covered by scattered rocks. A photograph of the area surrounding the sound level meter and the weather station at the R2 site is provided in Photo 3.2-1.

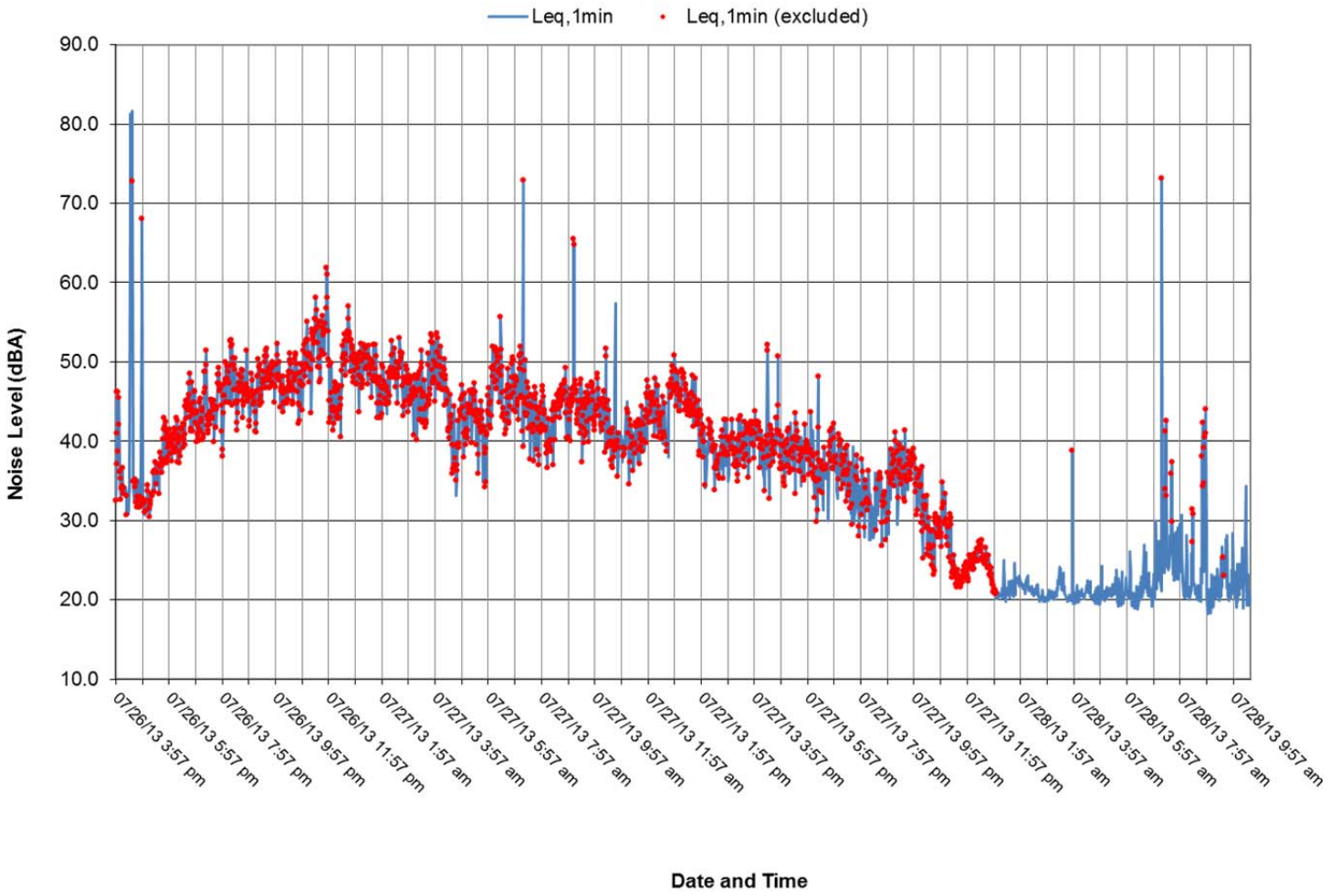
Photo 3.2-1 Sound Level Meter Deployed at the Receptor 2 Site



The noise level at the R2 Site was influenced primarily by noise generated by wind in vegetation, wildlife, and the sound of distant trucks on the Misery Haul Road.

