Appendix 5.1.1.3A
Noise and Vibration
2011-2013 Baseline Report

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Blackwater Gold Project

October 2013 / AMEC VE52277

Blackwater Gold Project

Noise and Vibration
2011-2013 Baseline Report

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ACRONYMS

Abbreviations and Units of Measure	Definition
AMEC	AMEC Environment & Infrastructure
AMSL	above mean sea level
ANSI	American National Standard Institute
BC	British Columbia
BC OGC	British Columbia Oil & Gas Commission
dB	decibel
dBA	decibel A-scale
°C	degree Celsius
EIA	environmental impact assessment
Hz	Hertz
ISO	International Organization for Standardization
km	kilometre
km/h	kilometre per hour
L_{10}	sound level equalled or exceeded 10% of the measurement time
L_{50}	sound level equalled or exceeded 50% of the measurement time
L_{90}	sound level equalled or exceeded 90% of the measurement time
L_{eq}	equivalent sound pressure level
$L_{eq\ D}$	day equivalent sound pressure level
$L_{eq\ N}$	night equivalent sound pressure level
L_{max}	maximum sound pressure level
L_{min}	minimum sound pressure level
log	logarithm base 10
m	metre
m/sec	metre per second
mm/h	millimetre per hour
%	percent
PNL	perceived noise level
Project (the)	Proposed Blackwater Gold Project
RH	relative humidity
SPL	sound pressure level
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator

EXECUTIVE SUMMARY

The baseline noise levels were estimated to characterize the acoustical environment at the proposed Project area in preparation for the Application for an Environmental Assessment (EA) Certificate (Application) under the *Environmental Assessment Act*. Specific objectives of the noise baseline programs were to find equivalent sound pressure levels and sound statistical descriptors, which exist at remote locations of the proposed Project prior to commencement of the exploratory, construction and operation activities.

The baseline sound monitoring surveys have been completed in central British Columbia by AMEC in connection with the mining projects that included Hillsborough Echo Hill Coal, Mt. Milligan Copper-Gold, and Bullmoose North Coal. The results were gathered and statistically analyzed in a desktop study. They were used as the pre-exploration and pre-construction natural sound levels representing the undisturbed acoustic environment of the Project site. The estimated baseline equivalent sound pressure levels (SPL) were just about 30 decibels (dBA), with almost no difference between daytime (30 dBA) and night time (29 dBA) levels.

To scrutinize accuracy of the above estimate it was necessary to conduct a real-time noise survey at anticipated sites of future noise sources in the area of the proposed Project. The survey conducted in July 2013 revealed actual baseline noise levels similar to those included in the desktop study. The average equivalent SPL at the proposed mine was 31.1 dBA.

Background noise will be added to the predicted construction and operation noise and the resulting cumulative values compare with permissible sound levels. Also, spatial distribution of cumulative noise levels will be presented in a noise impact assessment report to show the noise contours characterizing noise attenuation from the highest to the lowest baseline levels.

1.0 INTRODUCTION

Knowledge of a baseline noise level is a prerequisite to an environmental impact assessment. Noise levels during mining will be incremental to the existing background noise. The baseline noise strength is also important for assessing the perception of sound because a person's subjective reaction is to compare the new noise environment to the undisturbed acoustic environment.

In recent years, environmental noise surveys have been conducted by AMEC in pristine areas in central British Columbia for proposed mining projects as a component of an environmental impact assessment (EIA). The results show similar baseline sound parameters at all of the monitored sites. This can be attributed to the absence of anthropogenic noise sources at remote sites with only natural noise sources present, such as wind blowing through trees, wildlife, birdsongs, distant thunder, insects, etc. The proposed Blackwater Gold Project (the Project) is also located in a remote area with comparable topography, regional climate, and groundcover, and away from regional municipal and industrial centers such as Prince George and Vanderhoof. Average values of baseline sound parameters recorded at three surveyed locations were calculated and accepted as baseline noise for the Project as described in the Desktop Study sections.

To verify results of the desktop study, a real-time baseline noise survey was conducted during the last three days of July 2013 in the area of the Project. The survey included long-term continuous monitoring of ambient sound parameters near the proposed open pit mine and spot sampling at the proposed airstrip area and at the nearest permanently occupied dwelling located at the northern end of Tatelkuz Lake.

2.0 FUNDAMENTALS OF ENVIRONMENTAL ACOUSTICS

To better understand the noise potential issues in all stages of the Project lifetime, it is necessary to present a brief introduction to environmental acoustics, as follows.

Sound is mechanical energy transmitted by pressure waves through a medium such as air. Physically, there is no distinction between sound and noise: sound is a sensory perception evoked by physiological processes in the auditory brain. The complex pattern of sound waves is perceptually labelled as noise, music, speech, etc. Consequently, it is not possible to define noise exclusively on the basis of the physical parameters of sound. Instead, it is common practice to define noise simply as unwanted sound. Consequently, sound and noise terms are often used alternatively.

Three aspects of environmental sound are important in determining subjective response:

1. Intensity or level of the sound;
2. Frequency spectrum of the sound; and
3. Time-varying character of the sound.

These aspects are described in the sections that follow.

2.1 Sound Intensity

Several noise measurement scales are used to describe the intensity or level of the sound in a particular location. The most common is the A-weighted sound level expressed in the A-scale decibel (dBA) unit. The A-scale gives greater weight to the frequencies of sound to which the human ear is most sensitive.

There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10-decibel increase in sound pressure level is perceived as approximately a doubling of loudness over a fairly wide range of intensities (Bell, 1994). The decibel scale and typical corresponding noise sources are shown in **Table 2.1-1**.

