Appendix 7-A

Crown Mountain Coking Coal Project - Noise and Vibration Assessment

NWP COAL CANADA LTD

Crown Mountain Coking Coal Project Noise and Vibration Assessment

Sparwood, B.C.

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Executive Summary

Dillon Consulting Limited (Dillon) was retained by NWP Coal Canada Ltd (NWP) to prepare an environmental noise and vibration assessment (the Assessment) for the proposed Crown Mountain Coking Coal Project (the Project) located in Sparwood, British Columbia. The Assessment was prepared in support of the Application for an Environmental Assessment Certificate under the *B.C. Environmental Assessment Act* (2002) and the Environmental Impact Statement under the *Canadian Environmental Assessment Act* (2012).

This assessment investigated potential noise and vibration impacts from the Project on nearby receptor Value Components, including human and wildlife (terrestrial and aquatic) receptors as required by the provincial Application Information Requirements (AIR; 2018). The results presented in this assessment are reflective of worst-case noise emissions and vibration levels for the Project and were compared against the relative federal and provincial guidelines.

Representative nearby human receptors within 3 km radius of the Project footprint are included in this assessment. The assessment of noise and vibration impacts on aquatic wildlife (i.e., fish) pertains to the Blasting Operation and includes ground vibration and air-overpressure. The assessment of impact on terrestrial wildlife includes noise impact from Continuous Operations as well as ground vibration and overpressure associated with Blasting Operations.

The assessment of impact on aquatic wildlife reflected the worst-case scenario in terms of consideration for closest setback distances between the blast faces to the closest waterbodies. For the assessment of impact on terrestrial wildlife, noise level contours were prepared to reflect operation-related sound levels at various setback distances, and for ground vibration and air over-pressure, maximum levels were calculated at various setback distances from the nearest blast faces.

The results of the noise and vibration assessment confirm that with the implementation of operational mitigation measures specified in this report, the Project complies with all applicable provincial and federal guidelines/standards pertaining to noise and vibration. Exceptions include two receptor locations, **R7** and **R10** which both have "Application Case" sound levels in A-weighted decibels (dBA) in exceedance of their respective Permissible Sound Levels. The Application Case sound levels are determined by adding the expected noise impact from the Continuous Operations of the Project to the existing ambient sound levels at the receptors, thus accounting for the cumulative noise impact to be expected at the receptor. The receptors **R7** and **R10** represent locations of a "representative location of a possible indigenous seasonal dwelling". As such, there are currently no dwellings at these two locations. NWP is committing to implement necessary noise mitigation measures to achieve compliance at these receptors once (if) their location and status are confirmed by the Ktunaxa Nation Council and they are confirmed to be occupied.

1.0 Introduction

1.1 Purpose and Objectives

Dillon Consulting Limited (Dillon) was retained by NWP Coal Canada Ltd (NWP) to prepare an environmental noise and vibration assessment (the Assessment) for the proposed Crown Mountain Coking Coal Project (the Project) located in Sparwood, British Columbia (B.C.). The Assessment was prepared in support of the Application for an Environmental Assessment Certificate under the *B.C. Environmental Assessment Act* (BCEAA, 2002*)* and the Environmental Impact Statement (EIS) under the *Canadian Environmental Assessment Act* (2012).

Under the *Canadian Environmental Assessment Act* (2012), the Project is considered a 'Designated Project' under *Regulations Designating Physical Projects* since the mine will have a production capacity of more than 3,000 tonnes per day. Provincially, the Project is considered a Reviewable Project under Part 3 of the *Reviewable Projects Regulations* (B.C. Reg 370/02) of the Act given that the production capacity of the mine will be greater than 250,000 tonnes per year of clean coal and will result in a new land disturbance of greater than 750 hectares (ha). The Application Information Requirements (AIR) submitted to the Environmental Assessment Office (EAO) on April 26, 2018, specifies the information that the Proponent must provide in their Application for an Environmental Assessment Certificate (EAC) under section 16(2) of the BCEAA. Additionally, the AIR identified noise and vibration impacts associated with the Project as an "Intermediate Valued Component" (intermediate VC) that is a primary pathway to potential Project effects on "Receptor Valued Components" (receptor VCs).

This assessment investigated potential noise and vibration impacts from the Project on nearby receptor VCs, including human and wildlife (both aquatic and terrestrial) receptors as required by the AIR. The results presented in this assessment are reflective of worst-case noise emissions and vibration levels for the Project and were compared against the relative federal and provincial guidelines/standards.

1.2 General Overview of the Project

The Project is a proposed open pit metallurgical coal mine located in the Elk Valley coal field in the East Kootenay Region of southeastern British Columbia, as shown in **Figure 1**. There are several existing metallurgical coal mines in the Elk Valley and Crowsnest coal fields surrounding the Project, including Teck Coal Limited's (Teck) Elkview Operations (8 km southwest of the Project) and Line Creek Operations (12 km north of the Project). The Project is located approximately 12 km from Sparwood, B.C.

The approximate footprint of the Project will be 1,300 ha with 10 tenured coal exploration licenses, which account for approximately 5,630 ha. The anticipated production capacity of the Project is up to 3.7 million run-of-mine tonnes (M ROMt) per annum for 15 years, not including site decommissioning. This equates to a coal production capacity of approximately 10,150 tonnes per day. Exploration activities have indicated that the coal at the Project site is typical of coking coals produced from existing mines in the Elk Valley.

The high quality metallurgical coal would be transported via railway to the Port of Vancouver, where it would be shipped overseas to be used in steelmaking.

The key project components include:

- Surface extraction areas (three connected pits – north pit, east pit, and south pit);
- Waste rock management areas;
- Plant area (includes raw coal stockpile area, a processing plant, and site support facilities);
- Clean coal transportation route (overland conveyor and haul road);
- Rail load-out facility and rail siding (includes various auxiliary facilities such as a guard house; light vehicle wash; and a drug and alcohol testing/orientation building);
- Power supply;
- Natural gas supply;
- Explosives storage;
- Fuel storage;
- Sewage treatment; and
- Water supply.

1.1.1 Spatial Boundaries

As per the AIR, potential effects on the acoustic environment, including vibrations, were assessed within the Project footprint and within the acoustic Local Study Area (LSA), as shown in **Figure 2**. The boundary of the acoustic LSA is based on identified sensitive receptors and environments within a 3-km radius of the Project footprint to be inclusive of terrestrial environments (e.g., wildlife habitat). As well, the acoustic LSA includes areas used for recreation (e.g., hunting) that could be impacted by noise and vibration levels.

The Project area, and therefore the acoustic LSA is a greenfield site in the Kootenays, and is a combination of the Montane Spruce and Engelmann Spruce (Subalpine Fir) geoclimatic zones. The acoustic LSA extends across the Lower Elk Valley Road to the west, which is a moderately dense residential area. The northern extent of the LSA overlaps with Grave Creek and Grave Lake with a campground and an area with seasonal dwellings around Grave Lake. As per the British Columbia Oil & Gas Commission Noise Control Best Practices Guideline (B.C. OGC Guideline), a seasonal dwelling is a fixed residence that is occupied on a regular basis, which implies that it is occupied for six weeks per year or more but not occupied full-time (B.C. OGC, 2018). The eastern and southern extents of the LSA are densely forested and mountainous with a small number of seasonal cabins and unofficial campsites. For the purposes of this assessment, a campground is considered a designated camping area that is managed and has regular consistent use. An unofficial campsite refers to a location that may be used for camping (i.e., has a space for campers and a fire pit) but is not regulated in any way.

There are several existing metallurgical coal mines in the Elk Valley and Crowsnest coal fields, including the Teck Elkview Operations at approximately 8 km southwest of the Project and the Line Creek, at approximately 12 km north of the Project. Therefore, the acoustic LSA may be impacted by the noise emitted by the existing nearby mines. Additionally, the Canadian Pacific (CP) mainline and the Sparwood/Elk Valley Airport are within the LSA which affect the acoustic environment in the Project area.

The Project area is mainly used for recreational purposes, with the exception of a small number of seasonal dwellings around Grave Lake and a residential area on the Lower Elk Valley Road. Recreational fishermen and campers were observed in the area at the time of undertaking the ambient noise monitoring program.