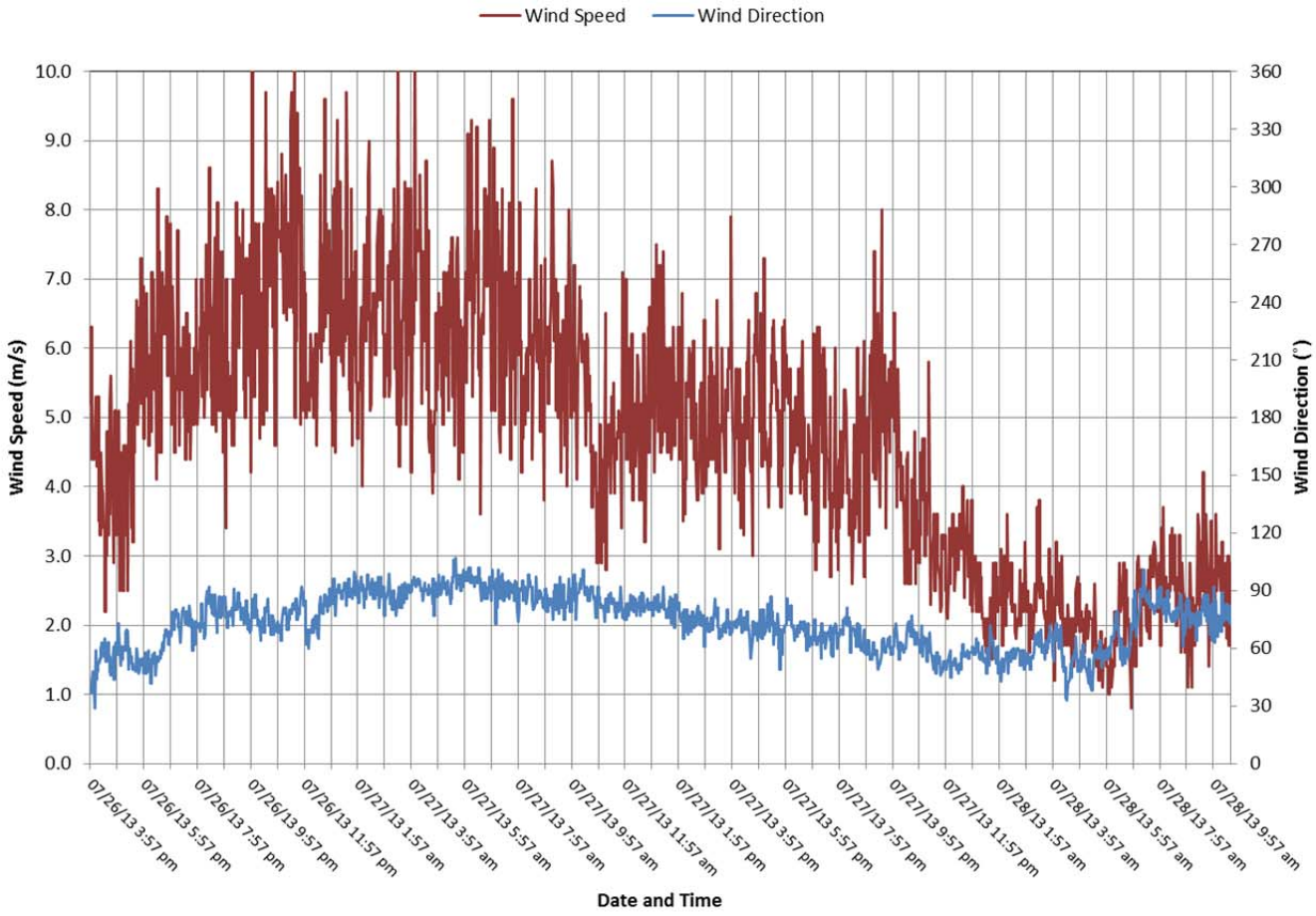
Invalid noise events removed from the data included technician activities, rain, periods of high wind speeds, and helicopter flyovers. Unfiltered one-minute noise levels ($L_{eq,1min}$) recorded at the R2 site are shown in Figure 3.2-1. Values of wind speed and wind direction recorded at the R2 site are presented in Figure 3.2-2. Temperature and relative humidity recorded at R2 are shown in Figure 3.2-3.

Figure 3.2-1 One-Minute Noise Data for the Receptor 2 Site



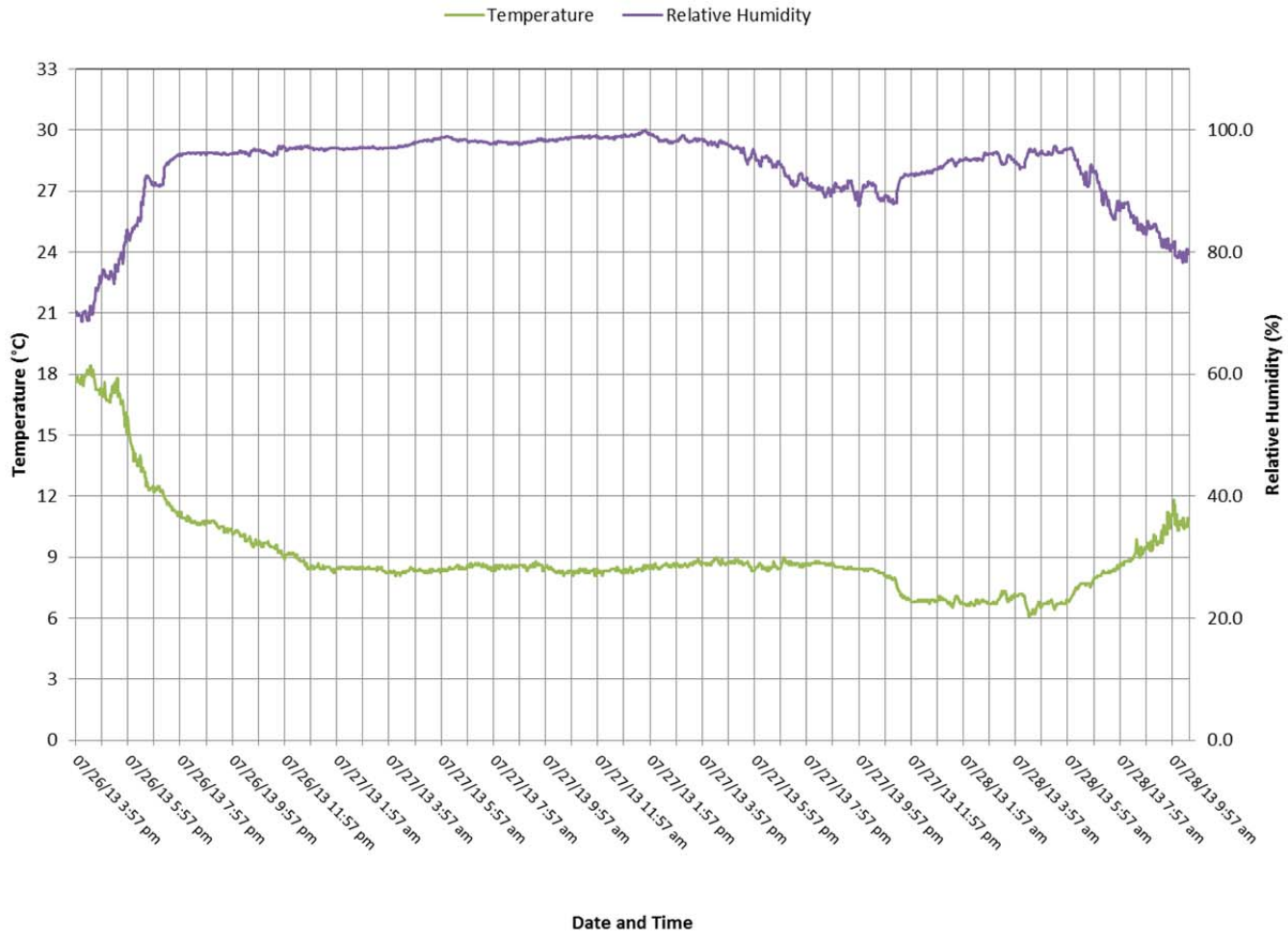
Leq,1min = equivalent energy noise level over one minute interval; dBA = A-weighted decibel; am = ante meridiem; pm = post meridiem.

