Appendix 18-B

Murray River Coal Project: 2012 Noise Baseline

HD Mining International Ltd.

MURRAY RIVER COAL PROJECT
2012 Noise Baseline

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MURRAY RIVER COAL PROJECT

2012 NOISE BASELINE

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Prepared for:

HD Mining International Ltd.

Prepared by:

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Executive Summary

Executive Summary

HD Mining International Ltd. (HD Mining) proposes to develop the Murray River Coal Project (the Project) as a 6 million tonne per annum (6 Mtpa) underground metallurgical coal mine. The property is located approximately 12.5 km south of Tumbler Ridge, British Columbia. The Project is located within the Peace River Coalfield (PRC), an area with a long history of metallurgical grade coal open pit mining.

To support HD Mining's planning and development of the Project, and to contribute to the environmental assessment process, environmental and socio-economic baseline studies were initiated by Rescan Environmental Services Ltd. (Rescan). Project-specific studies began in 2010 and have continued through 2012. As appropriate and when available, historical data from government sources and neighbouring projects, as well as traditional use/knowledge information, have been compiled and incorporated into the analysis. This report presents a cumulative summary of all Noise baseline information compiled for the Project to date.

Noise associated with industrial operations is often discussed in the context of worker health and safety. However, mining operations also expose the environment outside the Project fenceline to elevated noise levels. These can be perceived as a considerable nuisance by adjacent landowners even though typically noise levels beyond the project fenceline will not negatively affect human health or interrupt recreational activities. In addition, wildlife populations, especially caribou and birds, have been shown to avoid areas of elevated noise. This might lead to the fragmentation of valuable habitat and abandonment of migration routes. Baseline noise levels established before the commencement of construction and operations allow assessment of the potential cumulative effect of noise emissions associated with the proposed Project.

The main objectives of the noise baseline program were to:

- measure noise levels at a range of representative locations in the vicinity of the proposed mine; and
- provide a point of reference to assess potential project effects.

Four noise monitoring stations were set up within the study area and monitored during two periods, summer and winter. Noise levels were recorded over a 24 hour period per site in July 2012 and January 2013. The locations were selected to characterize the range of baseline conditions in the region.

Natural background noise sources observed included birds, mammals, wind, rain and thunder. Anthropogenic noise sources that were observed included aircraft, road vehicles, trains and mining activities. From the background data collected at the stations during the two monitoring periods:

- the mean noise (L_{eq}) levels averaged over the monitoring period ranged from 23.8 to 48.8 dBA;
- the hourly L_{90} levels averaged over the monitoring period ranged from 20.2 to 30.4 dBA;
- the absolute minimum (L_{min}) noise levels ranged from 16.6 to 22.5 dBA; and
- the absolute maximum (L_{max}) noise levels ranged from 51.6 to 96.2 dBA.

Typical baseline rural sound levels are around 35 dBA (nighttime) and 45 dBA (daytime) as presented in Alberta Energy and Utilities Board (EUB) Directive 38: Noise Control (EUB (the Energy Resources Conservation Board (ERCB)), 2007) and reproduced in the BC Oil and Gas Commission (OGC) *British Columbia Noise Control Best Practice Guideline* (OGC 2009). The monitoring data within the study area are within this typical range of baseline rural sound levels.

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Acknowledgements

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2012 NOISE BASELINE

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Glossary and Abbreviations

Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

dBA	Sound levels, in decibels, measured with an A-weighted filter.
EAC	Environmental Assessment Certificate
L_{90}	The ninetieth percentile level (the sound pressure level that is exceeded 90 percent of the time during the measurement period).
L_{eq}	Continuous equivalent sound level over a time period
L_{max}	Maximum recorded sound level during a time period
L_{min}	Minimum recorded sound level during a time period
MSC	Meteorological Service of Canada; a division of Environment Canada
Precipitation	Liquid or solid products of the condensation of water vapour falling from the clouds which include rain, sleet, hail, snow, and other forms of water.
QA	Quality Assurance
QC	Quality Control

1. Introduction

1. Introduction

HD Mining International Ltd. (HD Mining) proposes to develop the Murray River Coal Project (the Project) as a 6 million tonne per annum (6 Mtpa) underground metallurgical coal mine. The property is located approximately 12.5 km south of Tumbler Ridge, British Columbia (Figure 1-1), and consists of 57 coal licences covering an area of 16,024 hectares. The Project is located within the Peace River Coalfield (PRC), an area with a long history of metallurgical grade coal mining, mainly from open pit mining. HD Mining is proposing to access deeper zones of the coal field (600 to 1,000 m below surface) through underground mining techniques.

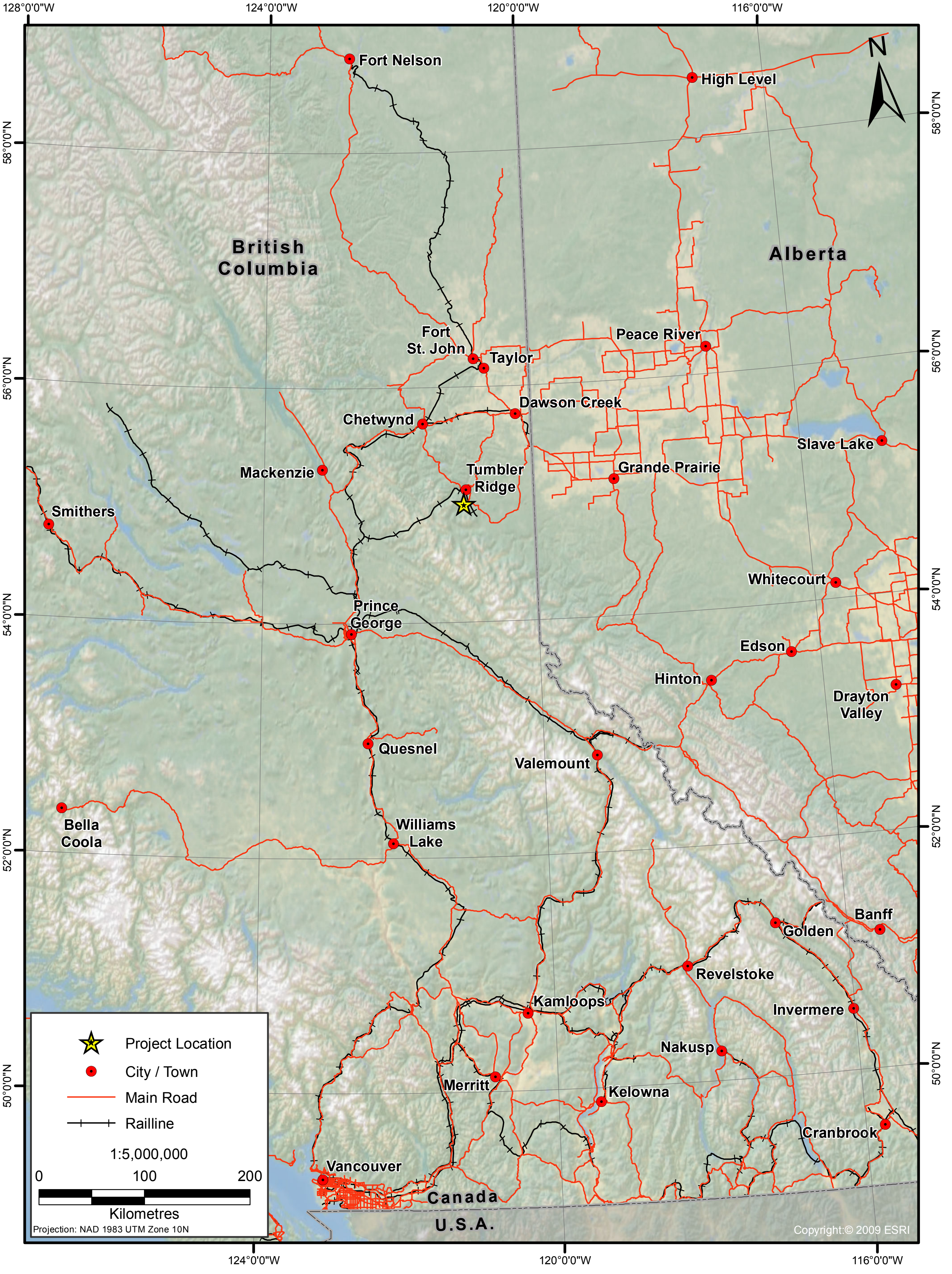
In October 2011, HD Mining submitted an application to the BC Ministry of Energy and Mines and Ministry of Environment seeking permission to complete a bulk sampling program as part of exploration of the property. In March 2012, HD Mining received approval to conduct a 100,000 tonne bulk sample for the purpose of conducting testing to assist in developing markets for the coal.

Beyond the bulk sample program, in order to develop a full mine at the proposed 6 Mtpa production level, the Project is subject to both the BC and Canadian environmental assessment processes. Development of any infrastructure for the full mine is not permitted before the requirements of these processes are met.

To support HD Mining's planning and development of the Project, and to contribute to the environmental assessment process, environmental and socio-economic baseline studies were initiated by Rescan Environmental Services Ltd. (Rescan). Project-specific studies began in 2010 and have continued through 2012. As appropriate and when available, historical data from government sources and neighbouring projects, as well as traditional use/knowledge information, have been compiled and incorporated into the analysis.

In order to help guide the scope of baseline studies, regional and local study areas (RSA and LSA, respectively) have been developed (Figures 1-2 and 1-3). The RSA is intended to encompass an area beyond which effects of the Project would not be expected. It is also intended to be ecologically relevant based on the home range of key wildlife species known to inhabit the region. The LSA encompasses an area surrounding the proposed Project infrastructure within which direct effects from the Project may be anticipated. Its boundary has also been developed following natural terrain and drainage boundaries in order to be ecologically relevant. For consistency, the same RSA and LSA are used for all environmental studies, except where local concerns outside the RSA need to be assessed. For example, the air quality assessment area will extend beyond the RSA as requested by the BC Ministry of Environment. This report presents a cumulative summary of all noise monitoring data information compiled for the Project to date.

Noise associated with industrial operations is often discussed in the context of worker health and safety. However, mining operations also expose the environment outside the Project fenceline to elevated noise levels. These can be perceived as a considerable nuisance by adjacent landowners even though typically noise levels beyond the project fenceline will not negatively affect human health or interrupt recreational activities. In addition, wildlife populations, especially caribou and birds, have been shown to avoid areas of elevated noise. This might lead to the fragmentation of valuable habitat and abandonment of migration routes. Baseline noise levels established before the commencement of construction and operations allow assessment of the potential cumulative effect of noise emissions associated with the proposed Project.