1.1.2 Temporal Boundaries

The emissions of noise and vibration are expected to change throughout the life of the Project, thus changes in the predicted noise and vibration impacts at nearby receptors are also expected throughout the life of the Project. These changes are expected due to changes in operating equipment numbers and locations and the varying pit extents throughout the Project life.

For the purpose of this Assessment, the Project phase with the predicted worst-case operating scenario(s) for noise and vibration impacts was (were) used. The worst-case operating scenario was determined based on the anticipated operating equipment counts, types, and proximity to the receptor VCs. In addition, the active pit extents of the Project were factored into this decision process. Through investigating these parameters for all Project phases, it was determined that operational Year 10 of the Project, was the worst-case year for noise and vibration impacts from the Project on surrounding sensitive receptors (excluding Aquatic Receptor **AQR1** which was assessed against Year 4 Blasting operations; further details on this are provided in **Section 6.2**). Year 10 will have the greatest counts and operating hours for mobile equipment of all Project Years and the equipment will located closer to several receptors than in other Project Years.

Noise impacts were determined at nearby receptors and throughout the acoustic LSA for daytime and nighttime periods (0700 – 2200 and 2200 – 0700, respectively) during summertime weather conditions as per B.C. OGC Guideline (B.C. OGC, 2018). Additionally, impacts were compared against various other provincial and federal guidelines for different receptors and scenarios as described in **Section 2.0**.

1.1.3 Administrative Boundaries

Administrative boundaries represent limitations imposed on the assessment due to political, economic, and social constraints (EAO, 2013). Administrative boundaries are not considered to constrain the identification of potential effects and the assessment thereof for noise and vibration impacts. As such, they are not applicable for the purposes of this VC.

1.1.4 Technical Boundaries

Technical boundaries represent constraints imposed on the assessment due to limitations in the ability to predict the effects of the Project (EAO, 2013). Noise propagation modelling is a tool that is used for determining noise impacts for the Project. The modelling is based on International Organization for

Standardization (ISO) standard and similar to other prediction methods, there are inherent uncertainties associated with the prediction methodology. For the purposes of this assessment, notable levels of conservatism are built into the assessment methodology to minimize/eliminate under-prediction.

For calculations of ground vibration and air overpressure associated with the blasting operations, site-specific parameters are used which have inherent variability. Similar to the above, conservative assumptions are incorporated in the analysis to ensure potential impact is not under-estimated.

2.0 Assessment Criteria

In **Table 7** of **Section 4.0** of the AIR, noise and vibration levels are listed as "measurement indicators" at human and wildlife habitat locations (i.e., receptor VCs). Therefore, the assessment criteria relative to noise and vibration impacts from the Project are split into two categories: Human Receptor Criteria and Wildlife Receptor Criteria (both terrestrial and aquatic wildlife).

2.1 Human Receptor Criteria

Criteria for noise and vibration impacts from the Project on Human Receptors were selected from a combination of provincial and federal guidelines/standards. The following sub-sections describe the pertinent criteria for this Assessment and a summary of the criteria is provided in **Table 2.1-1**.

Table 2.1-1: Human Receptor Criteria

Criteria	Description	Source	Limit
Permissible Sound Level (PSL)	A sound level that is expected not to disturb normal sleep patterns; takes into account the existing noise environment at the receptor.	B.C. OGC Guideline (2018)	Unique to each receptor.[1]
Change in Percent of Highly Annoyed (Δ % HA)	Indicator of human annoyance level to noise impacts.	Health Canada (2017)	6.5%
Day-Night Sound Level (L_{dn})	Day-night sound level from project that demands mitigation requirements.	Health Canada (2017)	75 dBA
Ground Vibration Limit - Receptor	Vibration level from blasting, in terms of peak particle velocity, which is expected to be noticeable.	MECP (1985)	10 mm/s
Air Overpressure	Noise level from blasting, in terms of air overpressure, which is expected to cause annoyance.	MECP (1985)	120 dBL
Daytime Noise Emissions	Daytime sound level from Project that is not expected to cause disturbances for residences near mine site.	ECPMM (2009)	55 dBA
Nighttime Noise Emissions	Nighttime sound level from Project that is not expected to cause disturbances for residences near mine site.	ECPMM (2009)	45 dBA

[1] Additional details on the determination of the PSLs for the Human Receptors in this Assessment are provided in **Section 4.4**.

2.1.1 British Columbia Oil and Gas Commission Noise Control Best Practices Guideline (2018)

The B.C. Oil and Gas Commission (OGC) Guideline outlines a detailed procedure to determine a permissible sound level (PSL) for receptors in the vicinity of wells or industrial facilities. This PSL is determined such that noise impacts are generally not expected to interfere with normal sleep patterns and the PSL is also determined on a receptor-by-receptor basis. Additionally, the PSL takes into account continuous operations from the Project only, blasting noise impacts are assessed against separate criteria. To determine the PSL for a receptor, it is recommended that an ambient noise monitoring campaign be completed. Further details on this are provided in **Section 4.0**.

2.1.2 Health Canada Guidance for Evaluating Human Health Impacts in Environmental Assessment: NOISE (2017)

For the purposes of this Assessment, two criteria from the *Health Canada Guidance for Evaluating Human Health Impacts in Environmental Assessment: NOISE* (Health Canada Guideline) were considered. The first criteria relates to an "annoyance" metric. Specifically, the Health Canada Guideline refers to a % highly annoyed (% HA), which "can be thought of as an aggregate indicator of assorted noise effects, present to varying degrees, which are creating a negative effect on the community and which may not be measurable when considered as separate negative effects". Health Canada uses the change in % HA (Δ% HA) as an indicator of noise-induced human health effects with a value of 6.5% or greater corresponding to the requirement of mitigation measures.

Additionally, Health Canada also uses the value of the day-night sound level (L_{dn}, dBA) from a project at a receptor as a determining factor for mitigation measures. If the L_{dn} of a project is greater than 75 dBA, despite what the Δ% HA may be, mitigation measures are recommended. The Δ% HA and the L_{dn} criteria both place emphasis on nighttime noise impacts.

2.1.3 Ontario Ministry of the Environment Noise Pollution Control (NPC) – 119 (1985)

The Ontario Ministry of the Environment, Conservation and Parks (MECP, formerly MOE) NPC-119 provides specific criteria for blasting impacts at a receptor in terms of vibration levels, in mm/s, and air overpressure, in linear decibels (dBL). Specifically, NPC-119 provides cautionary limits for ground vibration of 10 mm/s and air overpressure of 120 dBL. The guideline also provides peak pressure limit for concussion from blasting of 128 dBL and Peak Particle Velocity limit for ground vibration from blasting of 12.5 mm/s. The latter peak values are not to be exceeded.

The criteria specified in NPC-119 are in line with limits specified in other jurisdictions and by other regulatory agencies (see below).

2.1.4 Environment Canada Environmental Code of Practice for Metal Mines (2009)

Environment Canada's (EC) Environmental Code of Practice for Metal Mines (ECPMM) recommends that ambient noise from mining operations not exceed 55 dBA during daytime hours and 45 dBA during nighttime hours at residences for continuous operations. The ECPMM recommends adhering to the same noise criteria for impacts on wildlife (see **Section 2.2** below).

2.2 Wildlife Receptor Criteria

Noise and vibration impact criteria for wildlife receptors are less thorough than those for human receptors, however the following criteria outlined below and presented in **Table 2.2-1** were used in this Assessment.

2.2.1 Environment Canada Environmental Code of Practice for Metal Mines (2009)

The ECPMM recommends that mining sites in remote locations aim to produce noise emissions of 55 dBA during daytime hours and 45 dBA during nighttime hours to try to reduce effects on wildlife. These sound levels are relative to continuous Project operations (i.e., mobile equipment, plant processes, trucking, etc.) and do not include impacts from blasting. These criteria will be assessed by analyzing sound level contours for noise emissions from the Project with respect to wildlife habitat areas. The ECPMM does not include criteria for vibration impacts on wildlife, therefore for the purposes of this Assessment the predicted vibration levels at Wildlife Receptors will be compared against the Human Receptor vibration level criterion of 10 mm/s.

2.2.2 Effects of Simulated Jet Aircraft Noise on Heart Rate and Behaviour of Desert Ungulates (1996)

For offsite peak noise levels (L_{peak}) from blasting, it is recommended that impacts at wildlife receptors remain below 108 dB. This value represents the possibility for disturbed wildlife habitat as L_{peak} values of 85 to 108 dB have been shown to cause significant responses and increases in heart rates in mammals (Weisenberger et al., 1996).