Figure 3.2-2 Wind Speed and Direction Data for the Receptor 2 Site



m/s = metres per second; ° = degrees; am = ante meridiem; pm = post meridiem.

Figure 3.2-3 Temperature and Humidity Data for the Receptor 2 Site



°C = degrees Celsius; % = percent; am = ante meridiem; pm = post meridiem.

The results of the screening analysis of the data obtained during the noise survey at the R2 site are presented in Table 3.2-1. The valid hours and corresponding $L_{eq,day}$ and $L_{eq,night}$ are presented only for hours containing more than 30 valid minutes.

Table 3.2-1 Filtered One-Hour Noise Data for the Receptor 2 Site

Date	Start Hour	$L_{eq,\ 1hr}$ (dBA)[(a)]
07/26/13	3:00 pm	Not Valid
07/26/13	4:00 pm	Not Valid
07/26/13	5:00 pm	Not Valid
07/26/13	6:00 pm	Not Valid
07/26/13	7:00 pm	Not Valid
07/26/13	8:00 pm	Not Valid
07/26/13	9:00 pm	Not Valid
07/26/13	10:00 pm	Not Valid
07/26/13	11:00 pm	Not Valid
07/27/13	12:00 am	Not Valid
07/27/13	1:00 am	Not Valid
07/27/13	2:00 am	Not Valid
07/27/13	3:00 am	Not Valid
07/27/13	4:00 am	Not Valid
07/27/13	5:00 am	Not Valid
07/27/13	6:00 am	Not Valid
07/27/13	7:00 am	Not Valid
07/27/13	8:00 am	Not Valid
07/27/13	9:00 am	Not Valid
07/27/13	10:00 am	Not Valid
07/27/13	11:00 am	Not Valid
07/27/13	12:00 pm	Not Valid
07/27/13	1:00 pm	Not Valid
07/27/13	2:00 pm	Not Valid
07/27/13	3:00 pm	Not Valid
07/27/13	4:00 pm	Not Valid
07/27/13	5:00 pm	Not Valid
07/27/13	6:00 pm	Not Valid
07/27/13	7:00 pm	Not Valid
07/27/13	8:00 pm	32
07/27/13	9:00 pm	Not Valid
07/27/13	10:00 pm	Not Valid
07/27/13	11:00 pm	Not Valid
07/28/13	12:00 am	Not Valid
07/28/13	1:00 am	22
07/28/13	2:00 am	21

Table 3.2-1 Filtered One-Hour Noise Data for the Receptor 2 Site

Date	Start Hour	$L_{eq, 1hr}$ (dBA)[a]
07/28/13	3:00 am	21
07/28/13	4:00 am	21
07/28/13	5:00 am	21
07/28/13	6:00 am	22
07/28/13	7:00 am	26
07/28/13	8:00 am	24
07/28/13	9:00 am	23
07/28/13	10:00 am	25
07/28/13	11:00 am	Not Valid
$L_{eq,day}$ (dBA)	**7:00 am to 10:00 pm**	**27**
$L_{eq, night}$ (dBA)	**10:00 pm to 7:00 am**	**21**

a) Calculated based on valid 1-minute data.

Leq,1hr = equivalent energy noise level over one hour interval; dBA = A-weighted decibel; Leq,day = equivalent energy noise level over the daytime period (7:00 am to 10:00 pm); Leq,night = equivalent energy noise level during nighttime period (10:00 pm to 7:00 am); am = ante meridiem; pm = post meridiem.