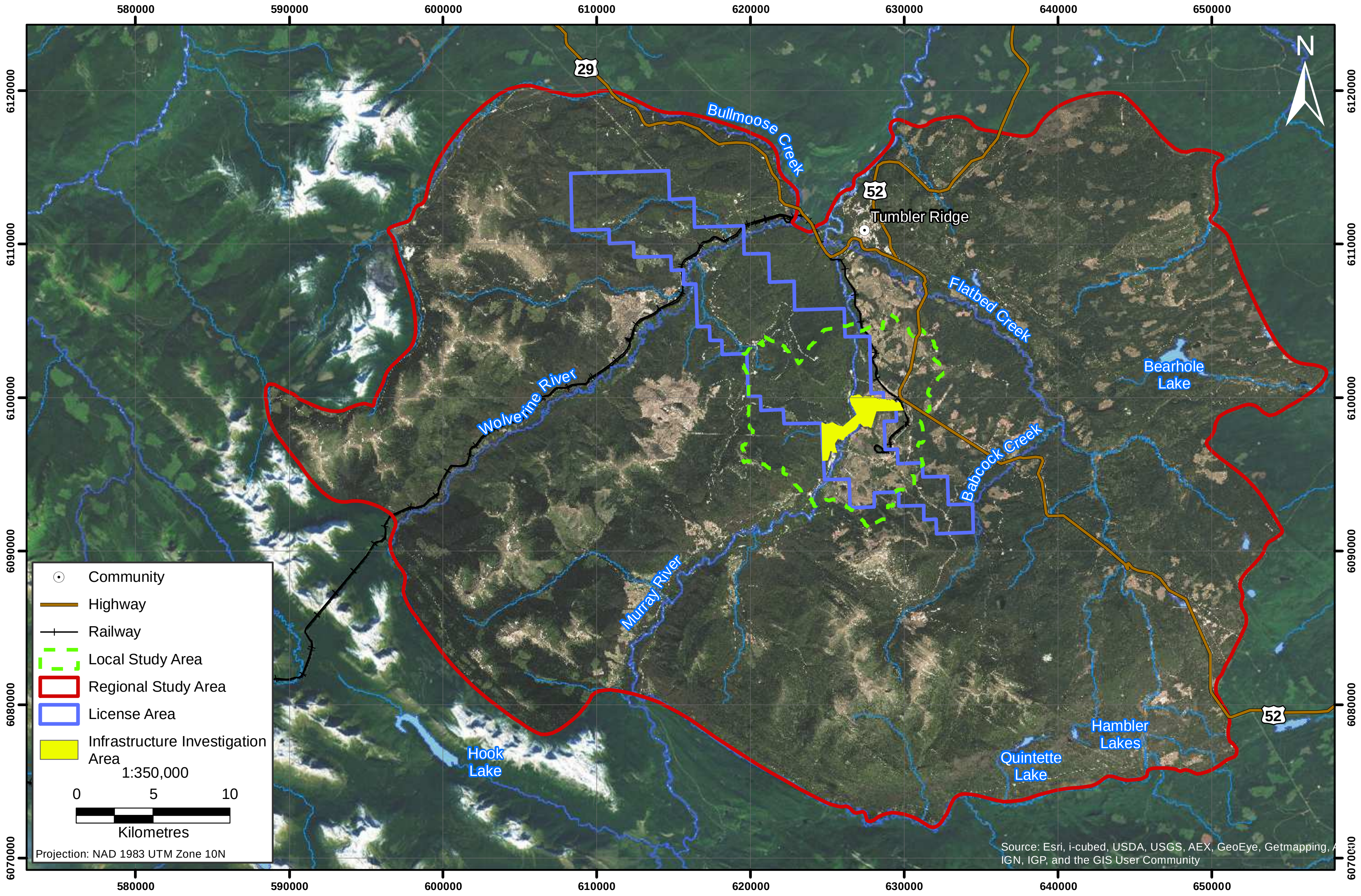


MURRAY RIVER COAL PROJECT

Project Location

Figure 1-1

PROJECT # 0194106 *GIS #* MUR-15-058 *VERSION #* T0.10 April 10 2013



Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, IGN, IGP, and the GIS User Community

MURRAY RIVER COAL PROJECT

Project Study Boundaries

Figure 1-2

The main objectives of the noise baseline program were to:

- measure noise levels at a range of representative locations in the vicinity of the proposed mine; and
- provide a point of reference to assess potential project effects.

The following chapters outline the available background information that supports the study (Chapter 2); a description of the methods and rationale used to identify sites and collect Project-specific data (Chapter 3); the results of data collection (Chapter 4); and a summary that synthesizes the key findings of the baseline program (Chapter 5).

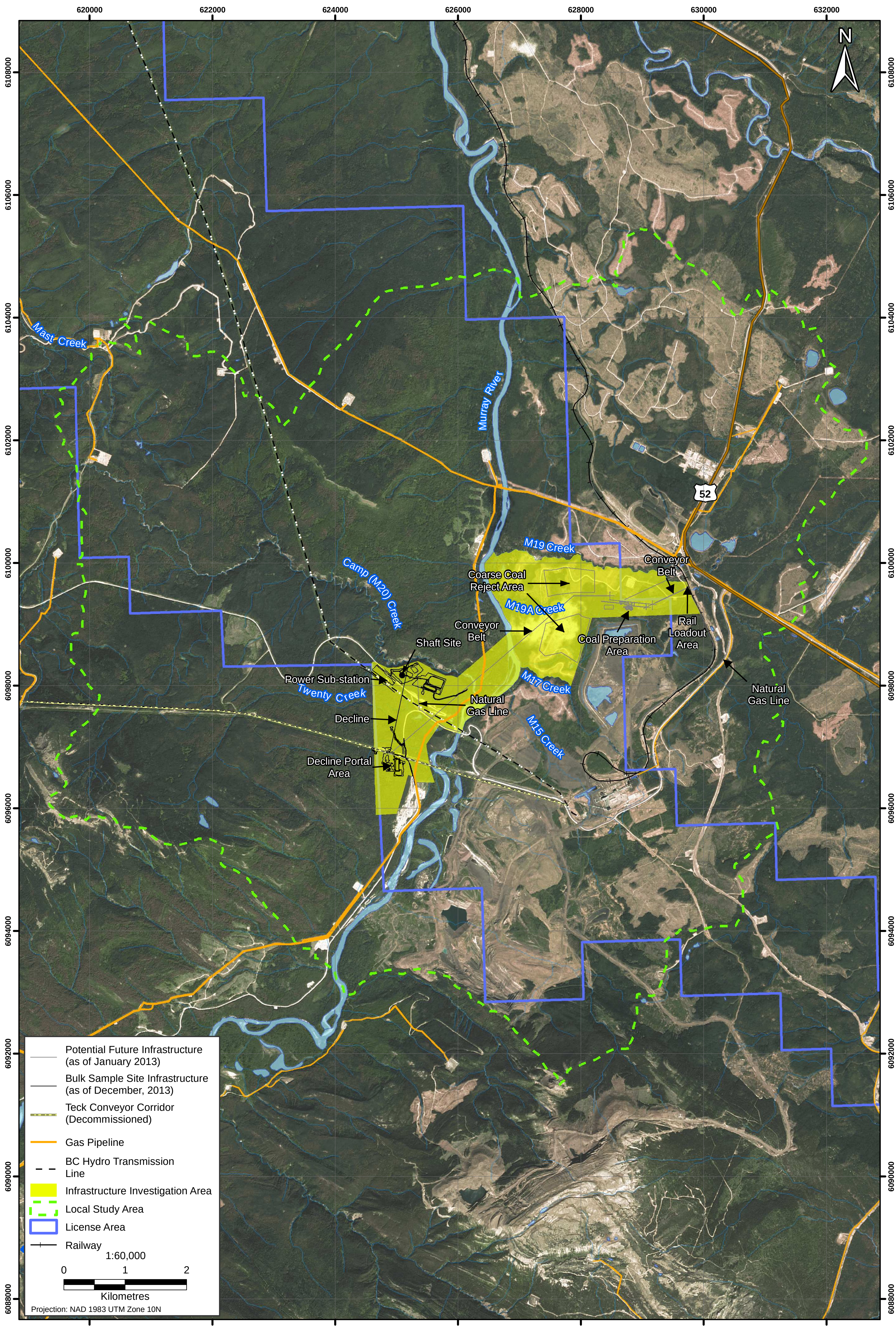


Figure 1-3

hd Mining

MURRAY RIVER COAL PROJECT

Preliminary Site Layout

Figure 1-3

Rescan Engineers & Scientists

2. Background Information

2. Background Information

2.1 LITERATURE REVIEW

Noise is generally defined as unwanted sound. It is characterized in terms of the pressure of the sound wave. Human perception of sound pressure is non-linear: a ten-fold increase in sound pressure is perceived as a doubling of the noise level by the average person. This non-linearity is reflected in the use of the decibel (dB), a logarithmic measure of noise level. The dB is the logarithm of the ratio of the root mean square (rms) sound pressure relative to a standard rms sound pressure, usually 20 µPa, the hearing threshold below which sound is not generally detectable by the human ear.

Noise is typically monitored as sound pressure level, in A-weighted decibels (dBA). The A-weighting is designed to match the average frequency response of the human ear. Some typical noise levels are as follows (in dBA):

- rustling leaves: 20;
- humming of refrigerator: 40;
- normal conversation: 60;
- business office: 65;
- average city traffic: 80 to 85;
- jackhammer:100;
- jet take-off at 100 m distance: 130; and
- motorcycles, firecrackers, small arms fire: up to 140.

In general, a 3 dBA difference is required by the average person to notice any alteration in noise level.

Because of the non-linearity nature of the dB scale, sound levels cannot simply be added. Instead the logarithm has to be inverted before adding and then applied to the sum (Alberta EUB, 2007):

$$L_{total} = 10\log_{10}(10^{\frac{L_1}{10}} + 10^{\frac{L_2}{10}})$$

For example, the addition of people talking (50 dBA) in a very calm room (background noise of 35 dBA) does not bring up the noise level in the room to 85 dBA. Adding the noise levels in this example according to the formula above will raise total noise levels to 50.1 dBA. In fact, the background noise will no longer be audible once people start talking. For the noise source to be audible it has to be at least at loud as the background (i.e., a background noise level of 35 dBA and a 35 dBA noise source have a total noise level of 38 dBA). On the other hand, if the total noise level is 41.2 dBA “switching off” the background noise and leaving only a noise source of 40 dBA (a 1.2 dBA change) will not be audible.

Typical baseline rural sound levels are around 35 dBA (nighttime) and 45 dBA (daytime) as presented in Alberta Energy and Utilities Board (EUB) Directive 38: Noise Control (EUB (the Energy Resources Conservation Board (ERCB)), 2007) and reproduced in the BC Oil and Gas Commission (OGC) *British Columbia Noise Control Best Practice Guideline* (OGC 2009).

3. Methodology

3. Methodology

3.1 MONITORING METHODOLOGY

Baseline noise samples were collected using Brüel & Kjær Model 2250 sound level meters capable of logging data. These instruments have operating ranges from 16.7 to 140 dBA (at 1 kHz pure tone signal) that captures low sound levels, which are typical for undisturbed wilderness areas, as well as high sound levels. Each instrument's microphone was protected by a wind screen/weather shield and bird spikes. Other than the ground, all surfaces or obstacles were at least 3 m away from the stations. A weather resistant case protected the meter and battery pack and provided a stable base for each kit. The average, minimum and maximum peak sound levels were measured using the "A" standardized frequency rating (dBA), designed to match the frequency response of the human ear. Each sound level meter was calibrated before sampling. Noise measurements were made once every 0.1 seconds, approximately 1 metre above ground. Each monitoring period was at least 24 consecutive hours, with the exception of S3 during the summer monitoring period. Only 16 hours of data was collected at the S3 station during the summer monitoring period due to numerous thunderstorms in close proximity which delayed the deployment of the noise monitoring equipment and to technical issues when retrieving the data. While each monitoring period is at least 24 hours in duration, the noise recorded during the installation and demobilization of the noise monitor is removed during post processing and this can make the reported timeframe of the monitoring period slightly less than 24 hours.

The instruments can be set up to record a range of statistics based on user-specified averaging periods. Data parameters logged during these survey periods included L_{eq}, L_{90}, L_{max}, and absolute L_{min}.

- L_{eq} is the continuous equivalent sound level over a time period, typically one hour, using the 0.1 second monitoring data. One minute L_{eq} values were also recorded for graphical data presentation and analysis.
- L_{90} is the ninetieth percentile level (the sound pressure level that is exceeded 90 percent of the time during the measurement period). For example, L_{90} = 20 dBA means that the sound pressure level exceeded 20 dBA during 90% of the measurement period. L_{90} is usually regarded as the residual level or the background noise level without discrete events (e.g., helicopters, fixed wing aircraft).
- L_{max} is the maximum value recorded during an hourly period, using the 0.1 second monitoring data.
- L_{min} is the minimum value recorded during and hourly period, using the 0.1 second monitoring data.
- The absolute L_{max} and L_{min} are the maximum and minimum 0.1 second values recorded in the monitoring period (typically 24 hours).

L_{eq} values include higher noise levels from anthropogenic sources such as helicopters and aircraft movement, and therefore may not accurately reflect the natural noise level conditions in the area. L_{90} values provide a better indication of the natural noise levels since discrete events that occur from anthropogenic sources will not typically be part of 90% of the measurement time period.