Table 2.1-1: Range of Typical Noise Levels

Sound Pressure Level (rounded in dBA)	Typical Source	Subjective Evaluation
130 (Threshold of pain)	Blasting	Extremely noisy – intolerable
120	Jet take-off	
110	Rock concert	
100	Pneumatic hammer	Very noisy
90	Heavy truck Loud shout	
80	Highway traffic	Loud
70	Loud radio or television Noisy restaurant	
60	Department store	Moderate to quiet
50	General office Quiet street	
40	Living room Library	Quiet to very quiet
30	Bedroom Country site	
20	Unoccupied recording studio Remote underdeveloped area	Almost silent
<10 (Threshold of hearing)	Anechoic chamber	Silent

Note: dBA = decibel

The sound level of 0 dBA corresponds roughly to the threshold of hearing. The sound level of a quiet countryside during a quiet night is approximately 20 dBA, whereas a calm environment has sound levels between 30 dBA and 50 dBA. Above 70 dBA, sounds become very disruptive (ISO, 1969; US EPA, 1974). Construction sources, e.g., pneumatic hammers, produce noise levels around 100 dBA.

With regard to increases in noise level, the following relationships can be helpful in understanding the quantitative changes in noise levels with reference to the public's perception (Cowan, 1994):

- Except in carefully controlled laboratory experiments, a change of only 1 dBA in sound level cannot be perceived;
- A 3 dBA change is considered a just-noticeable difference;
- A change in level of at least 5 dBA is required before any noticeable change in community response would be expected; and
- A 10 dBA change is subjectively heard as approximately a doubling in loudness, and would almost certainly cause an adverse community response.

The measurement of sound level with standard instruments equipped with an A-weighting filter results in a de-emphasis of the very low and very high frequency components of sound in a manner similar to the frequency response of the human ear. This correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless indicated otherwise.

2.2 Sound Frequency Spectrum

The frequency of a sound refers to the number of complete pressure fluctuations per second in the sound waves. The unit of measurement is the cycle per second (cps) or hertz (Hz). Most sounds in the environment do not consist of a single frequency, but of a broad band of frequencies, differing in level. The name of the frequency and level content of a sound is its sound spectrum. A sound spectrum is typically described in terms of 1/3 or 1/1 octave bands, which separate the audible frequency range (for human beings, approximately 20 Hz to 20,000 Hz) into ten segments.

The rate of sound propagation is frequency-dependent. Attenuations in air and other media are greater for low frequency noise than for infrasound. Typical air attenuations at 20°C and 70% relative humidity are as follows:

Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000
Attenuation (dB per 1 km)	0.0	0.1	0.3	1.0	2.7	5.4	9.7	23.2	74.8

Note: Hz = hertz; dB = decibel; km = kilometre

The above table shows no attenuation at low frequencies, e.g., 31.5 Hz, and very little at 63 Hz. Air attenuations are a small contributor to losses at low frequencies but, because attenuation increases rapidly as frequency rises, air attenuation can be a main contributor to noise dissipation at much higher frequencies. As a result, noise that has traveled over long distances is normally biased towards the low frequencies, e.g., long wavelengths.

The presence of a prevailing, specific, discrete frequency in the broadband noise results in a perception of noise loudness and noise character such as a rumble, roar, or hiss. Individual octave band noisiness estimates are combined to give an overall perceived noise level (PNL) that is intended to estimate accurately the subjective evaluations of the same sound. PNL values will vary with time, e.g., when an aircraft flies by a measuring point. The frequency spectrum values add a duration correction and a tone correction to PNL values. The duration correction ensures that longer duration events are rated as more disturbing. Similarly, noise spectra that seem to have prominent tonal components are rated as more disturbing by the tone correction procedure.

2.3 Time-Varying Character of Sound

Many environmental noises vary over time, such as for different times of day or from season to season. For example, service road traffic noise may be considerably louder during some hours of the day and much quieter at night. Aircraft noise may vary with the season due to different numbers of aircraft operations. It is usually not possible to measure sound pressure levels continuously over a long enough period of time to completely define the environmental noise exposure. In practice, measurements usually only sample some part of the total exposure.

Most environmental noise is a conglomeration of distant noise sources that results in a relatively steady background noise having no identifiable source. These distant sources may include aircrafts, industrial activities, wind in trees and bushes, insects, amphibians, running water, birds and animal noise, etc. and are relatively constant from moment to moment. As natural forces change or as human activity follows its daily cycle, the sound level may vary slowly from hour to hour. Superimposed on this slowly varying background is a succession of identifiable noisy events of brief duration. These may include nearby activities such as a single helicopter or aircraft flyover or snowmobile operation that cause the environmental noise level to vary from instant to instant. In undisturbed remote areas the anthropogenic noise sources are absent.

To describe the time-varying character of environmental noise, statistical noise descriptors were developed. L_{10} is the A-weighted sound level equalled or exceeded during only 10% of the measurement time. L_{10} provides a good measure of the maximum sound levels caused by intermittent or intrusive noise. L_{50} is the A-weighted sound level that is equalled or exceeded 50% of the measurement time period; it represents the median sound level. L_{90} is the A-weighted sound level equalled or exceeded 90% of the time. Since this represents “most” of the time, L_{90} generally has been adopted as a good measure of the ambient baseline noise of the measurement site. Therefore, the baseline noise is defined as L_{90} of the overall background noise.

Because sound levels can vary markedly over a short period of time, a method for describing the average character of the sound must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy equivalent sound/noise descriptor is called equivalent level denoted by L_{eq}. The most common averaging period is hourly; however, L_{eq} can describe any series of noise events for any selected duration such as daytime (7 a.m. to 10 p.m.), night time (10 p.m. to 7 a.m.) or 24-hour duration. The L_{eq} is particularly useful in describing the subjective sound change in an environment where the source of sound remains the same but there is change in the level of activity (Passchier, 2000).

In determining the daily measure of environmental noise, it is important to account for the different response of people to daytime and night time noise. During the night time, exterior background noise levels are generally lower than in the daytime; however, most household noise also decreases at night, thus exterior noise intrusions again become noticeable. Furthermore, most people trying to sleep at night are more sensitive to noise. To account for human sensitivity to night time noise levels, a special descriptor was developed. The descriptor is referred to as the Day/Night Average Sound Level ($L_{eq\ D}$ / $L_{eq\ N}$).

3.0 OBJECTIVES

The overall objective of assessing the baseline noise was to characterize the acoustical environment at the Project site in preparation for the Application for an Environmental Assessment (EA) Certificate (Application) under the *Environmental Assessment Act*. Specific objective of the noise baseline program was to find equivalent sound pressure levels and sound statistical descriptors that existed at the remote Project site prior to commencement of the exploratory, construction, and operation activities.