A detailed count of the recorded 1-minute noise data for R2 and information regarding rejected data (i.e., data removed from analysis due to unfavourable weather conditions or abnormal noise events) is presented in Table 3.2-2. The amount of valid minutes for both periods exceeded 180 minutes at the receptor. Therefore, the results of the survey are considered valid based on requirements outlined in Directive 038.

Table 3.2-2 Overview of the Recorded and Rejected Minutes at the Receptor 2 Site

Period	Total Number of Minutes	Number of Valid Minutes	Number of Rejected Minutes
Daytime (7:00 am to 10:00 pm)	1,497	334	1,163
Nighttime (10:00 pm to 7:00 am)	1,080	359	721

3.2.2 Low Frequency Noise Results

The results of the LFN analysis for the R2 site are presented in Table 3.2-3. Based on the results, the difference between the dBC and dBA noise levels exceeded the threshold of 20 dB during the daytime and nighttime periods. However, for either period, a distinctive tone was not identified in the spectrum of the recorded sound. Therefore, based on Directive 038, there is no potential for LFN issue at the R2 site.

Table 3.2-3 Low Frequency Noise Analysis Results for the Receptor 2 Site

Period	dBC minus dBA	Number of Tones Below 250 Hz	Potential Low Frequency Issue
Daytime (7:00 am to 10:00 pm)	27.7	0	No
Nighttime (10:00 pm to 7:00 am)	21.0	0	No

dBC = C-weighted decibel; dBA = A-weighted decibel; Hz = hertz; am = ante meridiem; pm = post meridiem.

3.3 Receptor 3 Site

3.3.1 Broadband Noise Results

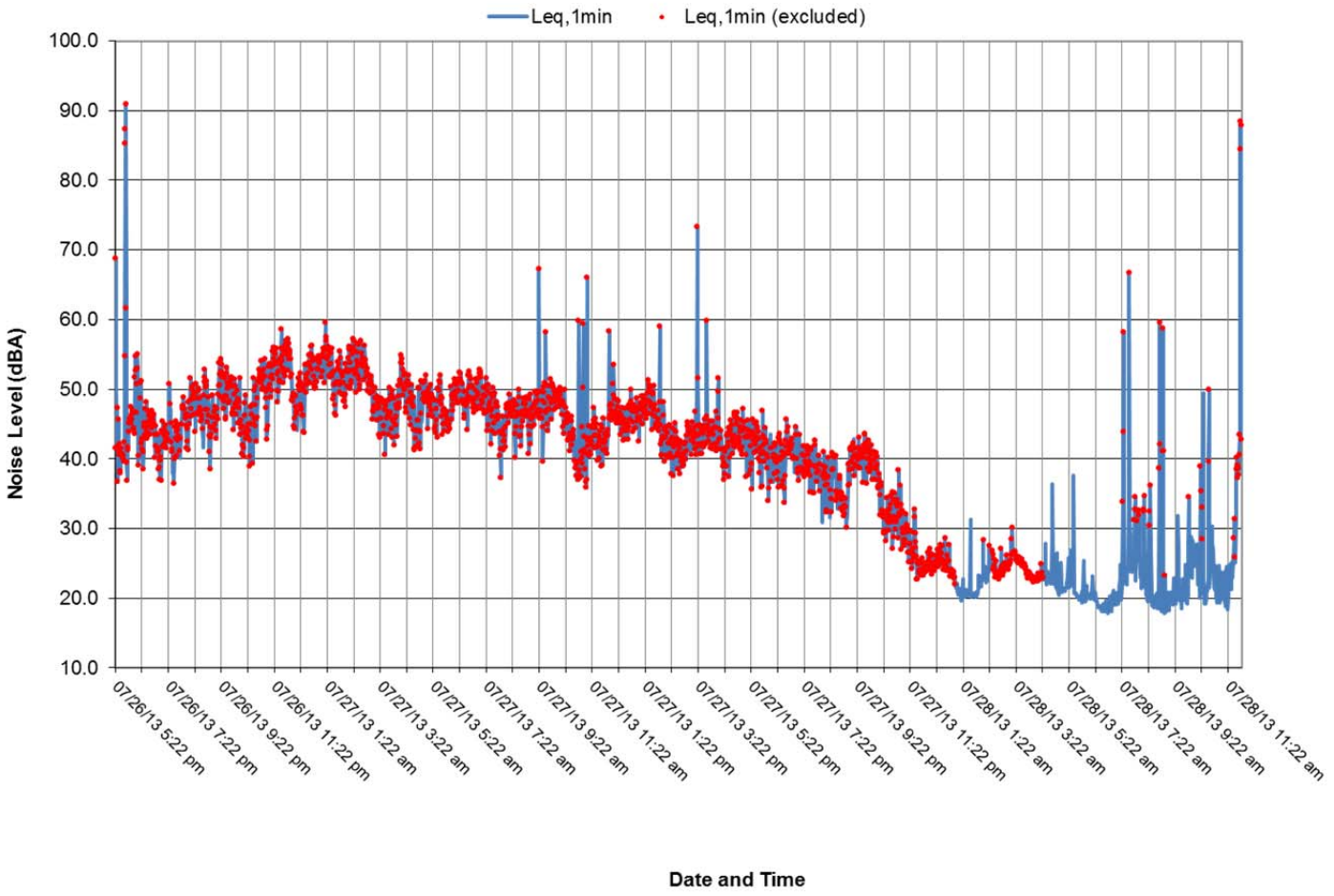
The R3 site was located on top of an elevated plateau covered by vegetation typical of tundra (i.e., low vegetation). In addition, the ground surface near the receptor was covered by scattered rocks. A photograph of the area surrounding the sound level meter and the weather station at the R3 site is provided in Photo 3.3-1.