Additionally, the sound level meters recorded audible sound files, which were used for the analysis of the baseline data to identify the peak events and the associated noise sources.

The following weather parameters were recorded at the Project's automated meteorological station during each noise measurement time period:

- relative humidity (%);
- wind speed (km/h or m/s);
- wind direction (degrees from true north);
- precipitation (mm); and
- temperature (°C).

The standard weather conditions for noise monitoring are:

- relative humidity of less than 90%;
- wind speeds of less than 20 km/h;
- no active precipitation (rain or snow); and
- temperatures that allow the meter body to be maintained within manufacturer's specifications.

The timings of the monitoring periods were selected to reduce the likelihood of unfavorable weather conditions, for example, by avoiding months that typically have high precipitation rates. Where unfavorable weather conditions occurred these have been investigated during the analysis and noted in this report. To maximize the size of the datasets used in this study no monitoring data have been removed due to unfavorable weather conditions, however, the installation of the S3 station was delayed due to a local thunderstorm.

The following information was recorded in the field during the noise monitoring program:

- descriptions of the monitoring site using pictures;
- time of set up and tear down;
- calibration settings;
- type of surface the meter is placed on;
- observed audible noise sources;
- details of nearby obstacles, where applicable (cannot be closer than 3 m to any surface except the ground);
- global position system (GPS) location;
- serial number of the meter being used; and
- weather conditions at each site at the time of set up, including precipitation and cloud cover.

3.1.1 Monitoring Locations

The first survey was conducted from July 23 to 26, 2012, and the second survey took place from January 22 to 24, 2013. There was no disturbance of the noise monitors by wildlife or humans during either sample period.

Table 3.1-1 provides the UTM locations of the sampling sites. The locations were selected to characterize the range of baseline conditions in the region, based on their proximity to proposed infrastructure and where future mining activities are expected. The time periods were chosen to encompass winter and summer conditions. Monitoring locations are shown in Figure 3.1-1.

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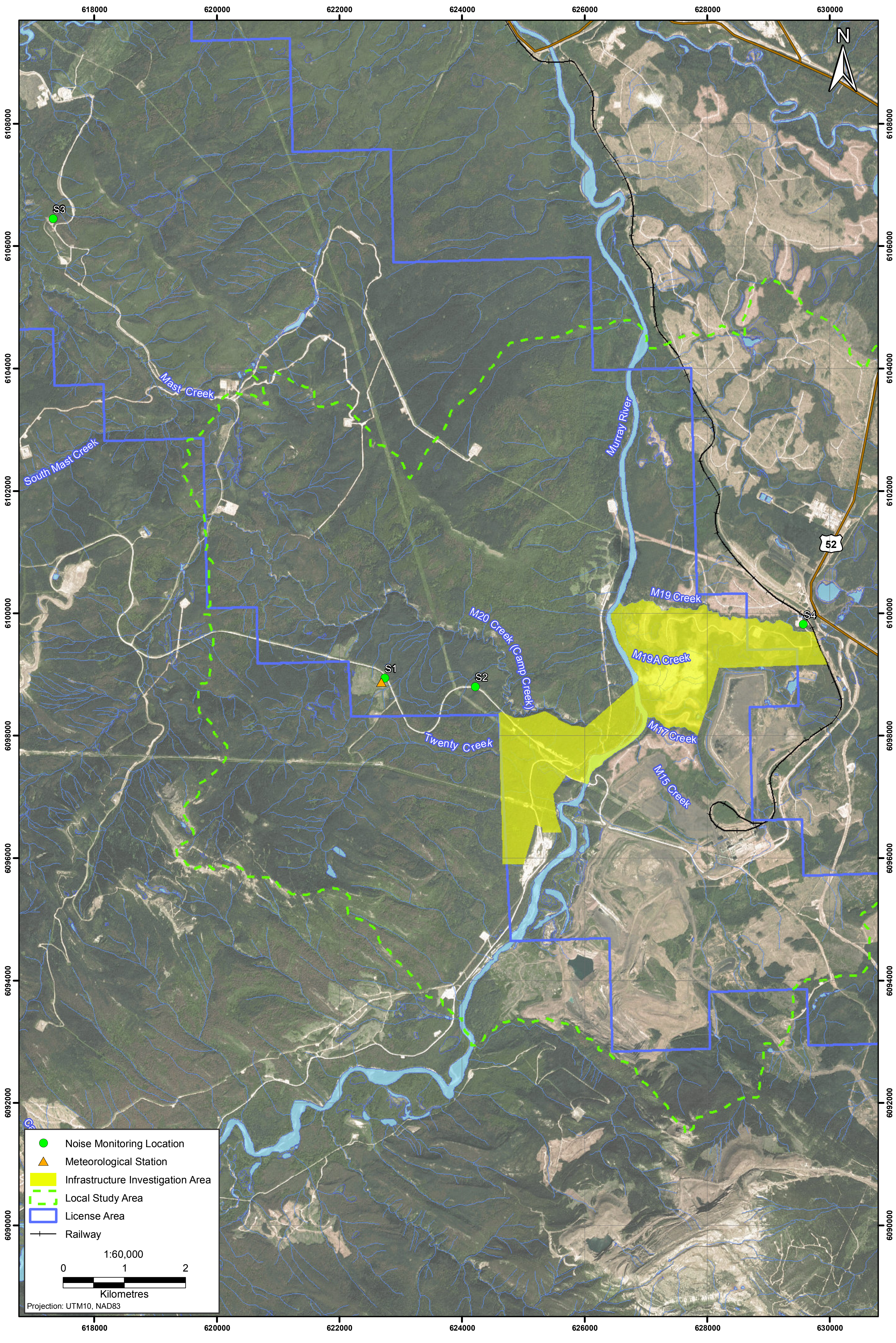


MURRAY RIVER COAL PROJECT

Figure 3.1-1

Noise Monitoring Locations

Figure 3.1-1

Table 3.1-1. Locations of Noise Monitoring Stations

Monitoring Station	UTM Zone	UTM Easting (m)	UTM Northing (m)
S1	10U	622737	6098944
S2	10U	624212	6098803
S3	10U	617323	6106449
S4	10U	629569	6099820

Note: UTM coordinates refer to NAD 83.

3.1.1.1 Station S1

Noise monitoring station S1 was located to the west of the infrastructure investigation area in the vicinity of The Project's automated meteorological station (Figure 3.1-1).

The microphone was set up in a flat open area, with a group of trees approximately 5 m to the north separating the noise monitor from the road, with a berm approximately 20 m to the west. The same location was used during the summer and winter. The station had road access during both monitoring periods (Plates 3.1-1 and 3.1-2).

Plate 3.1-1. Facing north, noise monitoring station S1, July 23, 2012.

Plate 3.1-2. Facing south, noise monitoring station S1, January 22, 2013. The Project meteorological station is in the background circled in red.

During the summer monitoring period, the noise monitor was started on July 23, 2012. In the winter, the station was set up on January 22, 2013. For each monitoring period, the station was collected the following day, after recording for at least 24 hours. No precipitation was recorded during either monitoring period.

3.1.1.2 Station S2

Noise monitoring station S2 was located to the west of the infrastructure investigation area (Figure 3.1-1).

The noise monitor was set up in an open area with a gentle south east slope adjacent to a gravel road. Trees and shrubs were approximately 10 m away to the north and east. The same location was used during the summer and winter monitoring periods (Plates 3.1-3 and 3.1-4). The station had road access during both monitoring periods.

Plate 3.1-3. Facing south east, noise monitoring station S2, July 24, 2012

Plate 3.1-4. Facing north, noise monitoring station S2, January 22, 2013.

During the summer monitoring period, the noise monitor was started on July 24, 2012. In the winter, the station was set up on January 22, 2013. For each monitoring period, the stations were collected the following day, after recording for at least 24 hours. No precipitation was recorded during the winter monitoring period, and 9.4 mm of precipitation was recorded during the summer monitoring period with rain occurring from 11:00 am -12:00 pm and 3:00 pm – 5:15 pm.

3.1.1.3 Station S3

Noise monitoring station S3 was located approximately 4 km north west of the LSA within the License Area (Figure 3.1-1).

The microphone was set up in an open gravel pit adjacent to a secondary gravel road, with the closest group of trees approximately 20 m to the north. There was no activity at the adjacent gravel pit during either monitoring period. The same location was used during the summer and winter monitoring period (Plates 3.1-5 and 3.1-6). The station had road access during both monitoring periods.

Plate 3.1-5. Facing west, noise monitoring station S3, July 25, 2012.

Plate 3.1-6. Facing west, noise monitoring station S3, January 23, 2013.

During the summer monitoring period the noise monitor was started on July 25, 2012. In the winter, the station was set up on January 23, 2013. For each monitoring period, the stations were collected the following day. Only 16 hours of data were collected during the summer period due to local thunderstorms delaying the deployment of the equipment and to technical issues when retrieving the data. No precipitation was recorded at the site meteorological station during either monitoring period; although precipitation was noted in the field sheet for July 2012 and was audible in the sound recording.

3.1.1.4 Station S4

Due to time and equipment availability an additional noise monitoring location was monitored on the east side of Murray River during the winter noise monitoring period. Noise monitoring station S4 was located near the proposed rail loadout area, southwest of Highway 52 (Figure 3.1-1).

The microphone was set up in on flat open area, with trees approximately 50 m to the east and west. A rail line was located approximately 75 m to the north east, but was not used during the monitoring period (Plate 3.1-7).

The station was set up on January 23, 2013. The station was collected the following day after a 24 hour monitoring period elapsed. No precipitation was recorded at the site meteorological station during the monitoring period.

3.2 QA/QC

Noise monitoring site visits were conducted by experienced technicians to ensure proper documentation and field observations. Detailed field notes were recorded during the monitoring period to record the state of the equipment and any audible noises. Once each noise monitoring station was set up, a calibration was performed in accordance to the calibration procedure found in the instrument’s manual. This involved using a separate device that produces reference sounds that are used to calibrate the noise monitor. These calibration results are presented in Appendix 1.

Plate 3.1-7. Facing northeast, noise monitoring station S4, January 23, 2013.

The noise meters were set up and operated to obtain reliable data given the on-site conditions. The noise meters, using a standard configuration, cannot operate reliably at air temperatures below -20°C. Typical battery power for these instruments does not last long (usually less than 24 hours) in extreme cold, so a spare battery was taken into the field to be certain that the sound level meters remained fully operational during the monitoring period. A housing or protection mechanism for the cable wire was used, and the tripod was secured to the ground to help prevent tampering by wildlife. When each monitoring session/period was completed, a preliminary quality check was performed in order to determine if the monitoring needed repeating.

Recorded sound level and audio sound files were downloaded to a computer for analysis with the Brüel & Kjær 7820 Evaluator® software program. The sound recordings were reviewed to identify noise sources, such as technician activities, wind, rain, construction and helicopter noise, and to determine whether unrepresentative data should be removed from the average statistics. Other indicators used to identify sources of noise were time of day and field observations. The analysis of the sound recordings helps to identify and understand apparent anomalies in noise levels and forms an important step in the QA/QC process

4. Results

4. Results

4.1 NOISE MONITORING

Background maximum, minimum, and logarithmic average L_{eq}, L_{max}, L_{min} and L_{90} results of the 24-hour July 2012 and January 2013 monitoring periods are shown in Table 4.1-1. Hourly results can be found in Appendix 2.