2.2.3 Department of Fisheries and Oceans Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (1998)

In addition to the above criteria, the Department of Fisheries and Oceans (DFO) Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (DFO Guideline) (Wright and Hopky, 1998) provides the following recommendations for blasting operations in close proximity to fish bearing waters:

- No explosive is to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change (i.e., overpressure) greater than 100 kPa (14.5 psi) in the swimbladder of a fish.
- No explosive is to be detonated that produces, or is likely to produce, a peak particle velocity greater than 13 mm/s in a spawning bed during the period of egg incubation.

Table 2.2-1: Wildlife Receptor Criteria

Criteria	Description	Source	Limit
Daytime Noise Emissions	Daytime sound level from Project that is not expected to cause disturbances for wildlife.	ECPMM (2009)	55 dBA
Nighttime Noise Emissions	Nighttime sound level from Project that is not expected to cause disturbances for wildlife.	ECPMM (2009)	45 dBA
Offsite Peak Noise Level, L_{peak} – At Wildlife Receptor	Threshold for peak noise level (L_{peak}) from blasting at wildlife receptors that is expected to cause disturbed habitat.	Weisenberger et al. (1996)	108 dB
Overpressure – At Aquatic Receptor	Threshold for overpressure (kPa/psi) level that can cause damage to fish.	Wright and Hopky (1998)	100 kPa / 14.5 psi
Vibration Limit - At Aquatic Receptor	Maximum vibration level from blasting, in terms of peak particle velocity, which should not be exceeded at fish spawning bed.	Wright and Hopky (1998)	13 mm/s

3.0 Study Area

3.1 Local Study Area

As described in **Section 1.1.1**, the Project area, and therefore the acoustic LSA is a greenfield site in the Kootenays, and is a combination of the Montane Spruce and Engelmann Spruce (Subalpine Fir) geoclimatic zones. The boundary of the acoustic LSA is based on identified sensitive receptors and environments within a 3-km radius of the Project footprint to be inclusive of terrestrial environments (e.g., wildlife habitat). As well, the acoustic LSA includes areas used for recreation (e.g., hunting) that could be impacted by noise and vibration levels.

3.2 Noise and Vibration Sensitive Receptors

Noise and vibration impacts from the Project were estimated at both human and wildlife receptors as required by the AIR. The following section describes the receptors used in this Assessment in detail.

3.2.1 Representative Human Receptors

A total of 12 representative Human Receptors were identified for this Assessment. These receptors are spread out across the LSA. Representative receptor locations were chosen based on their proximity to the Project and its noise/vibration generating activities. The descriptions for these receptors are provided in **Table 3.2-1** below. Receptors **R1** through **R6** were identified in 2017 as part of the ambient noise monitoring program that was carried out by Dillon for the Project. Receptors **R7** through **R12** were subsequently identified and included for the purposes of this assessment. Further details on this are provided in **Section 4.3.** The additional Human Receptors (**R7** – **R12**) were identified through consultation with Sparwood Fish and Wildlife and the Ktunaxa Nation Council (KNC), and through Land-Use/Socio-Economic studies.

The Human Receptor locations included in this assessment were assessed at a height of 1.5 m, 3.0 m, or 4.5 m to represent the open plane of the dwelling's top floor window and are presented in **Figure 3**.

Table 3.2-1: Representative Human Receptor Descriptions

Receptor ID	Location (UTM Coordinates)	Description of Receptor
R1	11 U, 5514686 mN, 664397 mE	Podrasky Cabin – Approximately 145 m east of the Alexander Creek Forest Service Road.
R2	11 U, 5521812 mN, 664578 mE	Snowmobile Cabin – Located off of a small unnamed road which splits from the Alexander Creek Forest Service Road at a helipad.
R3	11 U, 5522250 mN, 656550 mE	Unofficial Campsite – A small campsite which is located approximately 85 m southwest of the Grave Creek Forest Service Road/Clean Coal Haul Road.
R4	11 U, 5524777 mN, 655247mE	Grave Lake Seasonal Dwellings – Approximately 15 m west of Grave Lake Road.
R5	11 U, 5523283 mN, 652077mE	5568 Lower Elk Valley Road – Approximately 1.7 km west of the CN line and 600 m northwest of the end of the runway at the nearby Sparwood/Elk Valley Airport.
R6	11 U, 5518610 mN, 652190 mE	8882 Hidden Springs Road - Approximately 250 m northwest of the CN line and 3.15 km southwest of the runway at the nearby Sparwood/Elk Valley Airport.
R7	11 U, 5523456 mN, 653565 mE	KNC Crown HHRA and Sensory Receptor 4 – A representative location of a possible indigenous seasonal dwelling. Located approximately 35 m west of the section of Clean Coal Haul Road that runs south to the rail load out area.
R8	11 U, 5521874 mN, 657441 mE	Unofficial Campsite – A small campsite located approximately 1 km southeast of R3 and 65 m southwest of the Grave Creek Forest Service Road/Clean Coal Haul Road.
R9	11 U, 5524619 mN, 661584 mE	Trapline Cabin – A private cabin located approximately 740 m northwest of the explosives storage facility of the Project.
R10	11 U, 5515971 mN, 664191 mE	KNC Crown HHRA and Sensory Receptor 10 – A representative location of a possible indigenous seasonal dwelling. Located approximately 550 m south of the southernmost extent of the Project.
R11	11 U, 5521454 mN, 664764 mE	Cabin – A cabin located approximately 760 m east of the eastern extent of the Project and 400 m southeast of R2. Receptor location was identified by Sparwood Fish and Wildlife.
R12	11 U, 5521139 mN, 664863 mE	Cabin – A cabin located approximately 780 m east of the eastern extent of the Project and 730 m southeast of R2. Receptor location was identified by with Sparwood Fish and Wildlife.

3.2.2 Wildlife Receptors

There are numerous species of terrestrial wildlife that exist in the areas surrounding the Project that could be impacted by noise and vibration, as identified by the receptor VC list in **Table 7** of the AIR. These species range from small amphibians to large mammals and it is expected that they will habituate a variety of different terrains surrounding the Project. Additionally, several of the receptor VCs are expected to have seasonal movement patterns throughout the area surrounding the Project. Therefore, determining impacts at specific point locations, like in the case of Human Receptors (i.e., at residences, campground, cabins, etc.) is not feasible. As such, an area-based approach for determining operational noise impacts on terrestrial Wildlife Receptors was undertaken for this Assessment. The area-based approach consists of developing noise level contours in the areas surrounding the Project, with areas between contours depicting certain range of noise levels associated with the operations at the Project. This information was provided to Keefer Ecological Services Ltd. to determine impacts on wildlife habitat areas as part of the wildlife effects assessment.

For determining noise (air overpressure) and ground vibration impact on terrestrial Wildlife Receptors due to the Blasting Operations, levels are calculated at incremental setback distances from the pit (i.e., blast face), conservatively assuming no attenuation due to topography and pit depth. The incremental setback distances from the blast face range from 100 m to 2 km, in 100 m intervals up to 1 km from the blast face and at intervals of 500 m between 1 and 2 km from the blast face. As with the Continuous Operation noise from the Project, the blasting impact on wildlife (i.e,. air overpressure and ground vibration) was provided to Keefer Ecological Services Ltd. to determine impacts on wildlife habitat areas as part of the wildlife effects assessment for the Project. Further details on these receptor locations are provided in **Table 3.2-2**.

Table 3.2-2: Terrestrial Wildlife Receptor Locations for Blasting Impacts

Receptor ID	Setback Distance from Blasting Operations (m)
TR1	100
TR2	200
TR3	300
TR4	400
TR5	500
TR6	600
TR7	700
TR8	800
TR9	900
TR10	1000
TR11	1500
TR12	2000

In addition to the terrestrial Wildlife Receptors presented above, impacts from blasting were also assessed at Aquatic Receptors in the areas surrounding the Project. These receptor locations were provided to Dillon by Lotic Environmental and they are described in **Table 3.2-3** and presented in **Figure 4**. These locations are all representative of possible fish spawning locations and they are also located in the areas surrounding the pits associated with the Project (i.e., where significant amounts of blasting shall occur).