4.0 SCOPE OF WORK

Based on completed baseline noise surveys at similar undisturbed sites considered for mining projects in central BC, a desktop study was completed to establish likely background sound parameters for the Project site including:

- Equivalent sound pressure level (L_{eq});
- Sound statistical descriptors (L_{10}, L_{50}, and L_{90}); and
- Baseline sound pressure levels for day time ($L_{90\ D}$), night time ($L_{90\ N}$), and 24-hour (L_{90}).

The desktop study was complemented by a real-time baseline noise survey conducted in July 2013 at the Project area. The scope of the field work was to obtain empirical values of background sound parameters, as listed above.

5.0 DESKTOP STUDY

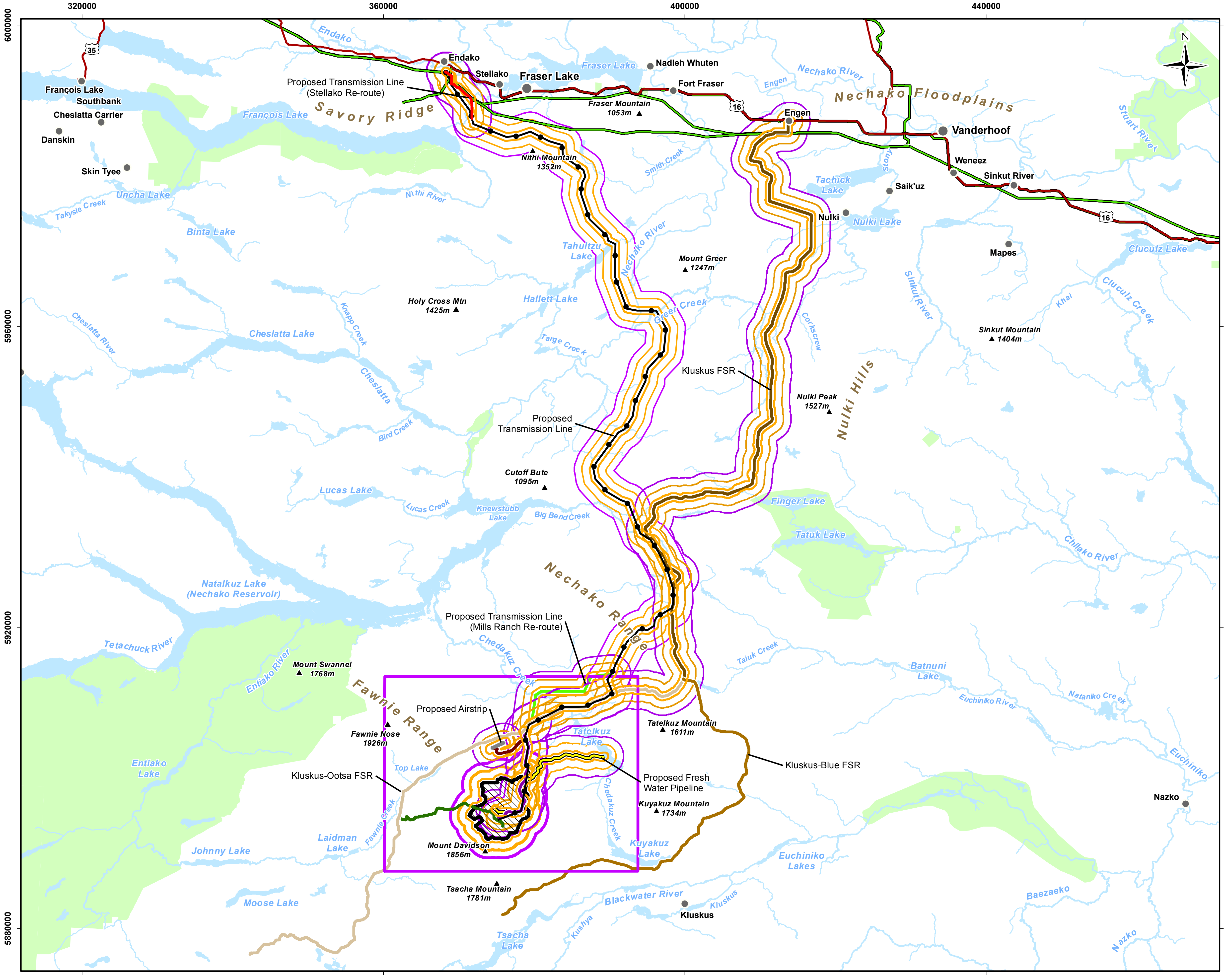
5.1 <u>Information Sources</u>

The results of previously completed background noise surveys at three relevant sites in BC have been published in EIA reports or are available at AMEC prior to publication in anticipated EIA reports. The following projects are references for the Project background noise estimate:

- Hillsborough Echo Hill Coal Project (AMEC, 2013);
- Mt. Milligan Copper-Gold Project (AMEC, 2008); and
- Bullmoose North Coal Mine Project (AMEC, 2012).

The locations and regional topography of these referenced projects are shown in **Figure 5.1-1**.

Detailed records of background noise surveys are available from AMEC.



Legend

- Populated Place
- Highway
- Kluskus FSR
- Kluskus-Blue FSR
- Kluskus-Ootsa FSR
- Existing Transmission Line
- Stream
- Waterbody
- Parks & Protected Areas

Project Components

- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Transmission Line (Mills Ranch Re-route)
- Proposed Transmission Line (Stellako Re-route)
- Proposed Fresh Water Pipeline
- Proposed Airstrip Access Road
- Proposed Airstrip
- Proposed Mine Site

Scale: 1:500,000

0 5 10 20

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Location and Regional Topography of Baseline Noise Reference Projects

DATE: April, 2014	ANALYST: WR	Figure 5.1-1
JOB No: VE52277	QA/QC: GH	PDF FILE: 12-100-001_v7_Noise_SA.pdf
GIS FILE: 12-100-001_v7_Noise_SA.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\12_noise\Baseline\12-100-001_v7_Noise_SA.mxd

5.2 Methodology

In recent years background noise surveys have been conducted by AMEC in remote areas in central BC for proposed mining projects. Analysis of the results revealed that the measured sound parameters are comparable, although not identical. The similarity in baseline noise levels can be explained by the absence of anthropogenic noise sources, comparable topography, similar groundcover, and sufficient proximity of sites with similar wildlife. These factors influence the acoustic environment, likely dominated by noise generated by various sources, such as wind blowing through trees and vegetation, wildlife, birdsongs, animal and amphibian calls, the sound of running water in streams, insects, etc.