Table 4.1-1. 24 Hour Sound Levels, July 2012 and January 2013

		July 2012					January 2013				
		Wind Speed[c] (m/s)	Total Sound Level[a] (dBA)				Wind Speed (m/s)	Total Sound Level[a] (dBA)			
			L_{eq}	L_{max}	L_{min}	L_{90}		L_{eq}	L_{max}	L_{min}	L_{90}
Station S1	Maximum	2.6	47.5	76.1	22.2	24.3	1.0	26.5	51.6	20.5	23.4
	Minimum	0.3	20.5	29.4	18.1	19.1	0.0	18.9	26.3	16.6	17.7
	Logarithmic average[b]	1.3	38.7	67.8	19.9	21.5	0.3	23.8	44.9	18.2	20.4
Station S2	Maximum	2.4	61.7	96.2	29.5	34.2	1.0	31.1	66.1	19.7	21.4
	Minimum	0.5	20.6	37.7	18.5	19.3	0.0	20.1	28.8	17.2	18.3
	Logarithmic average[b]	1.6	48.8	82.6	21.7	24.9	0.3	25.2	56.1	18.4	20.2
Station S3	Maximum	2.6	46.4	77.8	23.0	26.2	4.3	40.8	66.6	32.1	36.1
	Minimum	0.3	22.4	33.3	17.8	19.5	0.1	28.6	38.8	22.5	24.6
	Logarithmic average[b]	1.4	35.4	65.8	20.5	23.1	1.7	36.0	56.4	27.7	31.5
Station S4[d]	Maximum	-	-	-	-	-	4.3	44.3	75.0	32.6	36.8
	Minimum	-	-	-	-	-	0.1	30.8	44.9	18.4	21.6
	Logarithmic average[b]	-	-	-	-	-	1.7	38.9	64.5	26.5	30.4

Notes:
n/a = not available
[a] Values are calculated from hourly data; see Appendix 2 for more details.
[b] Arithmetic mean was used to calculate mean wind speed.
[c] Wind speed data from the Project meteorology station.
[d] Station S4 was only monitored in the January period.

The July 2012 monitoring period had higher L_{eq} values than the January monitoring period, with the exception of station S3 which had a slightly higher average L_{eq}. The higher L_{eq} at S3 could be attributed to increased train activity during the winter monitoring period from the nearby Wolverine mine which is located approximately 7 km southwest of the station S3.

The highest logarithmic average was measured at station S2 during July (61.7 dBA). This is due to the numerous trucks that passed the monitoring location as well as heavy rain and thunder in the last few hours of the monitoring period. As discussed above, these data have not been removed from the calculations.

The L_{eq} values are in the range that would be expected for baseline rural noise levels; approximately 35 dBA during the nighttime and around 45 dBA during the daytime. Higher values, such as at station S2 during July, are due to anthropogenic activity (mostly vehicle traffic) in the study area and occasionally less than ideal weather conditions.

Results from each station are provided below.

4.1.1 Station S1

One-minute L_{eq} sound levels recorded during the two monitoring periods are shown in Figure 4.1-1. Station S1's summer monitoring period started at 5:00 pm on July 23, 2012 and continued until 4:21 pm the following day. The winter monitoring period started at 10:16 am on January 22, 2013 and continued until 10:00 am the following day. General sources of noise observed were aircraft, animals, wind, thunder and numerous road vehicles.

During July, the average L_{eq} sound level was 38.7 dBA. The L_{90} level was lower at 21.5 dBA, this is representative of the low background noise without the anthropogenic noise (trucks and aircraft) as well as the thunder recorded during the monitoring period. The L_{eq} and L_{90} were lower during the January monitoring period (23.8 and 20.4 dBA respectively), due to the significantly decreased road traffic noise and the absence of thunder. Additionally the ground cover was snow which serves to dampen ambient noise levels. The minimum sound levels (L_{min}) were 18.1 and 16.6 dBA in July and January, respectively, and the maximum sound levels (L_{max}) were 76.1 and 51.6 dBA.

4.1.2 Station S2

One-minute L_{eq} sound levels recorded during the two monitoring periods are shown in Figure 4.1-2. Station S2's monitoring period started at 5:35 pm on July 24, 2012 and continued until 5:15 pm the following day. The January monitoring period started at 9:38 am on January 22, 2013 and continued until 9:21 am the following day. General sources of noise observed were aircraft, road traffic, animals, wind, rain and thunder.

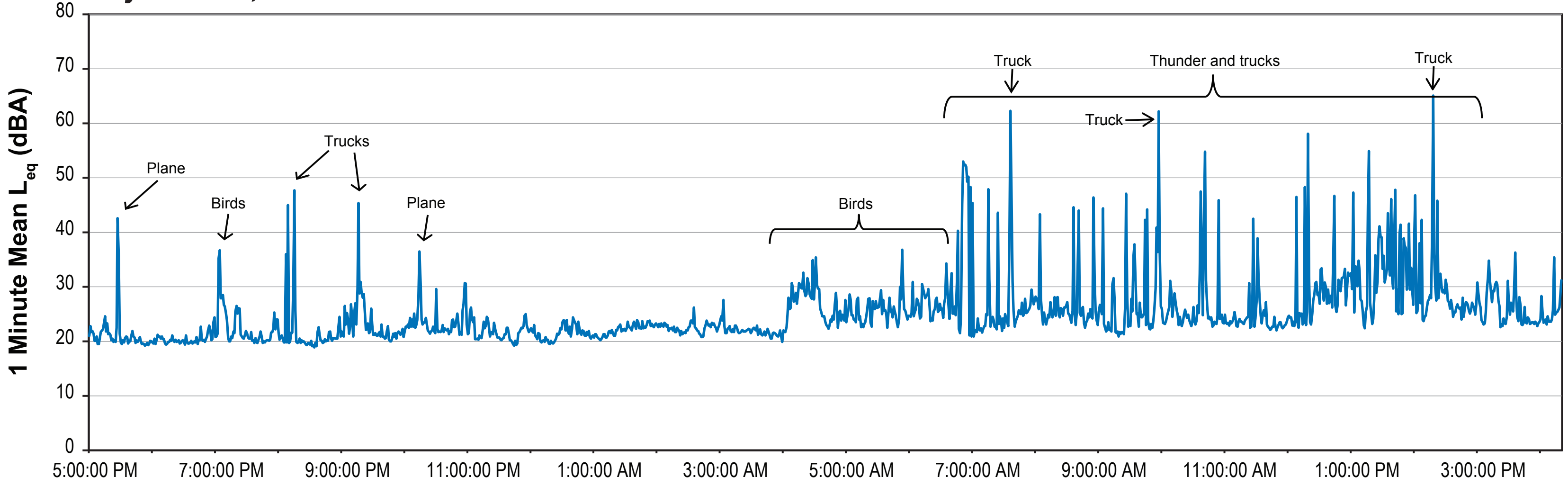
During July, the average L_{eq} sound level was 48.8 dBA, primarily due road vehicles that were active, particularly in the afternoon. The L_{90} was lower at 24.9 dBA, and is representative of the low background noise without the traffic and thunder. The L_{eq} and L_{90} were lower in January (25.2 and 20.2 dBA respectively), due to significantly less traffic noise and lack of thunder and rain. The minimum sound levels (L_{min}) were 18.5 and 17.2 dBA in July and January, respectively, and maximum sound levels (L_{max}) were 96.2 and 66.1 dBA. The high maximum sound levels recorded during the July period were from thunder in close proximity to the noise monitor.

4.1.3 Station S3

One-minute L_{eq} sound levels recorded during the two monitoring periods are shown in Figure 4.1-3. Station S3's summer monitoring period started at 6:22 pm on July 25, and continued until 10:03 am the following day. The summer monitoring period was shorter than the ideal 24 hours due the thunderstorms delaying the deployment of equipment and to technical issues when downloading the data. The winter monitoring period started at 11:50 am on January 23, and continued until 11:34 am the following day. General sources of noise observed were rain, thunder, animals, trains, trucks and planes.

During July, the average L_{eq} sound level was 33.6 dBA, primarily due to aircraft that were audible throughout the day. The L_{90} was lower at 21.4 dBA, and is representative of low background noise levels. The L_{eq} and L_{90} were higher in January (36.0 dBA and 31.5 respectively), due to the increase in mine activity at the nearby Wolverine mine. The minimum sound levels were 17.8 and 22.5 dBA in July and January, respectively, and maximum sound levels were 77.8 and 66.6 dBA.

July 23 to 24, 2012



January 22 to 23, 2013

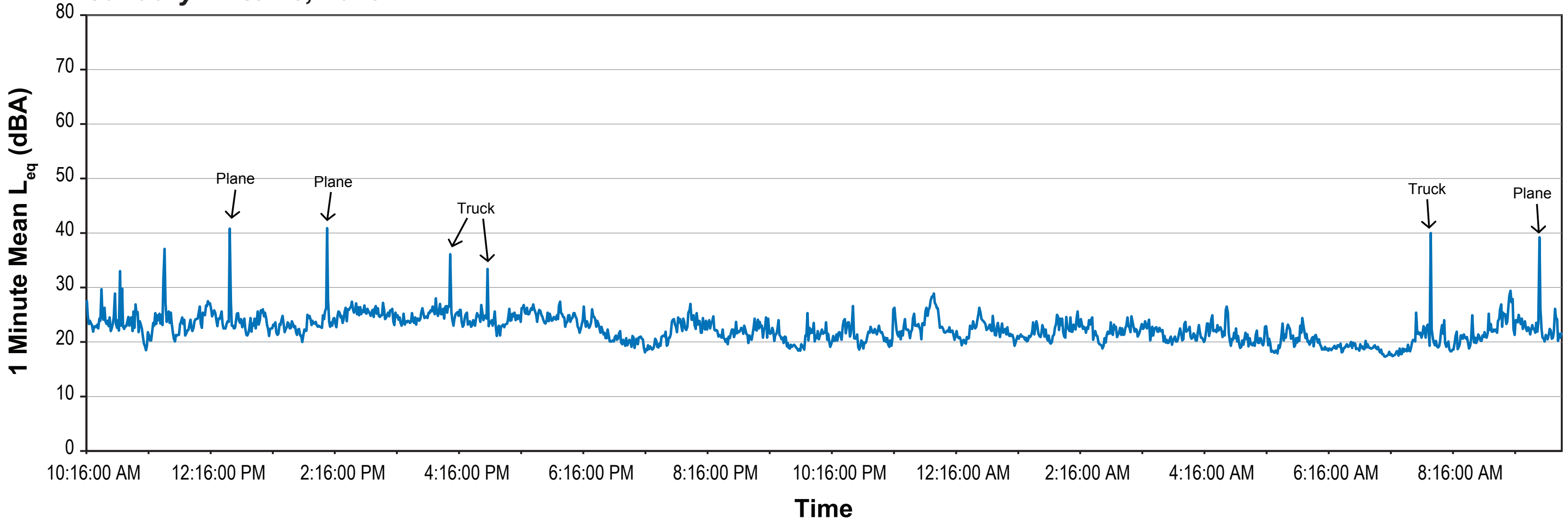


Figure 4.1-1

hd Mining

MURRAY RIVER COAL PROJECT

Murray River Noise Monitoring Station S1, July 2012 and January 2013

Figure 4.1-1

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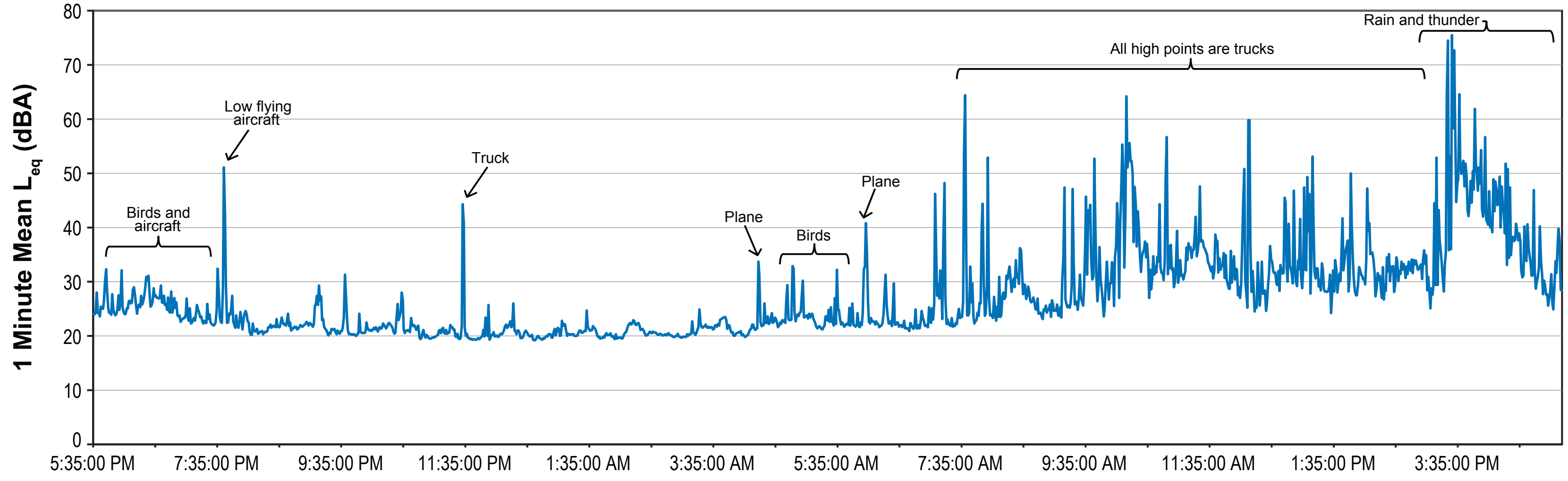
July 24 to 25, 2012