Photo 3.3-1 Sound Level Meter Deployed at the Receptor 3 Site

The noise levels at the R3 site were influenced primarily by noise generated by wind in vegetation, wildlife, and the sound of distant trucks on the Misery Haul Road, although the haul road traffic at R3 was less audible than at R2.

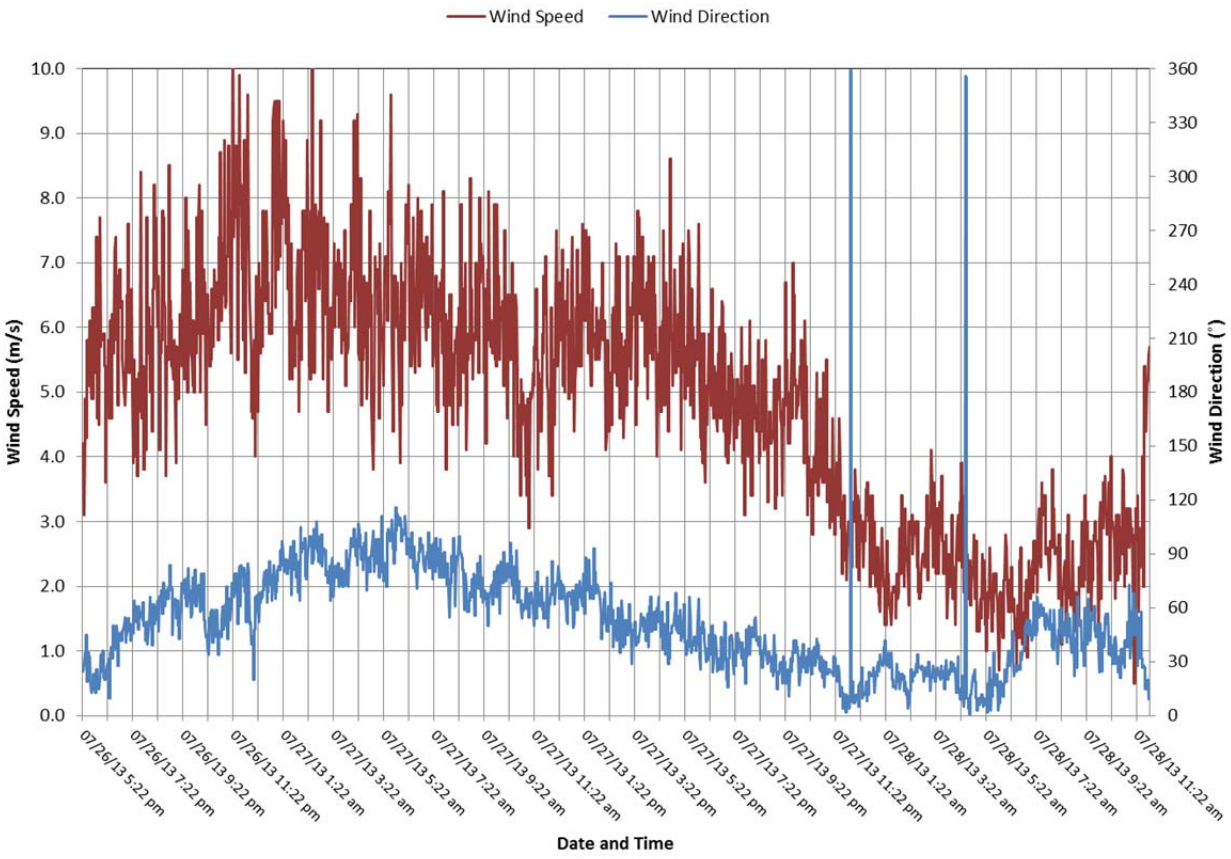
Invalid noise events removed from the data included technician activities, rain, periods of high wind speeds, and helicopter flyovers. Unfiltered one-minute noise levels ($L_{eq,1min}$) recorded at the R3 site are shown in Figure 3.3-1. Values of wind speed and wind direction recorded at the R3 site are presented in Figure 3.3-2. Temperature and relative humidity recorded at the R3 site are shown in Figure 3.3-3.