The differences in sound parameters between surveyed sites are insignificant when referred to the perception of changes in noise levels discussed in **Section 2.1** (Cowan, 1994). However, it must be realized that baseline noise levels at a specific site can change significantly with time of the day/night, season (quiet in winter), atmospheric conditions (high levels during windy weather and thunderstorms), and incidental anthropogenic sources (plane or helicopter flyover, logging activities). Therefore, baseline noise levels are usually understood as inexact values within some unpredictable maximum – minimum range.

Baseline noise levels for all three referenced projects were obtained by a direct 24-hour continuous monitoring conducted in accordance with the following guidelines:

- American National Standard ANSI 1994: Procedures for Outdoor Measurement of Sound Pressure Level (ANSI, 1994);
- International Organization for Standardization ISO 2005: Acoustics - Description, Assessment and Measurement of Environmental Noise. Part 2: Determination of Environmental Noise Levels (ISO, 2005); and
- British Columbia Noise Control Best Practices Guideline (BC Oil & Gas, 2009).

The following baseline noise survey requirements potentially affecting the monitoring results were fulfilled at each site:

- Meteorological parameters: wind speed below 4 m/sec (14.4 km/h), no precipitation, relative humidity below 95%, temperatures below the freezing point;
- Similar groundcover (trees, shrubs, grasses, etc.);
- Complex terrain (mountainous areas, elevations 900 to 1,100 m amsl); and
- Instrumentation: sound level meters Type 2 with the current versions of ANSI S1.4-1971 and ANSI S1.11-1966 standards and onsite calibrators.

5.3 Results

Baseline noise levels at the Project site were approximated by calculating the averages (the arithmetic means) of measured sound parameters of the referenced projects. A record of referenced projects results and calculated averages accepted for this Project are shown in **Table 5.3-1**.

As shown in **Table 5.3-1**, sound parameters continuously recorded during 24-hour surveys varied by less than 5 dBA. This is expected due to some differences between the monitored sites and constantly changing environmental sound levels (**Section 2.3**). A survey conducted at the Mt. Milligan Copper-Gold project site showed considerable lower sound levels as compared to other projects. This can be attributed to the survey time, which was in mid-October. Approaching winter with temperatures near the freezing point likely caused the disappearance of natural noise sources such as birds, insects, and amphibians from the monitored acoustic environment.

The average sound parameters representing the Project baseline noise includes 24-hour equivalent (L_{eq}) sound pressure level (SPL) of 32 dBA, the median sound level (L_{50}) of 30 BA and background sound (L_{90}) of 29 dBA. Daytime (7:00 a.m. to 10:00 p.m.) background SPL ($L_{90\,D}$) is estimated to be 30 dBA and night time SPL ($L_{90\,N}$) is 29 dBA. Small differences between these values indicate the acoustic environment free of rapid noise changes and lack of predominant frequencies in noise spectrum that would result in a wider range of noise levels.

Default baseline sound levels accepted in British Columbia by the BC Oil & Gas Commission Noise Control Best Practices Guideline (BC OGC, 2009) for rural areas are 35 dBA during the night and 45 dBA during the day.

Table 5.3-1: Baseline Sound Parameters for Reference Projects and Estimated for Blackwater Gold Project

Project	UTM Location		Elevation (m amsl)	Sound Meter Type	Survey Date	Sound Parameters (dBA)					
	m E	m N				L_{eq}	L_{10}	L_{50}	L_{90}	$L_{90\ D}$	$L_{90\ N}$
Hillsborough Echo Hill Coal	639252	6138094	889	Quest 2900	18-19 Aug 2011	27.8	29.9	24.4	24.3	25.3	27.7
					19-20 Aug 2011	32.2	34.5	29.3	28.6	29.4	26.6
					25-26 Aug 2011	33.6	36.0	27.1	27.3	28.3	25.3
Mt. Milligan Copper-Gold	436322	6107600	1,056	Larson Davis	12-13 Oct 2006	21.7	25.1	19.2	17.1	16.6	17.8
Bullmoose North Coal	600929	6118813	1,092	Quest SE/DL	14-15 Aug 2012	36.1	38.1	34.9	34.5	34.4	34.6
Blackwater Gold	**375400**	**5893000**	**1,602**	**N/A**	**N/A**	**30.3***	**32.7***	**27.0***	**26.4***	**26.8***	**26.4***

Note: UTM = Universal Transverse Mercator; amsl = above mean sea level; dBA = decibel; m = metres; E = east; N = north; L_{eq} = equivalent sound pressure level; L_{10} = sound level equalled or exceeded 10% of the measurement time; L_{50} = sound level equalled or exceeded 50% of the measurement time; L_{90} = sound level equalled or exceeded 90% of the measurement time; $L_{90\ D}$ = day sound level equalled or exceeded 90% of the measurement time; $L_{90\ N}$ = night sound level equalled or exceeded 90% of the measurement time; N/A = not applicable (no survey) ; * = the average

6.0 FIELD STUDY

In order to assess the accuracy of the desktop study, it was necessary to conduct a real-time baseline noise survey at anticipated future noise sources (the mine and airstrip) as well as the nearest permanently occupied dwelling. In general, the survey was completed in accordance with the BC OGC. The following subsections provide details and results of the survey.

6.1 Methodology

The survey methodology adhered to standards: ANSI/ASA S12.18-1994 Outdoor Measurement of Sound Pressure Level (ANSI, 1994); and ISO 1996-2 Acoustics – Description, measurement and assessment of environmental noise – Part 2: Determination of environmental noise levels (ISO, 1996-2:2007).

An AMEC scientist near the proposed open pit mine site from 29 to 31 July 2013 completed a continuous, 37-hour survey of baseline noise. During the monitoring period no anthropogenic sources were audible at the surveyed locations. Measured sound parameters included equivalent sound pressure levels, statistical descriptors, and sound frequency spectrum.