January 22 to 23, 2013

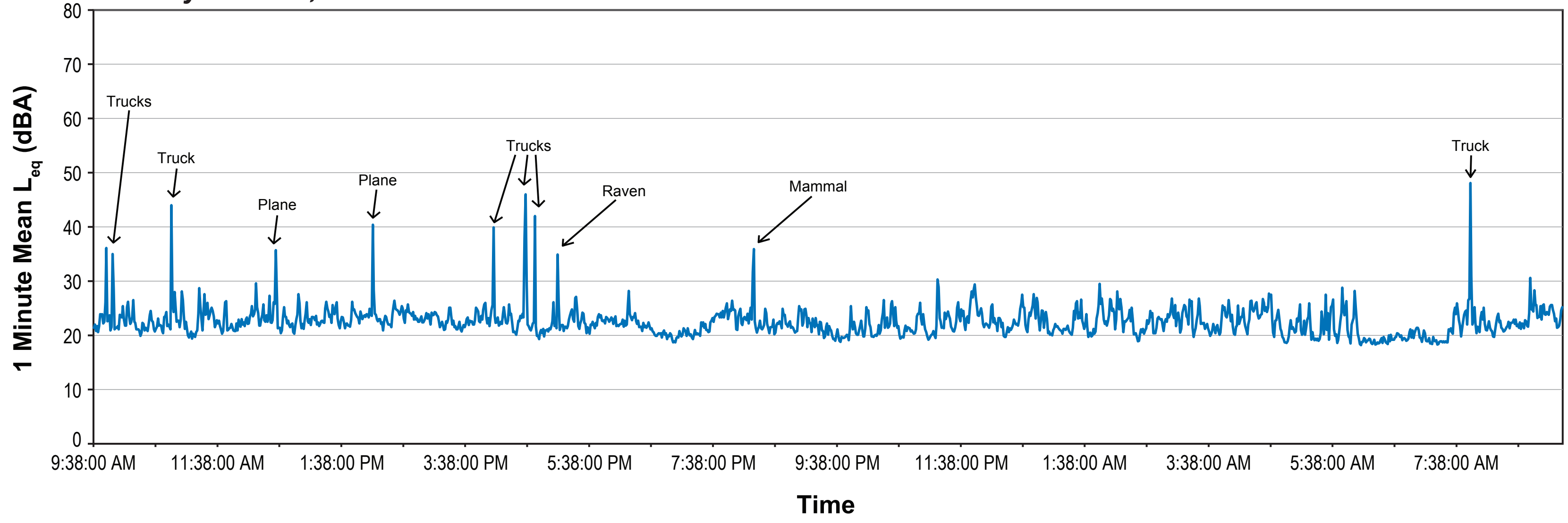


Figure 4.1-2

hd Mining

MURRAY RIVER COAL PROJECT

Murray River Noise Monitoring Station S2,
July 2012 and January 2013

Figure 4.1-2

Rescan™
Engineers & Scientists

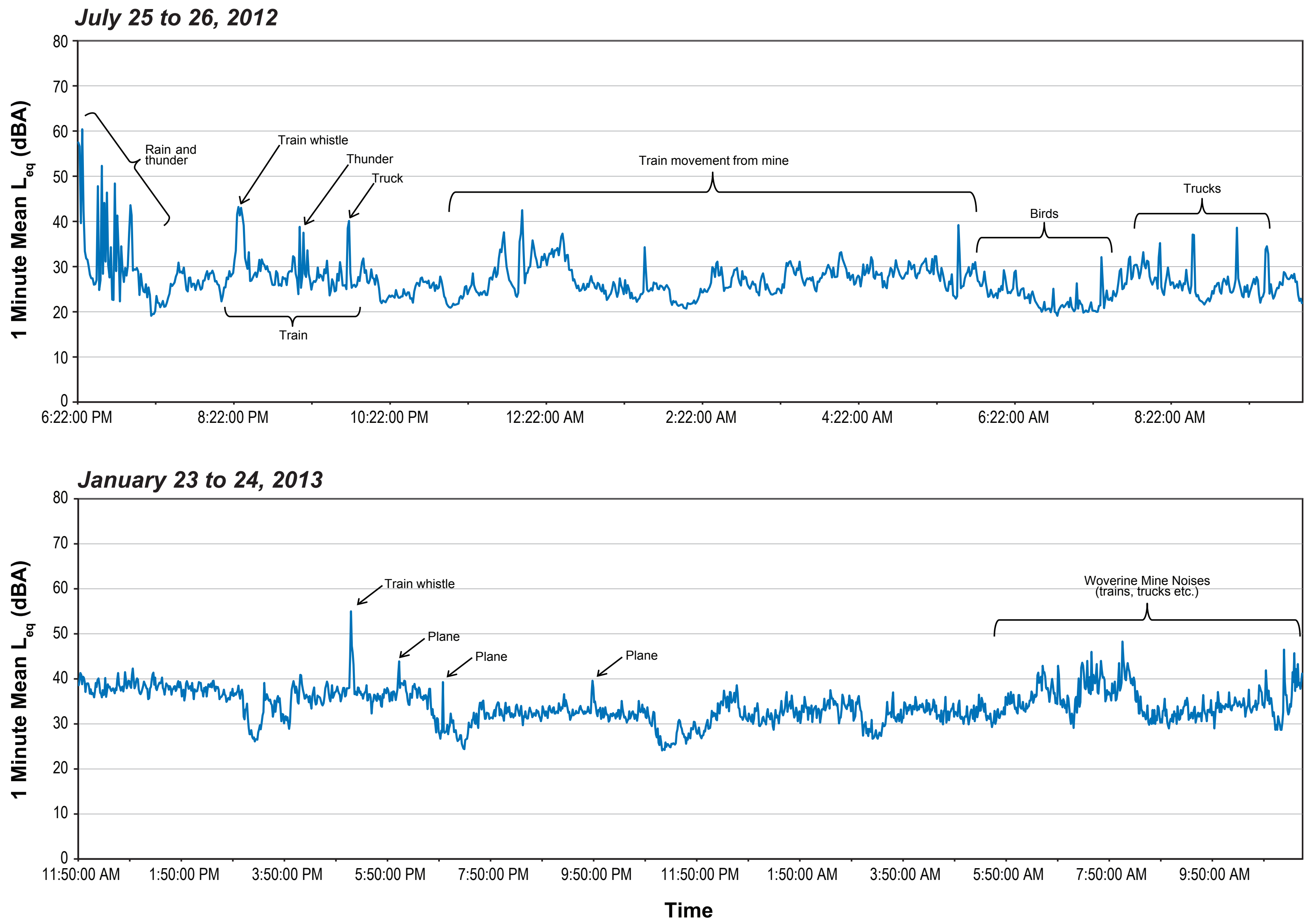


Figure 4.1-3

hd Mining

MURRAY RIVER COAL PROJECT

Murray River Noise Monitoring Station S3, July 2012 and January 2013

Figure 4.1-3

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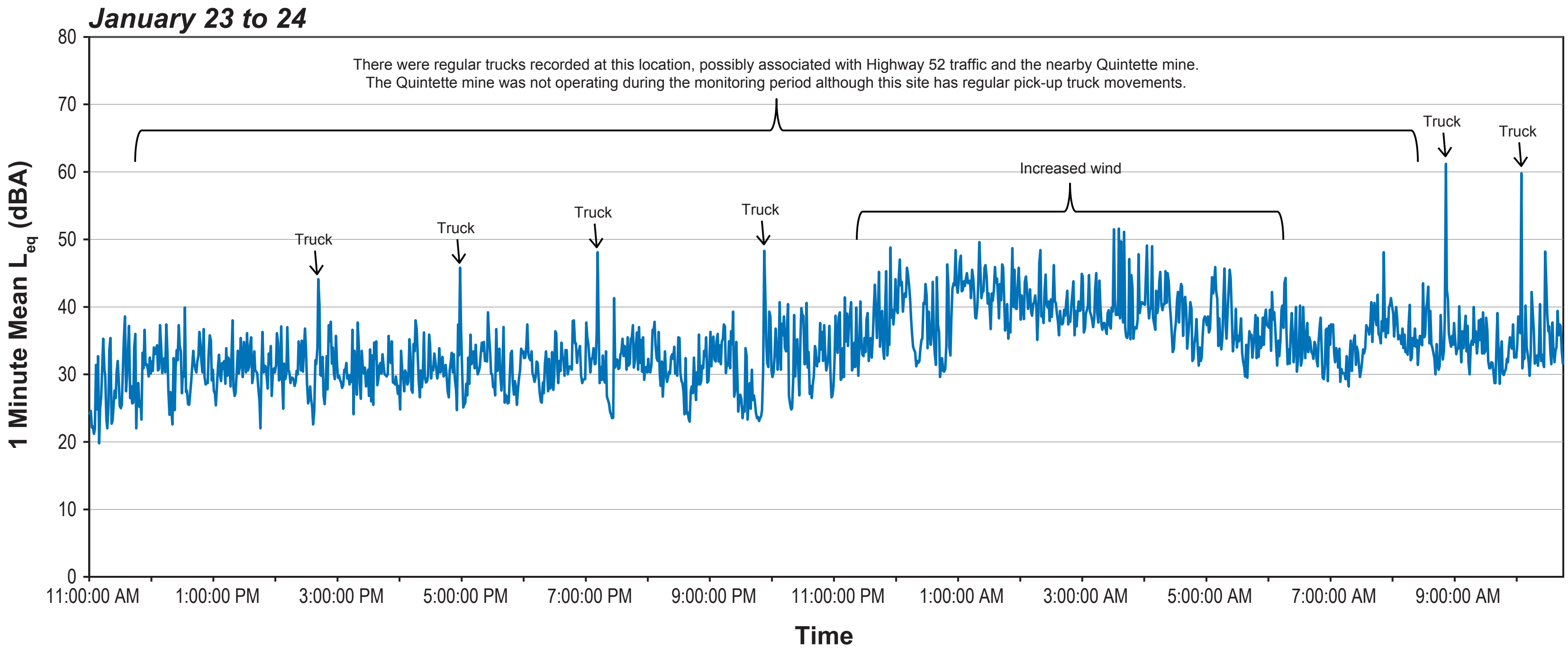
4.1.4 Station S4

Station S4 was only monitored during the winter monitoring period. One-minute L_{eq} sound levels recorded during this period are shown in Figure 4.1-4. Station S4's monitoring period started at 11:00 am on January 23, 2013, and continued until 10:45 am the following day. General sources of noise observed were nearby road traffic and wind.

The average L_{eq} sound level was 38.9 dBA, primarily due to mine haul trucks active on a nearby road, as well as the nearby Highway 52. The L_{90} was lower at 30.4 dBA, which is somewhat representative of the low background noise without the sounds associated with single events, such as traffic and the wind, but may still include some anthropogenic noise sources. The minimum sound level was 18.4 dBA, and the maximum sound level was 75.0 dBA.



MURRAY RIVER COAL PROJECT

hd Mining

Murray River Noise Monitoring Station S4, January 2013

Figure 4.1-4

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5. Summary

5. Summary

Four noise monitoring stations were set up within the study area and monitored during two periods, summer and winter. Noise levels were recorded over a 24 hour period per site in July 2012 and January 2013. The locations were selected to characterize the range of baseline conditions in the region.