Figure 3.3-1 One-Minute Noise Data for the Receptor 3 Site



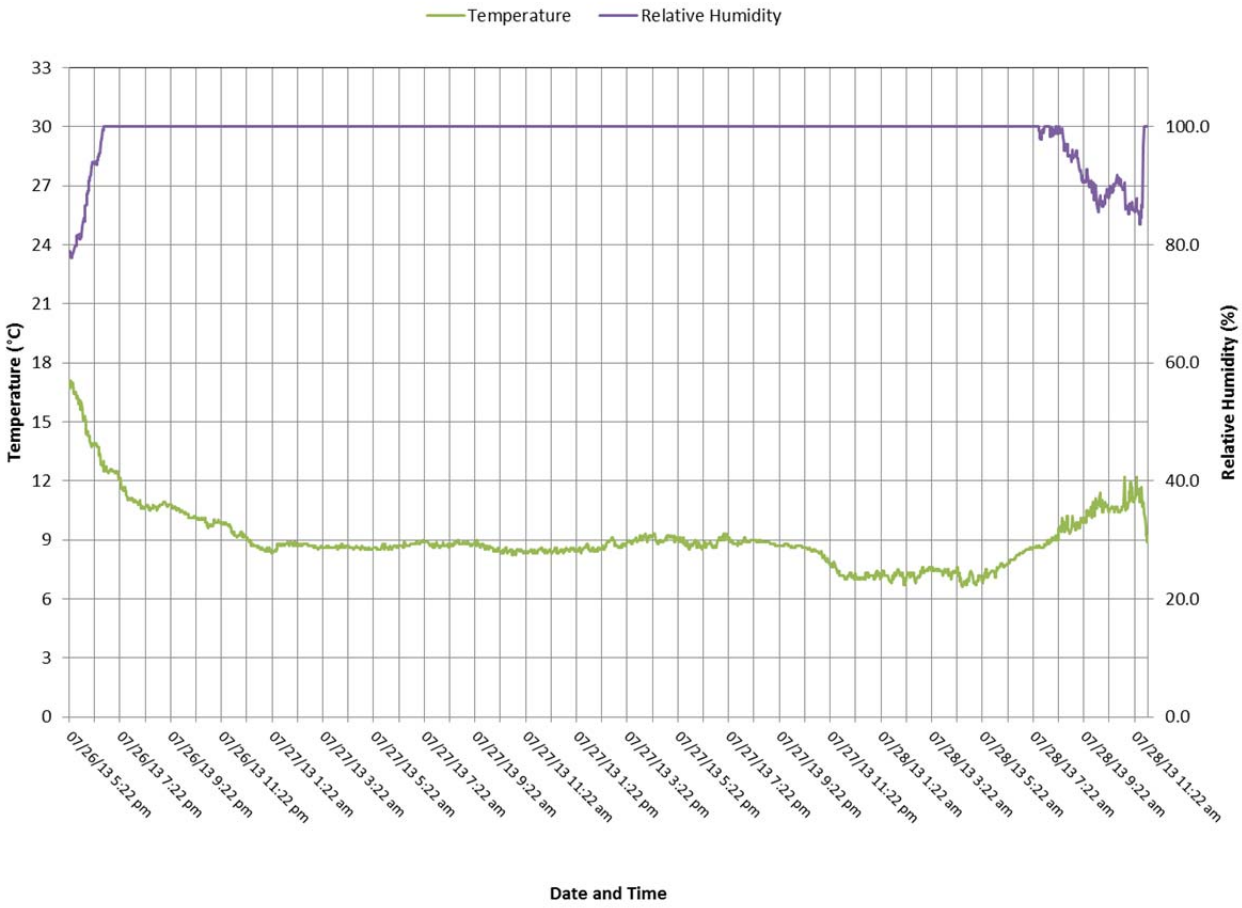
Leq,1min = equivalent energy noise level over 1 minute interval; dBA = A-weighted decibel; am = ante meridiem; pm = post meridiem.

Figure 3.3-2 Wind Speed and Direction Data for the Receptor 3 Site



m/s = meters per second; ° = degrees; am = ante meridiem; pm = post meridiem.

Figure 3.3-3 Temperature and Humidity Data for the Receptor 3 Site



°C = degrees Celsius; % = percent; am = ante meridiem; pm = post meridiem.

The results of the screening analysis of the data obtained during the noise survey at the R3 site are presented in Table 3.3-1. The valid hours and corresponding $L_{eq,day}$ and $L_{eq,night}$ are presented only for hours containing more than 30 valid minutes.

Table 3.3-1 Filtered One-Hour Noise Data for the Receptor 3 Site

Date	Start Hour	$L_{eq,\ 1hr}$ (dBA)[(a)]
07/26/13	5:00 pm	Not Valid
07/26/13	6:00 pm	Not Valid
07/26/13	7:00 pm	Not Valid
07/26/13	8:00 pm	Not Valid
07/26/13	9:00 pm	Not Valid
07/26/13	10:00 pm	Not Valid
07/26/13	11:00 pm	Not Valid
07/27/13	12:00 am	Not Valid
07/27/13	1:00 am	Not Valid
07/27/13	2:00 am	Not Valid
07/27/13	3:00 am	Not Valid
07/27/13	4:00 am	Not Valid
07/27/13	5:00 am	Not Valid
07/27/13	6:00 am	Not Valid
07/27/13	7:00 am	Not Valid
07/27/13	8:00 am	Not Valid
07/27/13	9:00 am	Not Valid
07/27/13	10:00 am	Not Valid
07/27/13	11:00 am	Not Valid
07/27/13	12:00 pm	Not Valid
07/27/13	1:00 pm	Not Valid
07/27/13	2:00 pm	Not Valid
07/27/13	3:00 pm	Not Valid
07/27/13	4:00 pm	Not Valid
07/27/13	5:00 pm	Not Valid
07/27/13	6:00 pm	Not Valid
07/27/13	7:00 pm	Not Valid
07/27/13	8:00 pm	Not Valid
07/27/13	9:00 pm	Not Valid
07/27/13	10:00 pm	Not Valid
07/27/13	11:00 pm	Not Valid
07/28/13	12:00 am	Not Valid
07/28/13	1:00 am	22
07/28/13	2:00 am	Not Valid
07/28/13	3:00 am	Not Valid
07/28/13	4:00 am	25

Table 3.3-1 Filtered One-Hour Noise Data for the Receptor 3 Site

Date	Start Hour	$L_{eq, 1hr}$ (dBA)[(a)]
07/28/13	5:00 am	25
07/28/13	6:00 am	20
07/28/13	7:00 am	24
07/28/13	8:00 am	22
07/28/13	9:00 am	23
07/28/13	10:00 am	33
07/28/13	11:00 am	24
$L_{eq,day}$ (dBA)	**7:00 am to 10:00 pm**	**28**
$L_{eq, night}$ (dBA)	**10:00 pm to 7:00 am**	**23**

a) Calculated based on valid 1-minute data.