In addition, on 31 July 2013 short-term baseline noise measurements were taken near the proposed airstrip and at the north end of Tatelkuz Lake. The noise sampling locations are shown in **Figure 6.1-1**.

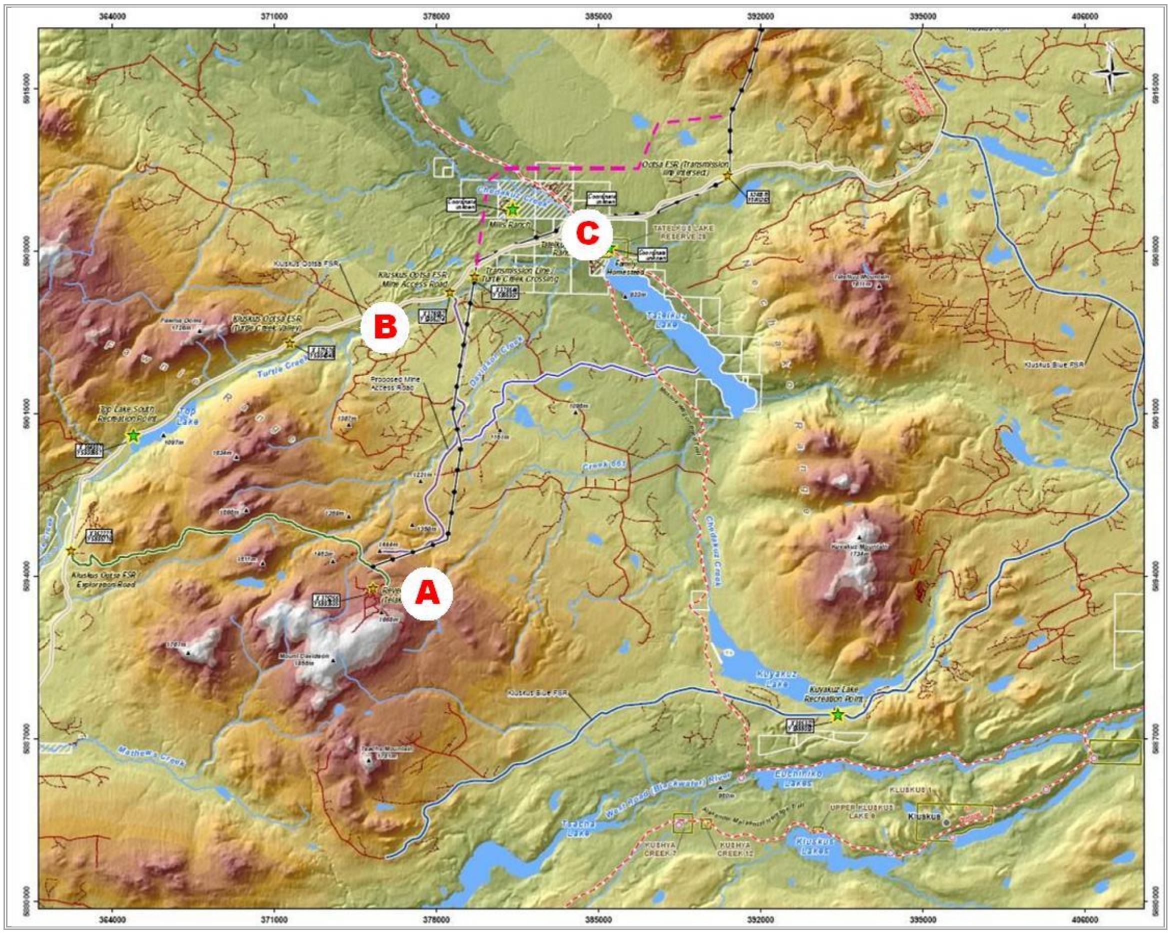


Figure 6.1-1: ***Location of Baseline Noise Survey Sites: (A) Mine; (B) Airstrip; (c) Tatelkuz Lake Ranch Resort***

A view of the monitoring sites and surroundings are depictured in **Figure 6.1-2**.

Figure 6.1-2: Location of Baseline Noise Monitoring Sites: (A) Mine; (B) Airstrip; (C) Tatelkuz Lake Ranch Resort

The weather observed at the surveyed sites during a three-day period was deemed suitable for noise monitoring. A record of average meteorological parameters during the sampling time is shown in **Table 6.1-1**.

Table 6.1-1: Baseline Sound Parameters for Blackwater Gold Project and Reference Projects

Date 2013	Wind Avg. (m/sec)	Wind Max. (m/sec)	Direction (from)	RH %	Temp. (°C)	Precipitation (mm/h)	Sky Cover
29 July	0.4	0.6	Various	35	21	Nil	6/10
30 July	0.9	1.4	N to SE	32	26	Nil	3/10
31 July	0.2	0.8	W	44	24	Nil	Clear

Note: m/sec = metres per second; RH = Relative Humidity; % = percent; °C = degrees Celsius; Avg. = average; mm/h = millimetres per hour; N = north; SE = southeast; W = west

The principal noise monitor was a System 824 Sound Level Meter/Real Time Analyzer manufactured by Larson Davis, Inc. This instrument is battery-powered and can be operated continuously in several modes including integrated sound level meter (ISM) for recording 48 sound parameters and a sound spectrum analyzer (SSA) with programmable real time 1/1 or 1/3 octave frequency analysis capability. The monitoring parameters were as follows:

Sound monitor type/model	Larson Davis System 824 Type 1
Instrument calibrator model	Larson Davis CAL200
Measurement range	30 to 100 dBA
Time weighting	Slow
Scale	A
Data storage	Enable
Energy exchange rate	Q = 3
Reports	Summary profile and statistical exceedances

The survey data were recorded at predetermined intervals and stored in the instrument data logger. The logged parameters were downloaded to a computer and analyzed using dedicated Larson Davis software. Sound pressure levels (SPL) as L_{eq} were retrieved and exported to an Excel spreadsheet to determine:

- Elimination of outliers (the Grubbs' test);
- Daytime and night time equivalent sound pressure levels L_{eq} in dBA;
- Statistical descriptors (L_{90}, L_{50}, L_{10}); and
- Sound lowest and highest L_{eq} in dBA.