Natural background noise sources observed included birds, mammals, wind, rain and thunder. Anthropogenic noise sources that were observed included aircraft, road vehicles, trains and mining activities. From the background data collected at the monitoring station during the two monitoring periods:

- the average noise (L_{eq}) levels that were measured ranged from 23.8 to 48.8 dBA;
- the average noise (L_{90}) levels that were measured ranged from 20.2 to 30.4 dBA;
- the absolute minimum (L_{min}) noise levels ranged from 16.6 to 22.5 dBA; and
- the absolute maximum (L_{max}) noise levels ranged from 51.6 to 96.2 dBA.

The L_{eq} values are in the range that would be expected for baseline rural noise levels; approximately 35 dBA during the nighttime and around 45 dBA during the daytime. Higher values, such as at station S2 during July, are due to anthropogenic activity (mostly vehicle traffic) in the study area and occasionally less than ideal weather conditions.

References

References

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

Alberta EUB. 2007. *Directive 038 – Noise Control*. Calgary, AB: Revised edition. February 16, 2007.

BC Oil and Gas Commission (OGC) 2009 *British Columbia Noise Control Best Practices Guideline*. March 2009

Appendix 1

Noise Field Sheets

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name: Murray River

Project #: 0791-007-16-12

ID (*e.g.* S1): MR Noise 1

UTM Coordinates: 622 737 E 6 098 944 N

UTM Datum: Nad 83

Ground Cover (*e.g.* soil/vegetation type): Snow

Start Date/Time: Jan 22/2013/10:00

Terrain (*e.g.* flat, hills, mountains): Flat

Finish Date/Time: Jan 23/2013/10:am

Weather:

Temperature (°C): -13°C

Cloud Cover (%): 100

Precipitation: ☐ Heavy ☐ Moderate ☐ Mild ☒ None

☐ Snow ☐ Rain ☐ Other

Wind: Speed ☐ Strong ☐ Moderate ☑ Light ☐ None

Direction: from SE

Instrument:

Type: 2250

Serial #: Case 5 2548173

Calibration: ☑ Before ☐ After

Method:

Weighting (*i.e.* A): A

Other Settings: New Sensitivity 50.68mV/Pa
Deviation from last 0.11dB

Response (*i.e.* fast/slow):

Observations: ***Include directions and estimated distances to the instrument in this section***

Audible noise observed: Trucks / Bird / Technicians working on met station

Potential noise sources: Trucks (Traffic on road ~20m) Birds

Obstacles (*e.g.* trees, buildings): ~~None~~ a few trees surrounding w̄ nearby Berm

Notes:

- installed where summer noise monitoring took place
- Near met station

Please be sure to take a few photos of the instrument and the surrounding area (*i.e.* one in each direction) and put them in the project folder with appropriate labels upon return to the office!

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name: Murray River

Project # 0791-007-16.12

ID (*e.g.* S1) MRNOISE2

UTM Coordinates: 624 612 E 6098803 N

UTM Datum 10U NAD83

Ground Cover (*e.g.* soil/vegetation type): Snow Covered

Start Date/Time Jan 22 2013 / 9:30am

Terrain (*e.g.* flat, hills, mountains): Flat

Finish Date/Time Jan 23 2013 / 9:30am

Weather:

Temperature (°C): -13

Cloud Cover (%): 100%

Precipitation: ☐ Heavy ☐ Moderate ☐ Mild ☒ None

☐ Snow ☐ Rain ☐ Other

Wind: Speed ☐ Strong ☐ Moderate ☒ Light ☐ None

Direction From the SE

Instrument:

Type 2250

Serial # Case 6 2566526

Calibration: ☒ Before ☐ After

Method

Weighting (*i.e.* A) A

Other Settings New Sensitivity 46.68mV/Pa

Deviation from last 1.15dB

Response (*i.e.* fast/slow)

Observations: ***Include directions and estimated distances to the instrument in this section***

Audible noise observed Trucks on Road (~20m)

Potential noise sources Trucks / nearby (~1KM) drilling rig / Wind / Birds

Obstacles (*e.g.* trees, buildings) Some trees surrounding instrument

Notes:

- installed where summer noise monitoring took place
-

Please be sure to take a few photos of the instrument and the surrounding area (*i.e.* one in each direction) and put them in the project folder with appropriate labels upon return to the office!

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name Murray River

Project # 0791-007.16.12

ID (*e.g.* S1) MRNoise 3

UTM Coordinates: 617323 E 6106449 N

UTM Datum Nad 83

Ground Cover (*e.g.* soil/vegetation type): Snow

Start Date/Time 11:50 Jan 23/2013

Terrain (*e.g.* flat, hills, mountains): Sloped to North

Finish Date/Time 11:50 Jan 24/2013

Weather:

Temperature (°C): -13°C

Cloud Cover (%): 100

Precipitation: ☐ Heavy ☐ Moderate ☐ Mild ☒ None

☐ Snow ☐ Rain ☐ Other

Wind: Speed ☐ Strong ☐ Moderate ☐ Light ☒ None

Direction

Instrument:

Type 2250

Serial # 2566526

Calibration: ☒ Before ☒ After

Method

Weighting (*i.e.* A) A

Other Settings New Sensitivity 41.24 mV/Pa
Deviation -1.08 dB

Response (*i.e.* fast/slow)

Observations: ***Include directions and estimated distances to the instrument in this section***

Audible noise observed Wolverine Mine ~15 km

Potential noise sources Road / Mine

Obstacles (*e.g.* trees, buildings)

Notes: At summer monitoring location

Please be sure to take a few photos of the instrument and the surrounding area (*i.e.* one in each direction) and put them in the project folder with appropriate labels upon return to the office!

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name Murray River

Project # 0791-007-16.12

ID (*e.g.* S1) MRNoise 4

UTM Coordinates: 629569 E 6099820 N

UTM Datum 10 U Nad 83

Ground Cover (*e.g.* soil/vegetation type): Snow

Start Date/Time 10:50/Jan 23/2013

Terrain (*e.g.* flat, hills, mountains): ~~gravelpit sloped~~ Flat

Finish Date/Time 10:50/Jan 24/2013

Weather:

Temperature (°C): -13°C

Cloud Cover (%): 100

Precipitation: ☐ Heavy ☐ Moderate ☐ Mild ☒ None

☐ Snow ☐ Rain ☐ Other

Wind: Speed ☐ Strong ☐ Moderate ☐ Light ☒ None

Direction

Instrument:

Type 2250

Serial # Monitor 5 S/N 2548173

Calibration: ☑ Before ☑ After

Method

Weighting (*i.e.* A) A

Other Settings New Sensitivity 48.98 mV/Pa

Deviation -0.30 db

Response (*i.e.* fast/slow)

Observations: ***Include directions and estimated distances to the instrument in this section***

Audible noise observed Trucks (Haulroad nearby) ~100m

Road Traffic (~200m)

Potential noise sources Trains / Haul trucks / gas plant

Obstacles (*e.g.* trees, buildings) Train / Trees

Notes: In a new location near CCR

Please be sure to take a few photos of the instrument and the surrounding area (*i.e.* one in each direction) and put them in the project folder with appropriate labels upon return to the office!

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name: Murray River

Project #: 791-002-03-02

ID (*e.g.* S1): Murray1001 / S1

elev 1065m

UTM Coordinates: 0622 737 E 6 0~~[illegible]~~98 944 N

UTM Datum: 10 U

Ground Cover (*e.g.* soil/vegetation type): Open staging area w/ 5-10m trees + shrubs arond.

Start Date/Time: 07-23-12 1615

Terrain (*e.g.* flat, hills, mountains): Gentle SE slope, 10m from logging road

Finish Date/Time: 08-24-12 1621

Weather:

Temperature (°C): 26

Cloud Cover (%): 40

Precipitation: ☐ Heavy ☐ Moderate ☐ Mild ☑ None

☐ Snow ☐ Rain ☐ Other

Wind: Speed ☐ Strong ☐ Moderate ☑ Light ☐ None

Direction: NW

Instrument:

Type: B&K 2250

Serial #: 2 575 763

Calibration: ☑ Before ☐ After

Method: using calibrator 4321 provided by XScala

Broadband AC
" Peak C
Spectrum Z

Weighting (*i.e.* A)

Other Settings: New sensitivity 48.42 mV/Pa

Response (*i.e.* fast/slow): Fast

Deviation from last 0.00 dB

Observations: ***Include directions and estimated distances to the instrument in this section***

Audible noise observed: Logging road w/ truck traffic ~10m away

Insects, birds, breeze, TBRG wind screen ~50m away

trees + leaves russeling

Potential noise sources

Obstacles (*e.g.* trees, buildings)

Notes:

Please be sure to take a few photos of the instrument and the surrounding area (*i.e.* one in each direction) and put them in the project folder with appropriate labels upon return to the office!

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name: Murray River

Project #: 791-002-03-02

ID (*e.g.* S1): Murray 2001 / S2

elev. 913m

UTM Coordinates: 0624 212 E 6 098 803 N

UTM Datum: 10 U

Ground Cover (*e.g.* soil/vegetation type): 30-50cm wild grass

Start Date/Time: 07-24-12 1715

Terrain (*e.g.* flat, hills, mountains): flat bench b/t road & forest

Finish Date/Time: 07-25-12 1720

Weather:

adjacent trees 15-20m

Temperature (°C): 24

Cloud Cover (%): 60

Precipitation: ☐ Heavy ☐ Moderate ☐ Mild ☑ None
☐ Snow ☐ Rain ☐ Other ____________

Wind: Speed ☐ Strong ☐ Moderate ☑ Light ☐ None

Direction: variable

Instrument:

Type: B&K 2250

Serial #: Z 575 763

Calibration: ☑ Before ☐ After

Method: 4321 Calibrator

Weighting (*i.e.* A): AC, C, Z

Other Settings: New Sensitivity 48.51 mV/Pa
Deviation from last 0.02dB

Response (*i.e.* fast/slow): fast

Observations: ***Include directions and estimated distances to the instrument in this section***

Audible noise observed: Bird, insects, trees rustling in the wind

Potential noise sources: Site adjacent to primary logging road w/ truck & gratter traffic

Obstacles (*e.g.* trees, buildings): ____________

Notes:

****Please be sure to take a few photos of the instrument and the surrounding area (*i.e.* one in each direction) and put them in the project folder with appropriate labels upon return to the office!****

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name: Murray River

Project #: 791-002-03-02

ID (*e.g.* S1): Murray 3001 / S3

UTM Coordinates: 617 323.66 E 6 106 449.59 N

UTM Datum: 10 U

Ground Cover (*e.g.* soil/vegetation type): Shale rock

Start Date/Time: 07-25-12 1822

Terrain (*e.g.* flat, hills, mountains): Open gravel pit adjacent to secondary logging road

Finish Date/Time: 07-26-12 1003

Weather:

Temperature (°C): 23

Cloud Cover (%): 100

Precipitation: ☐ Heavy ☐ Moderate ☑ Mild ☐ None

☐ Snow ☑ Rain ☐ Other Thunder + lightning

Wind: Speed ☐ Strong ☑ Moderate ☐ Light ☐ None

Direction: NE

Instrument:

Type: B&K 2250

Serial #: 2 575 763

Calibration: ☑ Before ☐ After

Method: 4321 Calibrator

Weighting (*i.e.* A): AC, C, Z

Other Settings: New sensitivity 48.36 mV/Pa

Response (*i.e.* fast/slow): fast

Deviation from last -0.03 dB

Observations: ***Include directions and estimated distances to the instrument in this section***

Audible noise observed: Numerous thunder, birds

Potential noise sources: Secondary logging road may see vehicular traffic

Obstacles (*e.g.* trees, buildings):

Notes:

Please be sure to take a few photos of the instrument and the surrounding area (*i.e.* one in each direction) and put them in the project folder with appropriate labels upon return to the office!