Table 3.2-3: Aquatic Receptor Descriptions

Receptor IDs	Location (UTM Coordinates)	Aquatic Receptor Description
AQR1	11 U, 5518396 mN, 662700 mE	West Alexander Creek – Located inside of Project Footprint
AQR2	11 U, 5516285 mN, 663965 mE	West Alexander Creek – Approximately 200 m south of Project Footprint.
AQR3	11 U, 5515900 mN, 664119 mE	Alexander Creek Reach 7 – Approximately 615 m south of Project Footprint.
AQR4	11 U, 5519044 mN, 664742 mE	Alexander Creek Reach 9 – Approximately 530 m east of Project Footprint.
AQR5	11 U, 5524122 mN, 660960 mE	Unnamed tributary of Grave Creek 1 – Approximately 195 m south of Truck Loadout Loop.

4.0 Baseline Noise

Ambient noise monitoring was performed in 2017 to determine ambient noise levels at Human Receptors in the acoustic LSA as stipulated by Section 6.1 in the Guidelines for the Preparation of an Environmental Impact Statement (EIS) for the Crown Mountain Coking Coal Project (Canadian Environmental Assessment Agency [CEAA], 2015) and Section 4.1.2 of the AIR. The details of the ambient noise monitoring study and the results are outlined below. Further details on the ambient noise monitoring campaign can be found in **Appendix A**.

4.1 Monitoring Methodology

An ambient noise monitoring program was undertaken to establish ambient noise levels at selected representative receptors. The program consisted of gathering hourly A-weighted sound level equivalents (i.e., Leq(A)) on a continuous basis at the nearest representative receptors. A-weighted decibels are defined as "the sound level as measured on a sound level meter using a setting that emphasized the middle frequency components similar to the frequency response of the human ear at levels typical of rural backgrounds in mid frequencies" (B.C. OGC 2018). Six receptors locations were chosen, near residences, cabins, and campsites. The noise monitoring was conducted between August 21st and 28th, 2017 (inclusive).

The ambient noise monitoring program was completed using six Rion NL-22 Type II noise level meters. The instruments were calibrated in the laboratory. Measurement methodology was based on CAN/CSA-ISO 1996-1 and the Ontario Ministry of the Environment (MOE) noise publication document NPC-103 (1978). The NL-22 units were equipped with an environmental enclosure, an external battery and a wind screen to protect the microphone from wind and precipitation. The units were either on the ground locked to a tree or hanging from a tree using a chain and lock, with the microphone hanging from a branch to prevent an animal from being able to reach the microphone.

The following information was recorded in the field when the equipment was set up, checked, and disassembled:

- Noise meter identifier;
- Start time;
- Location of the receptor placement including GPS points;
- Record of conversations with residents;
- Explanation of selected receptor location;
- Audible sources observed nearby;
- Battery status and length of time recording (when checking and disassembling the meters);
- State of microphone and meter (dry or wet); and
- Stop time.

It is assumed that coal mining operations at Teck's Elkview Operations 8 km southwest of the Project area and Line Creek Operations 12 km north of the Project area were ongoing during the ambient noise monitoring.

4.2 Monitoring Locations

The locations of the ambient noise monitoring locations are presented in **Table 3.2-1** and **Figure 5**. Descriptions of the monitoring locations are provided below.

4.2.1 Receptor 1 – Podrasky Cabin (ML1)

The unit was chained to the base of a tree, with the microphone hanging from a tree branch above. Due to occupants in the Podrasky Cabin at the time of the noise measurements, the meter was set up approximately 200 m from the cabin in order to minimize the noise interference from the cabin. This location was selected since it is the closest permanent residence to the proposed project area.

4.2.2 Receptor 2 – Snowmobile Cabin (ML2)

The unit was chained to the base of a tree, with the microphone hanging from a tree branch above. This location was selected since the snowmobile cabin is the only residence (seasonal or permanent) in the area and is in close proximity to the proposed project area.

4.2.3 Receptor 3 – Unofficial Campsite (ML3)

The unit was chained to the mid-section of a tree with the microphone sticking horizontally outside of the pelican case. This location was selected to capture the ambient noise in the campground area, which is adjacent to the proposed haul road (Grave Creek Forest Service Road). There were no campers at the campground during the meter set up or take-down, as well as when the meter was checked throughout the monitoring period.

4.2.4 Receptor 4 – Grave Lake Seasonal Dwellings (ML4)

The unit was chained to the base of a tree, with the microphone hanging from a tree branch above. This location was selected to capture the ambient noise near the Grave Lake Campground and Boat Launch as well as it being in close proximity to the residences on the western side of Grave Lake. Attempts were made to set up the meter in the yard of one of the residences on the west side of Grave Lake, however residents were either not home or did not give permission to set up the meter on their property. The Grave Lake Campground and Boat Launch was very busy at the time of the noise monitoring and there was a risk of tampering with the equipment if it was set up in the campground. Therefore, a discreet location in the forest across Grave Lake Road was chosen.

4.2.5 Receptor 5 – 5568 Lower Elk Valley Road (ML5)

The unit was chained to the mid-section of a tree in the backyard of 5568 Elk Valley Road, with the microphone hanging from a tree branch above. The microphone was hung from a branch higher up the tree to avoid the dog living at the residence from reaching it. There was a dog kennel on the adjacent property approximately 50 m east of the receptor. Attempts were made to find another yard in which to set up the meter (farther away from the kennel), however residents were either not home or did not give permission to set up the meter on their property. This location was selected to capture the ambient noise in the residential area on Lower Elk Valley Road.

4.2.6 Receptor 6 – 8882 Hidden Springs Road (ML6)

The unit was chained to the base of a tree, in the backyard of 8882 Hidden Springs Road, with the microphone hanging from a tree branch above. The microphone was hung from a branch higher up the tree to avoid the dog living at the residence from reaching it. This location was selected to capture the ambient noise in the residential area on Hidden Springs Road and Lower Elk Valley Road.

4.2.7 Additional Human Receptors (Receptor 7 – Receptor 12)

As mentioned in **Section 3.2.1**, a total of six additional Human Receptors (**R7** through **R12**) were brought to the attention of Dillon after the ambient noise monitoring campaign was completed. These receptors include a campground, a trapline cabin, private cabins, and representative locations for possible indigenous seasonal dwellings as identified by the KNC.

As these receptors were not identified during the ambient noise monitoring campaign, background sound level measurements at these locations were not taken. Therefore, it was assumed that the results from the closest ambient monitoring locations to the new receptor locations would be applicable. The associated monitoring locations (MLs) and Human Receptor IDs are shown in **Table 4.2-1**.

Table 4.2-1: Associated Noise Monitoring Locations with New Receptors

Monitoring Location ID	Associated Human Receptor ID(s)
ML1	R1, R10
ML2	R2, R9, R11, R12
ML3	R3, R8
ML4	R4
ML5	R5, R7
ML6	R6

4.3 Ambient Noise Monitoring Results

The gathered noise data was analyzed for average, maximum and minimum LeqA and L90, for both daytime hours (0700 to 2200) and nighttime hours (2200 to 0700). These results are summarized in **Table 4.3-1**. The Monitoring Locations IDs presented in these tables align the Receptor IDs presented in **Table 3.2-1** for receptors **R1** through **R6**. For the Receptor IDs **R7** through **R12** in **Table 3.2-1**, the ambient noise monitoring results of the closest monitoring location were assumed to be applicable for these receptors.

Table 4.3-1: Measured Leq Levels (dBA)

Monitoring Location ID	Associated Human Receptor ID(s)[3]	Measured Hourly Sound Pressure Levels (dBA) [4]	
		Daytime[1] Leq avg	Nighttime[2] Leq avg
ML1	R1, R10	38	37
ML2	R2, R9, R11, R12	47	47
ML3	R3, R8	47	46
ML4	R4	36	29
ML5	R5, R7	49	40
ML6	R6	46	44

1 Daytime hours are between 0700 and 2200.

2 Nighttime hours are between 2200 and 0700.

3 Receptor IDs **R7** – **R12** were assumed to have similar acoustic environments to the nearest ML.

4 Sound pressure levels have been rounded to the nearest whole number.

4.4 Permissible Sound Level Determination

The PSL was calculated for each Human Receptor as described in **Section 2.1**. The cumulative noise impact at each Human Receptor from regular operations associated with the Project will be logarithmically summed with the ambient sound level (ASL) to determine the Application Case Sound Level, which will then be compared against the PSLs presented in **Table 4.4-1** to determine compliance or the need for implementation of noise mitigation measures. Further details on the determination of the ASLs and PSLs presented in **Table 4.4-1** can be found in **Appendix A**.