6.2 Results

The summary of the long-term continuous baseline noise survey results for the proposed mine area (Location A) is provided in **Table 6.2-1**. The survey started on 29 July at 17:46 and ended on 31 July 2013 at 07:20. A total of 2,256 records of L_{eq} in dBA were logged at 1-minute intervals. The survey hourly sound parameters are shown in **Annex 1**, Table 1-A. The summary of short-term daytime noise survey results for the proposed airstrip area and near the Tatelkuz Lake ranch resort is provided in **Table 6.2-2**. The relevant survey record for the ranch area created by Larson Davis software is provided in **Annex 1**, Table 1-B.

The noise levels at the proposed mine area, as shown in **Table 6.2-1**, shows an overall (day and night) equivalent sound pressure level of 31.1 dBA $L_{eq\ D\ N}$ with almost no changes in daytime and night time levels. This indicates even distribution of sound over the entire survey period. This can be expected as no anthropogenic sources were present and the weather was calm. Also, small differences in the statistical descriptors (L_{10}, L_{50} and L_{90}) confirms a steady-state of the acoustical environment. The L_{eq} recorded at the airstrip and Tatelkuz Lake areas were even lower than at the mine area. Therefore, the long-term surveys at these locations were not warranted since the critical case defined by the highest baseline noise level was at Location A where a detailed survey was conducted. Noise levels at all three locations are similar to those typically observed at the remote areas where the audible anthropogenic sources are not present. Based on research conducted by the Environment Council of Alberta, the average rural ambient sound level in Alberta is approximately 35 dBA $L_{eq,}$ which includes contribution from farming activities and transportation sources (AER, 2007).

Table 6.2-1: Summary of Long Term Noise Survey Results at the Proposed Mine Area

Location	UTM Coordinates		Elevation (m amsl)	Sound Meter Type	Time	Sound Parameters (dBA)					
	m E	m N				L_{eq}	L_{10}	L_{50}	L_{90}	L_{max}	L_{min}
Location A – Mine Area	377,804	5,894,159	1,424	Larson Davis 824	Day	31.0	30.9	29.1	28.0	67.6	26.1
					Night	31.1	32.1	30.8	30.0	43.8	26.5
					Overall	31.1	31.5	29.9	29.0	67.6	26.1

Note: UTM = Universal Transverse Mercator; AMSL = above mean sea level; dBA = decibel; m = metres; E = east; N = north; L_{eq} = equivalent sound pressure level; L_{10} = sound level equalled or exceeded 10% of the measurement time; L_{50} = sound level equalled or exceeded 50% of the measurement time; L_{90} = sound level equalled or exceeded 90% of the measurement time; L_{max} = maximum sound pressure level; L_{min} = minimum sound pressure level

Table 6.2-2: Summary of Short Term Noise Survey Results at the Proposed Airstrip Area and near Tatelkuz Lake Ranch

Location	UTM Coordinates		Elevation (m amsl)	Sound Meter Type	Date 2013	Sound Parameters (dBA)			
	m E	m N				L_{eq}	L_{10}	L_{50}	L_{90}
Location B – A Proposed Airstrip	375,141	5,903,953	1,119	Larson Davis 824	29 July	27.7	-	-	-
					31 July	25.0	-	-	-
Location C – Tatelkuz Lake Ranch	384,613	5,907,721	937	Quest SoundPro DL	31 July	24.2	25.4	21.9	20.7

Note: UTM = Universal Transverse Mercator; AMSL = above mean sea level; dBA = decibel; m = metres; E = east; N = north; Leq = equivalent sound pressure level; L10 = sound level equalled or exceeded 10% of the measurement time; L50 = sound level equalled or exceeded 50% of the measurement time; L90 = sound level equalled or exceeded 90% of the measurement time

Short-term octave band frequency sound surveys were carried out on 31 August 2013 at Locations A and C. The detailed 1/1 and 1/3 octave band frequency reports generated by Larson Davis software are included in **Annex 1**, Tables 1-C and 1-D, respectively. The summary results for each survey are included in **Table 6.2-3**.

Table 6.2-3: Octave Band Frequency Spectrum

Frequency (Hz)	Band Sound Pressure Level (dB)	
	Location A – Mine Area	Location C – Tatelkuz Lake Ranch
16	41	50
31.5	37	40
63	28	38
125	27	32
250	27	22
500	29	23
1,000	30	23
2,000	27	21
4,000	23	22
8,000	22	22
16,000	24	25

Note: Hz = hertz; dB = decibel

An analysis of octave band measurements shows slightly higher noise levels at lower frequencies of 16 Hz to 63 Hz. This indicates that longer sound waves (i.e., lower frequency) prevail slightly in this wave spectrum. As per sound properties, the wavelength is inversely proportional to its frequency (Bies and Hansen, 2003). Higher sound pressure levels at low frequencies are caused by distant sources because long sound waves can propagate much further than short sound waves (**Section 2.2**). However, no single frequency dominates the octave band frequency spectrum, which confirms absence of tonal components in the background environmental sound at the Project study area.

7.0 SUMMARY AND CONCLUSIONS

Baseline sound monitoring results are available from surveys completed in central BC. They were retrieved and statistically analyzed in a desktop study leading to the estimate of noise levels at the Project site prior to commencement of exploratory and pre-construction activities. The Project has several common features related to baseline noise with the mining projects previously assessed by AMEC, which included Hillsborough Echo Hill Coal, Mt. Milligan Copper-Gold, and Bullmoose North Coal. The desktop study revealed that the baseline equivalent sound pressure levels at the Project site can be expected to be from 28 dBA to 36 dBA with the average L_{eq} of 30 dBA.