Appendix 2

Noise Monitoring Hourly Results

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Appendix 2. Noise Monitoring Hourly Results — Hourly Sound Levels, Station S1, July 2012

Date	Start Time	End Time	Wind Speed (m/s)[a]	Wind Direction (degrees from true north) [a]	Sound Level (dBA)			
					L_{eq}	L_{max}	L_{min}	L_{90}
7/23/2012	5:00:02 PM	6:00:02 PM	0.3	205.5	26.8	56.2	18.4	19.2
7/23/2012	6:00:02 PM	7:00:02 PM	0.6	332.6	20.5	34.6	18.4	19.2
7/23/2012	7:00:02 PM	8:00:02 PM	0.7	108.6	25.1	48.7	18.6	19.6
7/23/2012	8:00:02 PM	9:00:02 PM	0.8	258.5	32.3	60.0	18.1	19.1
7/23/2012	9:00:02 PM	10:00:02 PM	0.9	257.3	29.2	56.4	19.0	20.4
7/23/2012	10:00:02 PM	11:00:02 PM	1.4	245.9	25.3	44.9	19.9	21.3
7/23/2012	11:00:02 PM	12:00:02 AM	2.0	238.9	22.1	35.4	18.3	19.8
7/24/2012	12:00:02 AM	1:00:02 AM	1.3	277.6	21.7	29.4	18.5	19.7
7/24/2012	1:00:02 AM	2:00:02 AM	1.6	232.0	22.3	29.4	19.6	20.6
7/24/2012	2:00:02 AM	3:00:02 AM	1.1	224.1	22.6	39.7	19.6	21.2
7/24/2012	3:00:02 AM	4:00:02 AM	1.3	237.9	22.1	50.7	19.1	20.8
7/24/2012	4:00:02 AM	5:00:02 AM	1.1	219.7	28.2	56.4	19.3	21.2
7/24/2012	5:00:02 AM	6:00:02 AM	1.0	237.8	26.7	56.6	19.8	21.6
7/24/2012	6:00:02 AM	7:00:02 AM	0.8	274.5	42.4	67.6	18.9	20.8
7/24/2012	7:00:02 AM	8:00:02 AM	0.4	57.3	45.0	75.1	19.6	21.2
7/24/2012	8:00:02 AM	9:00:02 AM	1.0	95.9	33.8	60.7	20.8	22.4
7/24/2012	9:00:02 AM	10:00:02 AM	0.8	87.1	44.8	72.7	20.1	21.3
7/24/2012	10:00:02 AM	11:00:02 AM	1.6	21.9	38.6	66.6	21.2	22.4
7/24/2012	11:00:02 AM	12:00:02 PM	1.5	56.6	28.4	55.6	20.9	22.0
7/24/2012	12:00:02 PM	1:00:02 PM	2.1	312.0	41.5	76.1	21.0	22.6
7/24/2012	1:00:02 PM	2:00:02 PM	2.6	312.7	40.5	67.1	20.8	24.3
7/24/2012	2:00:02 PM	3:00:02 PM	2.2	358.5	47.5	75.2	22.2	24.3
7/24/2012	3:00:02 PM	4:00:02 PM	2.4	25.6	27.6	49.1	21.1	22.6
7/24/2012	4:00:02 PM	4:21:21 PM	1.7	139.3	27.1	47.9	21.5	22.7
Maximum			***2.6***		***47.5***	***76.1***	***22.2***	***24.3***
Minimum			***0.3***		***20.5***	***29.4***	***18.1***	***19.1***
Logarithmic average[b]			***1.3***		***38.7***	***67.8***	***19.9***	***21.5***

[a] Wind speed and direction data from The Project meteorology station.

[b] Arithmetic mean was used to calculate mean wind speed and direction.

'-' indicates data missing

Appendix 2. Noise Monitoring Hourly Results — Hourly Sound Levels, Station S2, July 2012

Date	Start Time	End Time	Wind Speed (m/s) [a]	Wind Direction (degrees from true north) [a]	Sound Level (dBA)			
					L_{eq}	L_{max}	L_{min}	L_{90}
7/24/2012	5:35:01 PM	6:35:00 PM	1.5	248.0	26.9	48.6	21.6	23.4
7/24/2012	6:35:00 PM	7:35:00 PM	1.7	250.8	24.9	39.7	20.8	22.0
7/24/2012	7:35:00 PM	8:35:00 PM	0.7	286.7	34.2	62.3	19.5	20.4
7/24/2012	8:35:00 PM	9:35:00 PM	1.7	265.6	22.8	37.7	19.5	20.5
7/24/2012	9:35:00 PM	10:35:00 PM	2.1	280.1	22.6	48.0	19.4	20.2
7/24/2012	10:35:00 PM	11:35:00 PM	2.0	255.3	28.9	58.2	18.7	19.5
7/24/2012	11:35:00 PM	12:35:00 AM	2.3	274.7	20.8	50.6	18.7	19.3
7/25/2012	12:35:00 AM	1:35:00 AM	2.4	275.6	20.6	46.5	18.5	19.4
7/25/2012	1:35:00 AM	2:35:00 AM	2.3	266.6	20.8	40.0	18.8	19.5
7/25/2012	2:35:00 AM	3:35:00 AM	1.8	272.0	20.8	39.2	19.1	19.8
7/25/2012	3:35:00 AM	4:35:00 AM	1.8	270.9	23.2	40.7	19.2	20.1
7/25/2012	4:35:00 AM	5:35:00 AM	1.8	274.2	24.7	51.6	20.2	21.4
7/25/2012	5:35:00 AM	6:35:00 AM	1.2	244.4	27.5	49.7	20.1	21.3
7/25/2012	6:35:00 AM	7:35:00 AM	0.7	260.3	33.4	60.0	20.0	21.1
7/25/2012	7:35:00 AM	8:35:00 AM	0.6	85.9	47.4	72.5	20.9	22.6
7/25/2012	8:35:00 AM	9:35:00 AM	0.5	74.0	33.5	62.5	21.1	23.0
7/25/2012	9:35:00 AM	10:35:00 AM	1.5	80.5	49.1	73.0	21.8	26.2
7/25/2012	10:35:00 AM	11:35:00 AM	2.1	337.7	41.2	67.6	22.8	27.8
7/25/2012	11:35:00 AM	12:35:00 PM	1.9	340.5	45.6	71.7	21.0	24.5
7/25/2012	12:35:00 PM	1:35:00 PM	1.3	111.6	40.1	66.0	21.8	25.3
7/25/2012	1:35:00 PM	2:35:00 PM	1.6	318.1	36.9	65.5	22.2	25.9
7/25/2012	2:35:00 PM	3:35:00 PM	1.7	1.2	61.7	96.2	22.3	26.7
7/25/2012	3:35:00 PM	4:35:00 PM	2.0	5.3	51.3	82.1	29.5	34.2
7/25/2012	4:35:00 PM	5:15:00 PM	2.0	201.4	36.0	60.5	21.5	25.2
Maximum			***2.4***		***61.7***	***96.2***	***29.5***	***34.2***
Minimum			***0.5***		***20.6***	***37.7***	***18.5***	***19.3***
Logarithmic average[b]			***1.6***		***48.8***	***82.6***	***21.7***	***24.9***

[a] Wind speed and direction data from The Project meteorology station.
[b] Arithmetic mean was used to calculate mean wind speed and direction.
'-' indicates data missing

Appendix 2. Noise Monitoring Hourly Results — Hourly Sound Levels, Station S3, July 2012

Date	Start Time	End Time	Wind Speed (m/s) [a]	Wind Direction (degrees from true north) [a]	Sound Level (dBA)			
					L_{eq}	L_{max}	L_{min}	L_{90}
7/25/2012	6:22:48 PM	7:22:48 PM	1.7	248.0	46.4	77.8	18.3	20.2
7/25/2012	7:22:48 PM	8:22:48 PM	2.6	250.8	26.7	37.8	19.3	21.9
7/25/2012	8:22:48 PM	9:22:48 PM	1.5	286.7	33.9	56.6	22.0	25.2
7/25/2012	9:22:48 PM	10:22:48 PM	2.1	265.6	29.0	45.0	20.4	22.8
7/25/2012	10:22:48 PM	11:22:48 PM	2.0	280.1	24.6	33.3	19.9	21.5
7/25/2012	11:22:48 PM	12:22:48 AM	1.1	255.3	31.5	46.8	21.1	23.9
7/26/2012	12:22:48 AM	1:22:48 AM	1.6	274.7	29.8	41.3	21.0	23.6
7/26/2012	1:22:48 AM	2:22:48 AM	1.4	275.6	24.7	43.9	19.3	21.3
7/26/2012	2:22:48 AM	3:22:48 AM	1.9	266.6	26.8	39.3	21.8	23.9
7/26/2012	3:22:48 AM	4:22:48 AM	1.2	272.0	28.8	39.4	21.9	25.3
7/26/2012	4:22:48 AM	5:22:48 AM	1.1	270.9	29.3	42.8	23.0	26.2
7/26/2012	5:22:48 AM	6:22:48 AM	1.6	274.2	28.0	46.8	20.7	23.1
7/26/2012	6:22:48 AM	7:22:48 AM	0.3	244.4	22.4	43.9	17.8	19.5
7/26/2012	7:22:48 AM	8:22:48 AM	0.7	260.3	28.1	43.2	18.2	20.5
7/26/2012	8:22:48 AM	9:22:48 AM	0.7	85.9	27.8	47.7	19.6	22.3
7/26/2012	9:22:48 AM	10:03:11 AM	1.0	74.0	27.4	41.5	20.4	22.5
Maximum			***2.6***		***46.4***	***77.8***	***23.0***	***26.2***
Minimum			***0.3***		***22.4***	***33.3***	***17.8***	***19.5***
Logarithmic average[b]			***1.4***		***33.6***	***64.1***	***18.8***	***21.4***

[a] *Wind speed and direction data from The Project meteorology station.*

[b] *Arithmetic mean was used to calculate mean wind speed and direction.*

'-' indicates data missing

Appendix 2. Noise Monitoring Hourly Results — Hourly Sound Levels, Station S1, January 2013

Date	Start Time	End Time	Wind Speed (m/s) [a]	Wind Direction (degrees from true north) [a]	Sound Level (dBA)			
					L_{eq}	L_{max}	L_{min}	L_{90}
1/22/2013	10:16:00 AM	11:16:00 AM	0.1	150.8	24.6	48.0	17.5	21.0
1/22/2013	11:16:00 AM	12:16:00 PM	-	-	25.5	49.8	18.3	20.8
1/22/2013	12:16:00 PM	1:16:00 PM	0.3	94.5	26.5	50.5	18.9	21.6
1/22/2013	1:16:00 PM	2:16:00 PM	0.8	95.0	26.2	51.6	18.6	21.1
1/22/2013	2:16:00 PM	3:16:00 PM	0.8	95.6	25.4	36.4	20.5	23.4
1/22/2013	3:16:00 PM	4:16:00 PM	1.0	98.5	25.8	46.6	20.1	22.9
1/22/2013	4:16:00 PM	5:16:00 PM	0.6	75.6	24.6	45.6	19.1	22.2
1/22/2013	5:16:00 PM	6:16:00 PM	0.2	55.0	24.9	31.7	19.9	22.8
1/22/2013	6:16:00 PM	7:16:00 PM	0.1	70.9	21.8	34.3	17.2	19.0
1/22/2013	7:16:00 PM	8:16:00 PM	0.3	65.6	22.5	33.6	17.4	18.8
1/22/2013	8:16:00 PM	9:16:00 PM	0.1	56.5	22.2	35.4	17.7	19.8
1/22/2013	9:16:00 PM	10:16:00 PM	0.0	46.7	21.0	32.6	17.3	18.5
1/22/2013	10:16:00 PM	11:16:00 PM	0.2	45.7	21.7	36.6	17.4	19.2
1/22/2013	11:16:00 PM	12:16:00 AM	0.3	41.3	24.0	38.3	18.3	20.5
1/23/2013	12:16:00 AM	1:16:00 AM	0.2	80.1	22.4	33.5	17.5	19.7
1/23/2013	1:16:00 AM	2:16:00 AM	0.0	49.8	22.3	35.7	17.8	19.9
1/23/2013	2:16:00 AM	3:16:00 AM	-	-	22.2	31.0	17.6	19.6
1/23/2013	3:16:00 AM	4:16:00 AM	0.0	54.4	21.7	33.7	17.9	19.7
1/23/2013	4:16:00 AM	5:16:00 AM	-	-	21.7	34.8	17.6	19.0
1/23/2013	5:16:00 AM	6:16:00 AM	-	-	20.6	34.2	17.0	18.2
1/23/2013	6:16:00 AM	7:16:00 AM	-	-	18.9	26.3	16.6	17.7
1/23/2013	7:16:00 AM	8:16:00 AM	-	-	24.4	50.4	16.7	17.7
1/23/2013	8:16:00 AM	9:16:00 AM	-	-	23.1	43.7	17.3	19.1
1/23/2013	9:16:00 AM	10:00:00 AM	-	-	25.8	47.8	18.5	20.3
Maximum			***1.0***		***26.5***	***51.6***	***20.5***	***23.4***
Minimum			***0.0***		***18.9***	***26.3***	***16.6***	***17.7***
Logarithmic average [b]			***0.3***		***23.8***	***44.9***	***18.2***	***20.4***