Leq,1hr = equivalent energy noise level over 1 hour interval; dBA = A-weighted decibel; Leq,day = equivalent energy noise level over the daytime period (7:00 am to 10:00 pm); Leq,night = equivalent energy noise level during nighttime period (10:00 pm to 7:00 am; am = ante meridiem; pm = post meridiem.

A detailed count of the recorded noise data for the R3 Site and information regarding rejected data (i.e., data removed from the analysis due to either unfavourable weather conditions or abnormal noise events) are presented in Table 3.3-2. The amount of valid minutes for both periods exceeded 180 minutes at the receptor. Therefore, the results of the survey are considered valid based on requirements outlined in Directive 038.

Table 3.3-2 Overview of the Recorded and Rejected Minutes at the Receptor 3 Site

Period	Total Number of Minutes	Number of Valid Minutes	Number of Rejected Minutes
Daytime (7:00 am to 10:00 pm)	1,471	326	1,145
Nighttime (10:00 pm to 7:00 am)	1,080	244	836

am = ante meridiem; pm = post meridiem.

3.3.2 Low Frequency Noise Results

The results of the LFN analysis for the R3 site are presented in Table 3.3-3. Based on the results, the difference between the dBC and dBA noise levels exceeded the threshold of 20 dB during the daytime period. However, a distinctive tone was not identified in the spectrum of the recorded sound. During the nighttime, the dBC minus dBA difference was below 20 dB and there was no distinctive low frequency tone present. Therefore, based on Directive 038, there is no potential for LFN issue at the R3 site.

Table 3.3-3 Low Frequency Noise Analysis Results for the Receptor 3 Site

Period	dBC minus dBA	Number of Tones Below 250 Hz	Potential Low Frequency Issue
Daytime (7:00 am to 10:00 pm)	20.5	0	No
Nighttime (10:00 pm to 7:00 am)	15.7	0	No

dBA = A-weighted decibel; dBC = C-weighted decibel; Hz = hertz; am = ante meridiem; pm = post meridiem.

4 SUMMARY

The results indicate that the existing noise levels surrounding the future site of the Project are primarily influenced by natural noise sources, such as wind and precipitation. In the absence of trees or other vegetation-based noise barriers, wind can be an important noise source, especially when it reaches substantial speeds. The closest industrial noise sources are associated with the Misery site and the Misery Haul Road. The noise from the haul road was only faintly perceived at two receptor sites (R2 and R3) that had a direct line of sight to the haul road. The noise emissions from mining operations at the Misery Pit could not be distinguished from the local ambient noise. During the baseline noise monitoring, the study area was not subject to frequent airplane or helicopter air traffic; however, all helicopter noise was removed from the analysis since it was not considered representative of the existing noise environment.

The previous sections provide the $L_{eq,1hr}$ values in dBA for the noise monitoring locations. All $L_{eq,1hr}$ values were based on at least 30 minutes of valid data. The sections also present $L_{eq,day}$ and $L_{eq.night}$ values in dBA for each monitoring location. The overview of valid minutes of noise samples for each monitoring location is shown in Table 4-1. Directive 038 requires a minimum of three hours of valid daytime monitoring data and three hours of valid nighttime monitoring data before a baseline program is considered sufficient. The three-hour requirement was met at all three monitoring locations, for both the daytime and nighttime periods.

Table 4-1 Summary of One-Minute Noise Data

Location	Valid Daytime (minutes)	Excluded Daytime (minutes)	Valid Nighttime (minutes)	Excluded Nighttime (minutes)	Total Valid Day+Night (minutes)	Total Excluded Day+Night (minutes)
R1	259	711	190	348	449	1,059
R2	334	1,163	359	721	693	1,884
R3	326	1,145	244	836	570	1,981

The equivalent daytime and nighttime noise levels presented in Table 4-2 indicate that daytime and nighttime noise levels, at the three receptors, are within 3 dB and 4 dB respectively. The maximum reported nighttime noise level of 25 dBA at the R1 site is well below the 35 dBA noise level that Directive 038 indicates is typical for a quiet rural area without anthropogenic activity.

Table 4-2 Equivalent Daytime and Nighttime Noise Levels

Receptor	$L_{eq,day}$ (dBA)	$L_{eq,\ night}$ (dBA)
R1	25	25
R2	27	21
R3	28	23

Leq,day = equivalent energy noise level over the daytime period (7:00 am to 10:00 pm); Leq,night = equivalent energy noise level during nighttime period (10:00 pm to 7:00 am); dBA = A-weighted decibel; am = ante meridiem; pm = post meridiem.

The LFN measurement, conducted according to Directive 038 guidance, indicates that potential LFN is not an issue at any of the receptors.