Table 4.4-1: Daytime and Nighttime ASLs and PSLs (dBA) for Human Receptors in LSA

Monitoring Location ID	Associated Representative Human Receptor ID(s)[3]	Daytime[1] ASL (dBA)	Nighttime[1] ASL (dBA)	Daytime[1] PSL (dBA)	Nighttime[2] PSL (dBA)
ML1	R1, R10	45	35	50	40
ML2	R2, R9, R11, R12	55	45	60	50
ML3	R3, R8	55	45	60	50
ML4	R4	39	29	44	34
ML5	R5, R7	48	38	53	43
ML6	R6	53	43	58	48

[1] Daytime hours are between 0700 and 2200.

[2] Nighttime hours are between 2200 and 0700.

[3] Receptor IDs **R7** – **R12** were assumed to have similar acoustic environments to the nearest ML.

5.0 Noise and Vibration Assessment Methodologies

5.1 Noise Propagation Modelling

Method Selection Factors

Sound power levels for dominant on-site noise sources were used as input to the predictive computer model CADNA/A noise prediction software developed by DataKustik GmbH. The outdoor noise propagation model is based on ISO Standard 9613, Part 1: Calculation of the absorption of sound by the atmosphere, 1993 and Part 2: General method of calculation (ISO-9613-2:1996). The model is capable of incorporating various site specific features, such as elevation, berms, absorptive grounds, and barriers to accurately predict noise levels at specific receptors, pertaining to noise emissions from particular source/sources. The ISO based model accounts for reduction in sound level due to increased distance and geometrical spreading, air absorption, ground attenuation, and acoustical shielding by intervening structures and topography. The model is considered conservative as it represents atmospheric conditions that promote propagation of sound from source to receiver.

5.2 Parameters / Assumptions for Calculations

Source specific noise data was input into the CADNA/A software to model the noise impacts at the selected nearest receptors. The significant stationary noise sources were modelled as point sources or moving point sources.

Reflections

Conservatively, sources were modelled assuming a second order reflection. This modelling parameter accounts for multiple sound reflections off of surfaces within the modelling domain.

Ground Absorption

Noise propagation can be impacted by the physical properties of the ground located between noise sources and receptors. Ground surfaces that are acoustically reflective, such as concrete pads, calm water bodies, or asphalt parking lots, have ground absorption coefficients G = 0. For acoustically absorptive surfaces, such as grassy fields or forested areas, G = 1.

For the noise modeling performed in this Assessment, a global ground absorption coefficient of 0.7 was used to represent the predominantly forested and undeveloped areas that exist between the Project Footprint and the surrounding sensitive receptors. Waterbodies within the noise LSA were assigned local ground absorption coefficients of 0 to represent their acoustically reflective properties. Various pads throughout the Project Footprint were assigned local G = 0.2 as the ground surface in these areas will likely be packed gravel.

Sound Quality

The dominant noise sources associated with regular operations were considered to emit noise on a continuous, steady-state manner. Noise impacts from blasting were assessed separately as described in **Section 2.0**.

Terrain and Foliage

The Project is located in a mountainous area with drastic changes in elevations throughout the acoustic LSA. As such, the topography of the LSA, in the form of 10 m contours, was incorporated into the noise modelling domain. In the areas surrounding the Project, there is also a large amount of forested areas. Through the investigation of satellite imagery and photographs taken as part of the ambient noise monitoring campaign, several forested areas were incorporated into the model as foliage with a default height of 3 m.

Noise Source Locations

The fixed equipment Project noise source locations were based on Project Footprint Auto CAD drawings obtained directly from NWP. Mobile equipment noise sources, excluding the Rail Loadout (RLO) and the Clean Coal Haul Road sources which had set locations based on the Project Footprint, were placed in worst-case locations as point sources based on Project areas where the equipment could be located. These locations were chosen to place the equipment closest to the nearest receptor of that Project area.

Coal Haul Road and Rail Loadout (RLO) Source Counts

The Coal Haul Road connects the eastern portion of the Project, where the pits and CHPP are located, to the RLO area at the western edge of the site. This road is approximately 14 km with a posted speed limit of 50 km/hr. Through discussions with NWP staff, the estimated maximum vehicular traffic counts on the Coal Haul Road were determined. The estimated counts presented in **Table 5.2-1** were incorporated into the noise assessment for this project except for the management vehicle trips. Noise impacts from this source, being a pick-up truck, were assumed to be insignificant compared to the noise emissions from the other vehicles on the haul road, which are typically large diesel-engine trucks. Additionally, the “Other”, “Diesel”, and “Explosives” delivery vehicles were assumed to only operate during daytime hours.

Table 5.2-1: Maximum Estimated Number of Vehicle Trips per Day on Haul Road

Vehicle Type	Round Trips per Day
Coal Haul Trucks	86
Management (Pick-up Truck)	40
Other Deliveries	5
Crew Bus	4
Diesel	3
Explosives	2
Total Trips	**140**

The RLO is located on the western side of the Project Footprint. The RLO has a looped-configuration, as shown by **Figure 1**, which connects directly to the Canadian Pacific (CP) Fording River Subdivision Main Track. The details of the trains that arrive onsite are provided in **Table 5.2-2** and it was assumed that the locomotives of the trains would operate at a throttle setting of eight, as per the Federation of Canadian Municipalities/Railway Association of Canada (FCM/RAC) Guidelines (FCM/RAC, 2013). Based on the radii of the four curved track sections in the RLO, it was assumed that wheel-squeal noise would be present at these locations. It was also assumed that onsite trains could operate during daytime or nighttime hours.

Table 5.2-2: RLO Details

Locomotive Type	Number of Locomotives per Train	Number of Cars per Train	Assumed Average Speed (km/hr)	Number of Train Trips per Year
Diesel-electric	Four	152	1	120

5.3 Blasting Overpressure and Vibration Impacts

Shockwave propagation from blasting through the ground and air results in ground vibration and blast air overpressure, respectively. The wavelengths and amplitudes of the elastic blasting wave change with distance. The rate of attenuation (reduction of energy) of the blast wave decreases with distance. Other factors that impact the attenuation of energy through the ground include density of rock, presence of joints in the rock, and how saturated the rock layers are between the blast site and receptor locations.

Ground Vibration

Site specific parameters that impact propagation of waves through the ground can be established through conducting several controlled test blasts and measuring ground vibration at various distances from the blast site. The data is then used to establish site-specific empirical relation/values for calculating vibration at sensitive receptor locations in proximity of the blast site.

Ground vibration is expressed as Peak Particle Velocity (PPV) in mm/s (or cm/s). The general equation used to determine PPV is as follows:

$$PPV = K\left(\frac{R}{\sqrt{W}}\right)^{\beta}$$

Where,

R = Distance to nearest sensitive receptor (m)
W = Maximum charge weight per delay (kg)
K and β = Site specific parameters

In the case of this Project where site specific empirical values were not established, relevant data has been obtained from a noise and vibration study that was completed for a nearby coal mine (Maxxam, 2015). The following constants, which were taken from the nearby study, were used for this Assessment:

K = 1181
β = -1.45

Blast details including the number of wholes and quantity of ANFO is provided in **Table 6.2-1**. Calculation details including area-specific parameters and modified equation are provided in **Appendix C**.

Air Overpressure

Similar to ground vibration, air overpressure is a function of distance, quantity of explosive used per delay, and site specific factors. The overpressure is typically expressed as 'Peak Sound Pressure Level' (PSPL/L_{peak}) in dBL, and calculated using the following equation:

$$PSPL = M\left(\frac{R}{\sqrt[3]{W}}\right)^{e}$$

Where,
R = Distance to nearest sensitive receptor (m)
W = Maximum charge weight per delay (kg)
M and e = Site specific parameters

In the case of this Project where site specific empirical values were not established, relevant data has been obtained from a noise and vibration study that was completed for a nearby coal mine. The following constants, which were taken from the nearby study, were used for this Assessment:

M = 168
e = - 0.095

For determining substrate vibration and pressure in water induced by blasting, the methodology specified in the *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* (DFO, 1998) was used. The details of these calculations, including assumptions are presented in **Appendix C**.