To verify the desktop study findings, a real-time, long-term (37 hours) baseline sound monitoring survey was conducted in the proposed mine area during July 2013. The survey revealed the daytime sound pressure level (SPL) $L_{eq\ D}$ of 31.0 dBA, the night time SPL $L_{eq\ N}$ of 31.1 dBA, and the overall average SPL $L_{eq\ D\ N}$ of 31.1 dBA, which is very close to 30 dBA of the desktop study. The survey background noise levels will be added to predicted construction and operational noise levels and the cumulative values assessed for compliance with permissible objectives. In addition, short-term sound surveys were completed at the proposed airstrip area and the Tatelkuz Lake ranch resort near the Eagles family dwelling where sound levels $L_{eq\ D}$ were lower (27.7 dBA and 25.0 dBA, and 24.2 dBA, respectively) as compared to the mine site (31.0 dBA). In line with conservative approach to impact assessment, the higher long-term baseline sound level of 31.1 dBA observed near the mine site has been adopted for the Project.

The baseline noise survey concluded that the sound levels and sound characteristics in the Project area are low, typical of a quiet remote environment.

REFERENCES

AMEC (2008). Mt. Milligan Copper-Gold Project Environmental Assessment. Volume 4 Baseline, Section 4.4 Noise. EIA Report. AMEC File: VE5156401. AMEC Earth & Environmental, Burnaby, BC, July.

AMEC (2012). Bullmoose North Coal Mine Project. Summary of Environmental Baseline and Assessment Work Progress as of 26 October 2012. Prepared for Canadian Dehua International Mines Group Inc., Vancouver, BC. Prepared by AMEC Environment & Infrastructure, Burnaby, BC. AMEC File: VE2012-058. Available at ftp://ftp.geobc.gov.bc.ca/pub/outgoing/Dehua%20Canada%20Bullmoose_Wapiti/Bullmoose_Amec%20Baseline%20Summary_121106.pdf. Accessed August 2013.

AMEC (2013). Echo Hill Coal Project Description. Submitted to The Canadian Environmental Assessment Agency, Vancouver, BC. Submitted by Hillsborough Resources Limited, Vancouver, BC. Prepared by AMEC Environment & Infrastructure, Burnaby, BC, January, 2013. AMEC File: VE52025. Available at www.ceaa-acee.gc.ca/050/documents/p80018/85750E.pdf. Accessed August 2013.

ANSI (1994). Procedures for Outdoor Measurement of Sound Pressure Level. American National Standard S.12.18-1994 (ASA 110-1994). Reaffirmed 6/23/2004.

BC Oil & Gas Commission (BC OGC) (2009). British Columbia Noise Control Best Practices Guideline. BC Oil & Gas Commission, March. Available at www.bcogc.ca/bc-noise-control-best-practices-guideline

Bell, L.H. (1994). Industrial Noise Control. Marcel Dekker, Inc., New York.

Bell, L.H. and D.H. Bell (1994). Industrial Noise Control Fundamentals and Applications. Marcel Dekker, Inc., New York, Basel.

Bies D.A., and C.H. Hansen (2003). Engineering Noise Control. Third Edition. Spon Press, London.

Cowan, J.P. (1994). Handbook of Environmental Acoustics. Van Nostrand Reinhold, New York.

EPA (1974). Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, US Environmental Protection Agency, ISO 2005. International Organization for Standardization: Acoustics - Description, Assessment and Measurement of Environmental Noise. Part 2: Determination of Environmental Noise Levels. Office of Noise Abatement and Control (ONAC), Report EPA550/9-74-004, Washington D.C.

ISO (1969). Noise Assessment with Respect to Community Responses. Publication ISO/TC 43. International Standards Organization, New York, United Nations.

Passchier-Vermeer, Willy, and Wim F. Passchier (2000). Noise Exposure Environmental Health Perspectives, 108 (Supp 1), March 2000.

ANNEXES

ANNEX 1
Baseline Noise Survey Results

Table 1-A: Baseline Noise Survey Hourly Records at Site A – Pit Mining Area

824 Logging Sound Level Meter

Model Number:	824
Serial Number:	A2824
Firmware Rev:	4.261
Software Version:	3.12
Name:	AMEC Environment & Infrastructure
Setup:	New_Gold.log
Setup Description:	Blackwater New Gold
Location A:	Pit Mining Area

Record No.	Date	Time	L_{eq}	Min.	Max.	L_{10}	L_{50}	L_{90}
2	29-Jul-13	18:00	29.4	27.0	50.3	28.9	27.8	27.2
3	29-Jul-13	19:00	43.2	26.7	67.6	30.2	28.6	27.6
4	29-Jul-13	20:00	28.4	26.6	32.1	29.5	28.4	27.3
5	29-Jul-13	21:00	28.6	27.3	35.6	29.5	28.3	27.3
6	29-Jul-13	22:00	27.9	26.7	38.2	28.9	27.7	27.1
7	29-Jul-13	23:00	28.7	26.5	38.3	30.0	28.1	27.1
8	30-Jul-13	00:00	31.3	28.1	40.2	33.3	30.3	29.0
9	30-Jul-13	01:00	32.3	28.9	39.2	34.4	31.7	30.0
10	30-Jul-13	02:00	31.4	27.9	43.8	33.6	29.7	28.4
11	30-Jul-13	03:00	28.5	27.4	31.4	29.1	28.4	27.5
12	30-Jul-13	04:00	30.7	28.9	39.7	31.7	30.0	29.2
13	30-Jul-13	05:00	29.7	28.8	36.9	30.6	29.7	29.1
14	30-Jul-13	06:00	30.4	29.3	35.2	31.1	30.4	29.5
15	30-Jul-13	07:00	33.4	28.3	62.2	32.7	30.3	29.1
16	30-Jul-13	08:00	28.4	27.0	36.4	29.0	28.4	27.4
17	30-Jul-13	09:00	29.0	26.4	51.2	29.0	28.0	27.2
18	30-Jul-13	10:00	33.6	26.2	57.9	29.8	28.3	27.1
19	30-Jul-13	11:00	29.2	26.6	38.0	30.9	28.7	27.4
20	30-Jul-13	12:00	30.3	26.4	39.7	32.7	29.0	27.5
21	30-Jul-13	13:00	31.7	26.2	53.2	33.3	29.5	27.7
22	30-Jul-13	14:00	31.2	27.1	45.7	33.2	29.9	28.2
23	30-Jul-13	15:00	29.5	26.1	43.5	30.9	29.1	27.3
24	30-Jul-13	16:00	29.3	26.6	40.6	30.8	28.8	27.6
25	30-Jul-13	17:00	32.6	27.3	56.3	32.9	30.0	28.4
26	30-Jul-13	18:00	30.0	27.6	46.0	30.8	29.6	28.8
27	30-Jul-13	19:00	30.5	28.8	43.6	30.9	29.9	29.2
28	30-Jul-13	20:00	30.8	29.7	39.3	31.7	30.7	30.1
29	30-Jul-13	21:00	30.4	29.7	31.4	30.9	30.5	30.1
30	30-Jul-13	22:00	30.8	29.9	31.9	31.5	30.6	30.1
31	30-Jul-13	23:00	31.5	30.7	32.9	31.9	31.5	31.1
32	31-Jul-13	00:00	32.0	30.9	32.8	32.8	31.9	31.2
33	31-Jul-13	01:00	32.3	31.5	33.3	32.9	32.4	31.6