5 REFERENCE

EUB (Alberta Energy and Utilities Board). 2007. Directive 038: Noise Control. Issued February 16, 2007. 54 pp.

6 GLOSSARY

Term	Definition
99% confidence level	Statistical quantity describing probability that the measured value corresponds to the true value of the measured quantity (e.g., sound pressure level).
Alberta Energy Regulator (AER)	An independent provincial body responsible for regulation of oil, oil sands, natural gas, and coal mining projects in Alberta. In the Northwest Territories (and other jurisdictions that lack specific environmental noise regulations), AER noise regulations are often used to guide noise assessments.
All-season road	A road that is motorable all year by the prevailing means of rural transport.
Anomalous or abnormal noise sources	Any noise source having undue influence on measured noise levels. An anomalous or abnormal noise source can include both noise sources that are not usually present in the environment (e.g., technicians deploying or recovering monitoring equipment) and noise sources that are usually present in the environment but which have an undue influence on measured noise levels as a result of proximity (e.g., wildlife very close to monitoring equipment).
Anthropogenic noise sources	Noise sources associated with manmade equipment or activities.
A-weighting	A spectral or frequency weighting scheme applied to noise measurements to replicate the frequency response of the human auditory system.
Barometric pressure	The absolute pressure exerted by the weight of a column of air above a given point.
Baseline noise	Current environmental noise levels, against which changes in the environment from the Jay Project could be measured; the baseline case focuses on summarizing the noise monitoring data gathered during the recent noise survey.
Broadband noise	Noise measured over the entire audible spectrum; for the average human the audible spectrum extends from approximately 20 Hz to approximately 20,000 Hz.
Calibrator	A device designed to provide a calibration signal of known noise level (e.g., 94 dBA); used to provide a reference signal for sound level meter internal reference circuit.
C-weighting	A spectral or frequency weighting scheme that emphasizes low frequency content.
Daytime	The hours between 7:00 am and 10:00 pm.
Decibel (dB)	The decibel (dB) is a measure, on a logarithmic scale, of the magnitude of a particular quantity (such as sound pressure level or sound power level) with respect to a standard reference value.
dBA	Decibel value obtained using A-weighting.
dBC	Decibel value obtained using C-weighting.
Directive 038	The regulation that applies to environmental noise from oil, oil sands, natural gas, and coal mining projects in Alberta. In the Northwest Territories (and other jurisdictions that lack specific environmental noise regulations), Directive 038 is often used to guide noise assessments. Directive 038 provides guidance regarding the approach used in preparation of noise assessments, including noise measurement techniques and methodology for identifying and addressing adverse noise effects.
Equivalent noise level L_{eq}	Continuous equivalent sound level, defined as the sound pressure level that, if constant over the stated measurement period, would contain the same sound energy as the actual monitored sound that is fluctuating in level over the measurement period. This type of average takes into account the natural variability of sound.
Esker	An esker is a long, winding ridge of stratified sand and gravel believed to form in ice-walled tunnels by streams which flowed within and under glaciers. After the retaining ice walls melt away, stream deposits remain as long winding ridges.
Footprint	The proposed development area that directly affects the soil and vegetation components of the landscape.
Hertz (Hz)	Physical unit describing the frequency of occurrence of a certain process expressed in number of cycles per second (e.g., 20 Hz is twenty cycles per second)
Kestrel 4500	A device capable of measuring and recording meteorological parameters such us temperature, humidity, barometric pressure, wind speed and direction.
Kimberlite	Igneous rocks that originate deep in the earth's mantle and intrude the earth's crust. These rocks typically form narrow pipe-like deposits that sometimes contain diamonds.

Term	Definition
Kimberlite pipe	A more or less vertical, cylindrical body of kimberlite that resulted from the forcing of the kimberlite material to the Earth‘s surface. Typically vertical structures of volcanic rock in the Earth’s crust that can contain diamonds.
Low frequency noise	Noise containing a clear tonal component at a frequency below 250Hz and for which the difference between the overall C-weighted sound level and the overall A-weighted sound level exceeds 20 dB.
Nighttime	The hours between 10:00 pm and 7:00 am.
Noise level	Describes magnitude of sound measured using the logarithmic dB scale.
Relative humidity	The ratio of the amount of water vapour in the atmosphere to the amount necessary for saturation at the same temperature. Relative humidity is expressed in terms of percent and measures the percentage of saturation.
Sound level meter	A device used to measure, record, and report sound pressure levels.
Treeline	An area of transition between the tundra and boreal forest to the south.
Tundra	An area between the polar ice cap and taiga that is characterized by a lack of trees and permanently frozen subsoil.
Variance	The difference between two quantities; in this case the difference between a reference sound pressure level and a measured sound pressure level.
Waste rock	Rock moved and discarded in order to access resources.
Waste rock storage area	Engineered landforms in which waste rock from mining activities is stored.
Waterbody	An area of water such as a river, stream, lake or sea.
Watercourse	Riverine systems such as creeks, brooks, streams and rivers.
Watershed	The area drained by a river or stream; see also drainage basin.
Wildlife	Under the Species at Risk Act, wildlife is defined as a species, subspecies, variety or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus that is wild by nature and is native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Winter road	Roads which are built over frozen lakes and tundra. Compacted snow and/or ice is used for embankment construction.

Appendix A
Calibration Record of Baseline Noise Measurements