6.0 Noise Source Summary

Significant noise sources associated with the Project are split into two primary categories: Continuous Operations and Blasting Operations. As described in **Section 2.0**, impacts from these two groups of sources are assessed separately. The following sections describe the two groups of sources in further detail.

6.1 Continuous Operations

Continuous Operations noise sources associated with the Project include equipment associated with the Coal Handling and Preparation Plant, all mobile equipment in the pit/waste rock areas/roads, the RLO area, and all coal transportation sources. These sources are discussed in greater details in the following sub-sections.

6.1.1 Fixed Equipment

The fixed equipment located within the Project Footprint that was assessed for noise emissions as part of this Assessment are presented in **Table 6.1-1**. As visible from **Figures 6** to **8**, the fixed equipment sources are distributed throughout the Project Footprint. Several of these sources are located within the Coal Handling and Preparation Plant (CHPP), as indicated by a Source Location of "I" in **Table 6.1-1**. Conservatively, it was assumed that the walls/roof of the CHPP did not have any sound attenuation effects on these sources. All of the sources presented in **Table 6.1-1** were assumed to operate simultaneously and continuously for daytime and nighttime hours.

Table 6.1-1: Noise Source Summary Table – Fixed Equipment

Source ID	Source Description	Quantity	Sound Power Level (dBA)	Source Location [1]	Sound Characteristics [2]	Noise Control Measures [3]
FB_101	Feeder Breaker	1	92	O	S	U
SC_101	Raw Coal Vibrating Screen	1	93	O	S	U
RB_101	Rotary Breaker	1	90	O	S	U
RC_801	Cogar RLO Reclaim Feeder 1	1	91	O	S	U
RC_802	Cogar RLO Reclaim Feeder 2	1	91	O	S	U
TH_601	Outotec Tank Mixer Motors	1	89.8	O	S	U
TH_701	Outotec Tank Mixer Motors	1	89.8	O	S	U
TB_920	Pacific Boiler Steam Boiler	1	94	I	S	U
BN_801	BN-801 Shaker	1	131.7	O	S	U
STW	Special Trackworks (Train Crossover)	1	104.3	O	S	U
TLO_DC	Train Loadout Bin Dust Collector	1	105.9	O	S	U
EF_3	Wall Mounted Exhaust Fan 3	1	98.7	I	S	U
EF_2	Wall Mounted Exhaust Fan 2	1	98.7	I	S	U
EF_1	Wall Mounted Exhaust Fan 1	1	98.7	I	S	U
CV_802A	Overland Conveyor Drive 1, 150 kW	1	102	O	S	U
CV_802B	Overland Conveyor Drive 2, 150 kW	1	102	O	S	U
RC_801B	Product Coal Reclaim Feeder Chain Drive, 186 kW	1	102.4	O	S	U
RC_802B	Product Coal Reclaim Feeder Chain Drive, 186 kW	1	102.4	O	S	U
CV_805	Train loadout conveyor drive, 450 kW Electric Motor	1	103.4	O	S	U

Source ID	Source Description	Quantity	Sound Power Level (dBA)	Source Location [1]	Sound Characteristics [2]	Noise Control Measures [3]
FE_401	Aury Deslime Screen Feeder	1	93	I	S	U
SC_402	Conn-Weld Vibrating Screen	1	103.5	I	S	U
SC_401	Conn-Weld Vibrating Screen	1	103.5	I	S	U
SC_401	Conn-Weld Vibrating Screen	1	103.5	I	S	U
PF_601	Bokela Hyperbaric Disc Filter	1	93	I	S	U
AC_602	Atlas Copco HDF Air Compressor	1	90.4	I	S	U
AC_601	Atlas Copco HDF Air Compressor	1	90.4	I	S	U
AC_602_D	Atlas Copco HDF Air Compressor Dryer	1	99	I	S	U
AC_601_D	Atlas Copco HDF Air Compressor Dryer	1	99	I	S	U
AC_901	Atlas Copco Air Compressor	1	85	I	S	U
CY_401	Multotec Dense Medium Cyclone	1	93	I	S	U
SV_401	Joest Product and Reject Screen Pre-drain (Two Motors Each)	1	79	I	S	U
SV_402	Joest Product and Reject Screen Pre-drain (Two Motors Each)	1	79	I	S	U
CF_402	Conn-Weld Vibrating Screen	1	93.2	I	S	U
CF_401	Conn-Weld Vibrating Screen	1	93.2	I	S	U
CV_101	Raw Coal Conveyor Drive	1	77	O	S	U
CV_102	Plant Feed Conveyor Drive, 110kW	1	82	O	S	U
CV_801	Conveyor Drive, 75kW	1	80	O	S	U

Source ID	Source Description	Quantity	Sound Power Level (dBA)	Source Location [1]	Sound Characteristics [2]	Noise Control Measures [3]
CV_701	Reject Conveyor Drive, 90kW	1	82	O	S	U

1. Source Locations	2. Sound Characteristics	3. Noise Control Measures
O – located/installed outside the building, including on the roof	S – Steady	S – silencer, acoustic louver, muffler
I – located/installed inside the building	Q – Quasi Steady Impulsive	A – acoustic lining, plenum
	I – Impulsive	B – barrier, berm, screening
	B – Buzzing	L – lagging
	T – Tonal (includes +5 dB penalty)	E – acoustic enclosure
	C – Cyclic	O – other
	Int – Intermittent	U – uncontrolled

6.1.2 Mobile Equipment

Similarly to the fixed equipment, the mobile equipment associated with the Project are distributed across the Project Footprint. As described in **Section 5.2**, the mobile equipment locations were determined based on predicted worst-case noise impacts on the nearby receptors. All of the sources presented in **Table 6.1-2** were assumed to operate simultaneously and continuously for daytime and nighttime hours, except for the backup beepers (Source ID: **BCKUP_BPR**). These sources were assumed to operate for up to 10 minutes of any given hour during daytime or nighttime and have tonal characteristics (a tonal penalty of +5 dB was applied). Additionally, backup beeper noise sources were only applied to the Komatsu 830E5 Electric Drive Dump Trucks and the Komatsu PC5500 Excavators (Source IDs: **EDT_830E5** and **EX_PC5500**, respectively) as the sound data provided for these pieces of equipment did not account for backup beepers operating in conjunction with the vehicle. Additionally, the explosives deliveries and diesel/other deliveries (Source IDs: **DELIV_EX** and **DELIV_T**, respectively) were assumed to occur only during daytime hours.

For certain pieces of equipment listed in **Table 6.1-2**, it was determined that a different, but comparable, make and model of equipment could be used in lieu of those presented. In these cases, the make and model combination that had the highest sound power level (dBA) was used in the Assessment. This ensured that the worst-case noise emissions from the mobile equipment were captured. Additionally, the quantities for mobile equipment in **Table 6.1-2**, represent the maximum for equipment counts based on actual counts that will be used and projected equipment location distributions across the Project. For certain pieces of equipment, this resulted in an over-estimation of equipment counts.

As described in **Section 5.2**, it was assumed that wheel squeal (Source IDs: **RLO_WS1** – **WS4**) will be present at the RLO based on the radii of the curved track sections. These sources were assumed to be tonal in nature and a tonal penalty of +5 dB was applied. Additional details for the onsite trains that were modelled for noise impacts are provided in **Table 5.2-2**.