[a] *Wind speed and direction data from The Project meteorology station.*

[b] *Arithmetic mean was used to calculate mean wind speed and direction.*

'-' indicates data missing

Appendix 2. Noise Monitoring Hourly Results — Hourly Sound Levels, Station S2, January 2013

Date	Start Time	End Time	Wind Speed (m/s) [a]	Wind Direction (degrees from true north) [a]	Sound Level (dBA)			
					L_{eq}	L_{max}	L_{min}	L_{90}
1/22/2013	9:38:00 AM	10:38:00 AM	0.141	150.8	24.9	55.8	18.6	20.4
1/22/2013	10:38:00 AM	11:38:00 AM	-	-	28.1	66.1	18.1	20.1
1/22/2013	11:38:00 AM	12:38:00 PM	0.285	94.5	24.6	46.4	18.9	20.7
1/22/2013	12:38:00 PM	1:38:00 PM	0.772	95	23.3	34.0	19.0	20.9
1/22/2013	1:38:00 PM	2:38:00 PM	0.839	95.6	26.2	49.3	19.7	21.4
1/22/2013	2:38:00 PM	3:38:00 PM	1.028	98.5	23.1	35.6	19.3	21.0
1/22/2013	3:38:00 PM	4:38:00 PM	0.609	75.55	30.6	65.8	18.7	21.1
1/22/2013	4:38:00 PM	5:38:00 PM	0.184	54.97	26.8	54.9	18.2	20.1
1/22/2013	5:38:00 PM	6:38:00 PM	0.072	70.88	22.7	37.3	18.9	21.0
1/22/2013	6:38:00 PM	7:38:00 PM	0.33	65.63	20.6	28.8	17.7	19.1
1/22/2013	7:38:00 PM	8:38:00 PM	0.14	56.48	24.7	48.9	18.8	20.8
1/22/2013	8:38:00 PM	9:38:00 PM	0.037	46.68	22.2	31.4	18.1	19.6
1/22/2013	9:38:00 PM	10:38:00 PM	0.177	45.66	22.0	36.5	17.8	19.2
1/22/2013	10:38:00 PM	11:38:00 PM	0.299	41.34	22.7	44.4	18.1	19.6
1/22/2013	11:38:00 PM	12:38:00 AM	0.191	80.1	23.8	36.0	18.4	20.5
1/23/2013	12:38:00 AM	1:38:00 AM	0.043	49.82	23.1	36.6	18.6	20.0
1/23/2013	1:38:00 AM	2:38:00 AM	-	-	23.4	38.1	17.8	19.6
1/23/2013	2:38:00 AM	3:38:00 AM	0.01	54.4	23.4	34.4	18.2	20.3
1/23/2013	3:38:00 AM	4:38:00 AM	-	-	23.8	36.4	18.6	20.1
1/23/2013	4:38:00 AM	5:38:00 AM	-	-	22.3	36.3	17.5	18.9
1/23/2013	5:38:00 AM	6:38:00 AM	-	-	21.5	34.2	17.4	18.3
1/23/2013	6:38:00 AM	7:38:00 AM	-	-	20.1	32.9	17.2	18.5
1/23/2013	7:38:00 AM	8:38:00 AM	-	-	31.1	59.7	18.0	19.8
1/23/2013	8:38:00 AM	9:21:00 AM	0	110.4	24.3	50.3	19.6	21.3
Maximum			***1.0***		***31.1***	***66.1***	***19.7***	***21.4***
Minimum			***0.0***		***20.1***	***28.8***	***17.2***	***18.3***
Logarithmic average[b]			***0.3***		***25.2***	***56.1***	***18.4***	***20.2***

[a] *Wind speed and direction data from The Project meteorology station.*

[b] *Arithmetic mean was used to calculate mean wind speed and direction.*

'-' indicates data missing

Appendix 2. Noise Monitoring Hourly Results — Hourly Sound Levels, Station S3, January 2013

Date	Start Time	End Time	Wind Speed (m/s) [a]	Wind Direction (degrees from true north) [a]	Sound Level (dBA)			
					L_{eq}	L_{max}	L_{min}	L_{90}
1/23/2013	11:50:00 AM	12:50:00 PM	-	-	38.5	46.6	31.9	35.7
1/23/2013	12:50:00 PM	1:50:00 PM	-	-	38.7	48.7	32.1	36.1
1/23/2013	1:50:00 PM	2:50:00 PM	-	-	37.6	46.5	31.5	35.0
1/23/2013	2:50:00 PM	3:50:00 PM	-	-	34.1	46.1	24.4	27.1
1/23/2013	3:50:00 PM	4:50:00 PM	-	-	36.6	46.7	27.0	31.8
1/23/2013	4:50:00 PM	5:50:00 PM	-	-	40.8	66.6	30.4	34.3
1/23/2013	5:50:00 PM	6:50:00 PM	-	-	36.9	50.6	25.1	31.4
1/23/2013	6:50:00 PM	7:50:00 PM	0.2	112.9	30.8	51.5	22.7	26.0
1/23/2013	7:50:00 PM	8:50:00 PM	-	-	32.5	41.3	27.2	30.3
1/23/2013	8:50:00 PM	9:50:00 PM	0.1	193.4	33.6	45.7	28.3	31.2
1/23/2013	9:50:00 PM	10:50:00 PM	0.4	262.0	32.5	44.3	27.4	30.3
1/23/2013	10:50:00 PM	11:50:00 PM	0.8	263.0	28.6	38.8	22.5	24.6
1/23/2013	11:50:00 PM	12:50:00 AM	0.2	271.2	33.4	45.0	24.6	27.8
1/24/2013	12:50:00 AM	1:50:00 AM	0.8	242.1	32.6	46.6	26.1	29.3
1/24/2013	1:50:00 AM	2:50:00 AM	0.5	356.6	33.9	44.3	27.3	30.5
1/24/2013	2:50:00 AM	3:50:00 AM	0.3	227.9	31.7	53.9	24.1	26.7
1/24/2013	3:50:00 AM	4:50:00 AM	1.6	212.0	33.4	41.6	26.9	30.4
1/24/2013	4:50:00 AM	5:50:00 AM	0.4	272.0	32.6	43.5	26.3	29.5
1/24/2013	5:50:00 AM	6:50:00 AM	2.5	217.5	37.1	59.2	29.0	32.4
1/24/2013	6:50:00 AM	7:50:00 AM	4.0	208.5	39.1	61.8	27.4	31.7
1/24/2013	7:50:00 AM	8:50:00 AM	4.3	204.6	38.4	61.4	25.2	30.1
1/24/2013	8:50:00 AM	9:50:00 AM	3.8	209.2	32.6	54.3	26.4	29.4
1/24/2013	9:50:00 AM	10:50:00 AM	2.8	218.0	34.6	51.6	26.4	31.6
1/24/2013	10:50:00 AM	11:34:00 AM	3.8	219.9	38.0	58.6	25.3	29.0
Maximum			***4.3***		***40.8***	***66.6***	***32.1***	***36.1***
Minimum			***0.1***		***28.6***	***38.8***	***22.5***	***24.6***
Logarithmic average[b]			***1.7***		***36.0***	***56.4***	***27.7***	***31.5***

[a] Wind speed and direction data from The Project meteorology station.

[b] Arithmetic mean was used to calculate mean wind speed and direction.

'-' indicates data missing

Appendix 2. Noise Monitoring Hourly Results — Hourly Sound Levels, Station S4, January 2013

Date	Start Time	End Time	Wind Speed (m/s) [a]	Wind Direction (degrees from true north) [a]	Sound Level (dBA)			
					L_{eq}	L_{max}	L_{min}	L_{90}
1/23/2013	11:00:00 AM	12:00:00 PM	-	-	30.8	55.4	18.4	21.6
1/23/2013	12:00:00 PM	1:00:00 PM	-	-	32.6	46.7	20.0	25.0
1/23/2013	1:00:00 PM	2:00:00 PM	-	-	31.7	49.8	20.2	24.6
1/23/2013	2:00:00 PM	3:00:00 PM	-	-	33.4	52.3	20.3	24.9
1/23/2013	3:00:00 PM	4:00:00 PM	-	-	31.3	44.9	21.4	25.9
1/23/2013	4:00:00 PM	5:00:00 PM	-	-	33.5	56.3	21.2	26.1
1/23/2013	5:00:00 PM	6:00:00 PM	-	-	32.0	46.3	21.2	25.3
1/23/2013	6:00:00 PM	7:00:00 PM	0.2	112.9	32.4	46.2	22.0	27.1
1/23/2013	7:00:00 PM	8:00:00 PM	-	-	35.0	57.4	21.2	26.2
1/23/2013	8:00:00 PM	9:00:00 PM	0.1	193.4	31.8	47.1	21.1	24.4
1/23/2013	9:00:00 PM	10:00:00 PM	0.4	262.0	35.1	54.9	20.5	23.3
1/23/2013	10:00:00 PM	11:00:00 PM	0.8	263.0	34.7	47.1	21.9	26.1
1/23/2013	11:00:00 PM	12:00:00 AM	0.2	271.2	38.8	65.8	24.9	29.7
1/24/2013	12:00:00 AM	1:00:00 AM	0.8	242.1	40.8	60.1	27.3	30.7
1/24/2013	1:00:00 AM	2:00:00 AM	0.5	356.6	43.5	58.8	32.6	36.8
1/24/2013	2:00:00 AM	3:00:00 AM	0.3	227.9	41.2	55.3	31.3	35.8
1/24/2013	3:00:00 AM	4:00:00 AM	1.6	212.0	42.8	60.9	31.9	35.4
1/24/2013	4:00:00 AM	5:00:00 AM	0.4	272.0	40.9	58.1	28.1	32.6
1/24/2013	5:00:00 AM	6:00:00 AM	2.5	217.5	39.0	62.3	27.3	31.5
1/24/2013	6:00:00 AM	7:00:00 AM	4.0	208.5	36.8	54.7	26.7	30.3
1/24/2013	7:00:00 AM	8:00:00 AM	4.3	204.6	37.1	63.7	26.6	29.6
1/24/2013	8:00:00 AM	9:00:00 AM	3.8	209.2	44.3	73.2	27.4	31.1
1/24/2013	9:00:00 AM	10:00:00 AM	2.8	218.0	34.9	51.3	26.4	29.6
1/24/2013	10:00:00 AM	10:45:00 AM	3.8	219.9	44.3	75.0	27.0	29.9
Maximum			***4.3***		***44.3***	***75.0***	***32.6***	***36.8***
Minimum			***0.1***		***30.8***	***44.9***	***18.4***	***21.6***
Logarithmic average[b]			***1.7***		***38.9***	***64.5***	***26.5***	***30.4***

[a] Wind speed and direction data from The Project meteorology station.

[b] Arithmetic mean was used to calculate mean wind speed and direction.

'-' indicates data missing