Table continues...

34	31-Jul-13	02:00	32.2	31.4	33.4	32.9	32.3	31.4
35	31-Jul-13	03:00	31.9	31.0	35.6	32.7	31.7	31.1
36	31-Jul-13	04:00	32.4	31.3	34.6	32.9	32.4	31.8
37	31-Jul-13	05:00	32.8	31.8	37.7	33.5	32.6	32.1
38	31-Jul-13	06:00	32.9	32.0	33.8	33.7	32.7	32.1
		Log Average (dBA):				31.8	30.2	29.3
		Mean (dBA):				31.5	29.9	29.0

Table 1-B: Baseline Noise Survey Data Summary at Site C – Tatelkuz Lake Ranch Resort

824 Logging Sound Level Meter
Model Number: 824
Serial Number: A2824
Firmware Rev: 4.261
Software Version: 3.12
Name: AMEC Environment & Infrastructure
Setup: New_Gold.log
Setup Descr: Blackwater New Gold
Location: Tatelkuz Lake Ranch
Note 1: Near Mr. Eagles dwelling

Detector	**Slow**			
Weighting:	A			
Calibrated:	31-Jul-13	07:54:58	Offset:	-47.9 dB
Checked:	31-Jul-13	11:16:33	Level:	114.1 dB
Calibrator:	3943		Level:	114 dB
Ln Level:	15 dB			
L10.00	25.4			
L50.00	21.9			
L90.00	20.7			
	A Weight	**C Weight**	**Flat**	
Leq:	24.2 dBA	38.9 dBC	43.9 dBF	
Lmax (slow):	45.5 dBA	52.7 dBC	58.1 dBF	
Lmin (slow):	19.8 dBA	34.2 dBC	36.3 dBF	

Table 1-C: Octave Band Frequency Spectra at Site A – Pit Mining Area

824 Logging Sound Level Meter / RTA

Model Number:	824
Serial Number:	A2824
Firmware Rev:	4.261
Software Version:	3.12
Name:	AMEC Environment & Infrastructure
Descr1:	New Gold Blackwater
Descr2:	Near Pit Mine

Sound Level Meter / RTA Settings	
Bandwidth:	1
Detector:	Fast
Weighting:	Flat

824 Calibration Settings			
Calibration Offset:	-47.89		
Calibration Date:	15-Jul-13	Calibration Time:	07:54:58
Calib Check Date:	31-Jul-13	Calib Check Time:	07:16:33
Calib Check Level:	114.12		
SLM & RTA Summary			
	A Weight	**C Weight**	**Flat**
Leq:	34.8 dBA	39.3 dBC	42.7 dBF

Spectra		
Start Time:	31-Jul-13	07:39:30
Freq Hz	Leq 1/3 Oct	Leq 1/1 Oct
12.5	33.2	
16	35.2	40.7
20	38.1	
25	35.9	
31.5	25.4	36.5
40	22.9	
50	24.7	
63	22.6	28.2
80	22.8	
100	22.5	
125	21.1	26.6
160	21.8	
200	22.6	
250	22.2	27.0
315	21.7	

Table continues...

400	24.4	
500	24.4	29.4
630	25.1	
800	25.4	
1000	25.2	29.9
1250	24.6	
1600	23.5	
2000	22.0	27.0
2500	20.9	
3150	19.1	
4000	17.1	22.7
5000	17.3	
6300	16.6	
8000	16.8	21.6
10000	17.2	
12500	17.7	
16000	18.9	24.0
20000	20.5	

Table 1-D: Octave Band Frequency Spectra at Site C – Tatelkuz Lake Ranch Resort

824 Logging Sound Level Meter / RTA

Model Number:	824
Serial Number:	A2824
Firmware Rev:	4.261
Software Version:	3.12
Name:	AMEC Environment & Infrastructure
Setup:	SLM_NEW.ssa
Setup Description:	SLM NEW_GOLD Analyzer
Location:	Tatelkuz Lake
Note 1:	Near the Eagles family dwelling

Sound Level Meter / RTA Settings	
Bandwidth:	1
Detector:	Fast
Weighting:	Flat

SLM & RTA Summary			
	A Weight	C Weight	Flat
Leq:	32.0 dBA	45.6 dBC	52.7 dBF
Lmax (slow):	40.4 dBA	59.8 dBC	68.7 dBF
Lmin (slow):	31.0 dBA	37.6 dBC	38.6 dBF

Spectra		
Start Time:	31-Jul-13	11:18:18
Freq Hz	Leq 1/3 Oct	Leq 1/1 Oct
12.5	47.6	
16	45.6	50.2
20	40.6	
25	37.8	
31.5	34.9	40.3
40	31.7	
50	38.1	
63	25.4	38.4
80	22.7	
100	31.3	
125	17.9	31.7
160	17.9	
200	17.5	
250	17.1	21.8
315	16.5	
400	17.8	

Table continues...

500	17.7	22.6
630	18.0	
800	17.8	
1000	18.1	23.0
1250	18.8	
1600	16.5	
2000	16.2	21.3
2500	16.8	
3150	17.5	
4000	17.3	22.1
5000	17.3	
6300	17.0	
8000	17.4	22.2
10000	17.8	
12500	18.4	
16000	19.5	24.5
20000	20.9	