Table 6.1-2: Noise Source Summary Table – Mobile Equipment

Source ID	Source Description	Quantity	Sound Power Level (dBA)	Source Location [1]	Sound Characteristics [2]	Noise Control Measures [3]
C_BUS	Crew Bus	2/hour	107.1	O	S	U
DELIV_EX	Explosives deliveries	2/hour	107.1	O	S	U
DELIV_T	Diesel and other deliveries	2/hour	107.1	O	S	U
HT_E	Coal Haul Truck - Empty	2/hour	111.6	O	S	U
HT_F	Coal Haul Truck - Full	2/hour	111.6	O	S	U
RLO_WS1	Rail Load Out Wheel Squeal	-	108.4	O	T	U
RLO_WS2	Rail Load Out Wheel Squeal	-	108.4	O	T	U
RLO_WS3	Rail Load Out Wheel Squeal	-	108.4	O	T	U
RLO_WS4	Rail Load Out Wheel Squeal	-	108.4	O	T	U
G_24	CAT 24M Grader	2	111	O	S	U
EX_390D	CAT 390D Excavator	4	110	O	S	U
ADT_740GC	CAT 740 GC Articulated Dump Truck	4	110	O	S	U
L_992K	CAT 992K Wheel Loader	1	119	O	S	U
L_994K	CAT 994K Wheel Loader	1	119	O	S	U
D_D10T	CAT D10T Dozer	7	114	O	S	U
G_16M	CAT 16M Grader	1	111	O	S	U
D_834	CAT834 Rubber Tire Dozer	1	114	O	S	U
EDT_830E5	Komatsu 830E5 Electric Drive Dump Truck	26	118	O	S	U
WT_HD1500	Komatsu HD1500 Water Truck	2	118.2	O	S	U
EX_PC5500	Komatsu PC5500 Excavator	3	122	O	S	U
PVD_275	PVD-275 Blast Hole Driller	3	119	O	S	U

Source ID	Source Description	Quantity	Sound Power Level (dBA)	Source Location [1]	Sound Characteristics [2]	Noise Control Measures [3]
EXP_T	On-site Explosives Delivery Truck	2	111.6	O	S	U
FL_TRK	On-site Fuel and Lube Truck	2	111.6	O	S	U
BCKUP_BPR	Backup Beeper	29	107	O	T	U

1. Source Locations	2. Sound Characteristics	3. Noise Control Measures
O – located/installed outside the building, including on the roof	S – Steady	S – silencer, acoustic louver, muffler
I – located/installed inside the building	Q – Quasi Steady Impulsive	A – acoustic lining, plenum
	I – Impulsive	B – barrier, berm, screening
	B – Buzzing	L – lagging
	T – Tonal (includes +5 dB penalty)	E – acoustic enclosure
	C – Cyclic	O – other
	Int – Intermittent	U – uncontrolled

6.2 Blasting Operations

The Blasting Operations for Year 4 and Year 10 were analyzed for this Assessment as the site conditions and operations for Year 4 and 10 represent the predicted worst-case noise and vibration impacts based on the details provided in **Table 6.2-1** and the proximity of the blasting locations relative to the sensitive receptors.

The blasting impacts at the receptors in this Assessment were assessed against the Blasting Operations in Year 10, except for the Aquatic Receptor **AQR1**. For this receptor, the assessment of Blasting Operations was completed for Year 4 of the Project as this receptor is within the Project Footprint and after Year 4, the receptor is removed to expand the waste rock area of the Project. The details provided in **Table 6.2-1** were used in conjunction with Project Footprint drawings and above-mentioned calculation methodologies to determine ground vibration and air overpressure impacts at nearby sensitive receptors.

Table 6.2-1: Year 4 and Year 10 Blasting Details

Blasting Parameter	Quantity	
	Year 4 – North Pit	Year 10 – South Pit
Number of Blasts per Year	316	283
Average Number of Blasts per Day	0.99	0.89
Maximum Number of Blasts per Day	3	3
Average Holes per Blast	86	129
Maximum Holes per Blast	171	214
Charge Depth (m)	10	10
ANFO (%)	82	82
Emulsion (%)	18	18

7.0 Noise and Vibration Effects Assessments

The noise and vibration impacts from the Project on surrounding sensitive receptors have been split into the following two categories: Continuous Operations and Blasting Operations. The respective impacts from each of these categories are presented in the following sections.

7.1 Continuous Operations Impacts

Noise impacts from Continuous Operations of the Project are expected to impact both Human and Wildlife receptors; excluding Aquatic Receptors which are only expected to be impacted by Blasting Operations. Continuous Operations Impacts on Human and Wildlife receptors are presented in the following sections.

7.1.1 Human Receptor Continuous Operations Impacts

Noise Impacts from Continuous Operations on Human Receptors were compared against various provincial and federal guidelines, as described in **Section 2.1**. The first criteria that these impacts were compared against was the B.C. OGC's PSL, which is explained further in **Section 4.4** and **Appendix A**. This criteria, which is calculated based on the existing ambient noise environment of a given receptor and adjusted according to the B.C. OGC Guideline, is split into daytime and nighttime categories with a greater emphasis on nighttime noise impacts.

Table 7.1-1 and **Figure 9** provide the predicted sound levels at each Human Receptor for daytime and nighttime periods. Additionally, sound level contours at a height of 1.5 m are provided for daytime and nighttime Continuous Operations in **Figure 10** and **11**, respectively. As visible from the presented sound levels, there is little variation in the daytime and nighttime impacts at each receptor. This is because most Continuous Operations associated with the Project operate during both daytime and nighttime hours, with the exception of certain Clean Coal Haul Road (Source IDs: **DELIV_EX** and **DELIV_T**) sources which operate during daytime only.

For the Representative Human Receptors investigated for this Assessment, the predicted sound levels from Continuous Operations during daytime hours are less than their respective PSLs. The receptor with the greatest daytime predicted sound level from the Project's Continuous Operations, which is 47.7 dBA as presented in **Table 7.1-1**, is **R7**. This resulted in an Application Case daytime sound level of 51.4 dBA. This receptor is located northwest of the RLO and approximately 37 m west of the Clean Coal Haul Road. The primary noise sources that impact this receptor are the Coal Haul Trucks (Source IDs: **HT_F** and **HT_E**) and secondarily are various equipment associated with the RLO. Despite this being the Human Receptor with the highest predicted daytime sound level from Continuous Operations, this sound level is comparable to being 1 m away from a household refrigerator (FCM/RAC, 2013).

With respect to nighttime impacts from Continuous Operations, Application Case predicted sound levels at **R7** and **R10** were determined to be greater than their respective PSLs. The Application Case nighttime sound levels at **R7** and **R10** were calculated to be 48.2 dBA (5.2 dBA in excess of PSL) and 41.8 dBA (1.8 dBA in excess of PSL), respectively. As previously mentioned, for **R7**, the primary noise sources that impact this receptor are the Coal Haul Trucks. At **R10**, which is located approximately 565 m south of the eastern side of the Project footprint, the primary contributors to noise impacts are dump trucks (Source IDs: **EDT_830E5**). Specifically, the Komatsu 830E5 Electric Dump Trucks located northwest of the Main Sediment Pond, as shown by **Figure 1**.

As described in **Section 4.4** of the B.C. OGC Guideline, "*If a well or facility operation is found to exceed the PSL, the permit holder should provide both a detailed noise control mitigation plan and a timeline as to when adherence to the PSL will be achieved.*" Based on this, noise mitigation measures for these two receptors are required. However, as described in **Section 3.2.1**, receptors **R7** and **R10** are both considered "*a representative location of a possible indigenous seasonal dwelling*". As such, there are currently no dwellings at these two locations. If mitigation measures were to be developed for these "representative locations", compliance issues for possible future indigenous dwellings in the nearby surrounding areas could arise.

Therefore, it is the recommendation of this report to postpone developing mitigation measures for each of these receptors until such time that these locations, or locations in the vicinity of the receptors, become occupied. This will allow for the development of a location-specific mitigation plan which will effectively target problem noise sources and provide sufficient mitigation to meet the applicable criteria. Development of mitigation measures (if required) post occupancy also eliminates the possibility of creating access issues for the subject lands (e.g., barriers or berms reducing/block access to the areas).

Table 7.1-1: Receptor Sound Levels (dBA) and Application Case Sound Levels (dBA) Compared to PSLs from Continuous Operations

Receptor ID	Point of Reception Description	Time of Day [1], [2]	Predicted Sound Level at Receptor (dBA) (L_{eq})	Application Case Sound Level (dBA) (L_{eq})[3]	PSL (dBA)	Application Case Less than PSL?
R1	Cabin	Daytime	36.6	45.6	50	Yes
		Nighttime	36.6	38.9	40	Yes
R2	Cabin	Daytime	29.1	55	60	Yes
		Nighttime	29.1	45.1	50	Yes
R3	Campground	Daytime	45.6	55.5	60	Yes
		Nighttime	44.5	47.8	50	Yes
R4	Residence	Daytime	32.2	39.8	44	Yes
		Nighttime	31.7	33.6	34	Yes
R5	Residence	Daytime	36.3	48.3	53	Yes
		Nighttime	36.3	40.2	43	Yes
R6	Residence	Daytime	23.8	53	58	Yes
		Nighttime	23.9	43.1	48	Yes
R7	Representative location of a possible indigenous seasonal dwelling.	Daytime	47.7	51.4	53	Yes
		Nighttime	**47.7**	**48.2**	43	**No**
R8	Campground	Daytime	45	55.4	60	Yes
		Nighttime	43.9	47.5	50	Yes
R9	Cabin	Daytime	43.3	55.3	60	Yes
		Nighttime	42.9	47.1	50	Yes
R10	Representative location of a possible indigenous seasonal dwelling.	Daytime	40.8	46.4	50	Yes
		Nighttime	**40.8**	**41.8**	40	**No**
R11	Cabin	Daytime	31.5	55	60	Yes
		Nighttime	31.5	45.2	50	Yes
R12	Cabin	Daytime	34.1	55	60	Yes
		Nighttime	34.1	45.3	50	Yes

[1] Daytime hours are between 0700 and 2200.

[2] Nighttime hours are between 2200 and 0700.

[3] Application Case Sound Levels represent the logarithmic sum of the Predicted Sound Level and the ASL (see **Section 4.4)** (B.C. OGC, 2018).

In addition to the criteria for noise impacts prepared by the B.C. OGC, Health Canada has two metrics for quantifying noise impacts and determining if mitigation is required; the change in Δ HA % and L_{dn}. Further details on the determination of these two metrics are provided in **Appendix B**.

The results presented in **Table 7.1-2** indicate that the Health Canada criteria for noise impacts at Human Receptors from Project noise are met at the receptors identified in this Assessment. The Human Receptor **R10** was determined to have the closest Δ% HA and L_{dn} to the respective criteria. This is associated with the proximity of this receptor to the operations in the south pit and the fact that this receptor is otherwise located in a rural setting (i.e., low ambient noise levels), and therefore the determination of its Δ% HA and L_{dn} required a rural area adjustment, as shown in **Appendix B**.

Table 7.1-2: Change in % Highly Annoyed (Δ% HA) and day-night sound levels (L_{dn}) compared against applicable Health Canada Criteria

Receptor ID	Δ% HA	Δ% HA > 6.5%?	L_{dn} (dBA)[1]	L_{dn} > 75 dBA?
R1	2.8	No	63.0	No
R2	0.1	No	59.7	No
R3	2.4	No	61.8	No
R4	1.4	No	59.6	No
R5	0.3	No	61	No
R6	0.0	No	58.1	No
R7	3.4	No	63.6	No
R8	2.2	No	61.6	No
R9	1.5	No	61.2	No
R10	6.1	No	65.3	No
R11	0.1	No	59.8	No
R12	0.2	No	59.9	No

The ECPMM also provides guidance for noise impacts from facility noise on nearby receptors as described in **Section 2.1.4**. Specifically, the ECPMM recommends that daytime and nighttime noise impacts from residences not exceed 55 and 45 dBA, respectively. As visible from the predicted sound levels presented in **Table 7.1-1** and **Figure 9**, no receptors are expected to experience daytime sound levels from the Project above 55 dBA from Continuous Operations.

For nighttime impacts, **R7** is expected to exceed the ECPMM noise criterion of 45 dBA. This would result in a trigger for implementing noise mitigation measures, however as previously discussed, this receptor is a representative location of a dwelling and it is recommended that mitigation options be investigated if/when a residence is established in this location or the surrounding area.

7.1.2 Wildlife Receptor Continuous Operations Impacts

Noise impacts across wildlife habitat areas surrounding the Project are presented in the form of noise level contours in **Figures 12** and **13** for daytime and nighttime, respectively. These contours represent expected noise impacts at a height of 1.5 m from the Continuous Operations of the Project in the surrounding areas. As outlined in **Section 2.1.4**, off-site daytime sound levels of 55 dBA and nighttime sound levels of 45 dBA should be targeted to reduce the likelihood of negatively impacting wildlife.

In **Figure 12** (daytime impacts) the areas with sound levels of 55 dBA or greater are shown in light green. These results demonstrate that noise levels outside of the Project Footprint greater than 55 dBA are primarily expected west of the CHPP and the southern end of the waste dump area. Additionally, some smaller areas surrounding the RLO, the explosives storage facility, and south of the east pit are expected to have sound levels of up to 55 dBA. In **Figure 13** (nighttime impacts) the areas with sound levels of 45 dBA or greater are shown in purple. This figure demonstrates that a large area west of the CHPP/waste dump will experience nighttime sound levels greater than 45 dBA. Additionally, areas surrounding the RLO and the explosives storage facility, as well as between the east and south pits, will have sound levels of 45 dBA or greater.

7.2 Blasting Operations Impacts

Blasting Operations have the potential to impact receptors in the areas surrounding the Project through sound and/or vibration. The following sections, **Section 7.2.1** and **7.2.2**, present the results for noise (air overpressure) and ground vibration impacts on Human and Wildlife Receptors from Blasting Operations and compare the results against their respective criteria.

7.2.1 Human Receptor Blasting Operations Impacts

As described in **Section 2.1**, two parameters are used for quantifying impacts from blasting on Human Receptors: ground vibration level (typically reported in mm/s) and air overpressure (linear decibels, dBL). **Table 7.2-1** presents the results for the Blasting Operations noise and vibration impacts on Human Receptors. The calculations used to determine these impacts are provided in **Appendix C**.

As the results indicate, with the upper limit of 2300 kg (maximum charge per delay), the representative Human Receptors identified in this Assessment are in compliance with the respective criteria for ground vibration and air overpressure.

Although the predicted levels are well below the applicable criteria for ground vibration and overpressure, the loud instantaneous blast noise will be audible at the human receptors. Also, the ground vibration will likely be felt at the receptors. As such, steps indicated in **Section 9.0** – *Noise and Vibrations Management Plan* will be undertaken by NWP to notify residences and manage potential complaints from nearby receptors.

Table 7.2-1: Human Receptor Blasting Operations Impacts Compared to Applicable Criteria

Receptor ID	Distance Between Receptor and Blast (m)	Max Charge per Delay (kg)	Ground Vibration Level - PPV (mm/s)	Vibration level > 10 mm/s?	Air Overpressure (dB)	Air Overpressure > 120 dBL?
R1	2738	2300	0.8	No	101	No
R2	1711	2300	1.58	No	106	No
R3	7192	2300	0.2	No	92	No
R4	9535	2300	0.13	No	90	No
R5	11735	2300	0.1	No	88	No
R6	10877	2300	0.11	No	89	No
R7	10416	2300	0.11	No	89	No
R8	6229	2300	0.24	No	94	No
R9	4884	2300	0.35	No	96	No
R10	1435	2300	2.04	No	108	No
R11	1498	2300	1.92	No	107	No
R12	1400	2300	2.11	No	108	No

7.2.2 Wildlife Receptor Blasting Operations Impacts

As described in **Section 3.2.2**, the determination of noise (air overpressure) and ground vibration on Wildlife Receptors associated with Blasting Operations was done through establishing peak levels at incremental distances from the blast face (pit area). **Table 7.2-2** outlines the expected Blasting Operations impacts, in terms of L_{peak} (air overpressure, dBL) and vibration level (mm/s), at various setback distances from the pit extent (blast face).

The results indicate that the L_{peak} values surpass the 108 dB threshold for Wildlife Receptors at a distance of up to approximately 1500 m from the pit. As described in **Section 3.2.2,** there is not a specific criterion for vibration levels at Wildlife Receptors. However, for context the vibration levels at the Terrestrial Wildlife Receptors were compared against the Human Receptor vibration impact criterion of 10 mm/s. It was determined that vibration levels at a distance of over 400 m surpass the 10 mm/s criterion. The results presented in **Table 7.2-2** will be utilized in the Wildlife Effects analysis for this Project.

Table 7.2-2: Terrestrial Wildlife Habitat Impacts from Blasting Operations

Receptor IDs	Distance to Blast Site in Pit (m)	Peak Noise Levels (L_{peak}, dB)	L_{peak} (Air Overpressure) > 108 dB?	Ground Vibration Level - PPV (mm/s)	Vibration level > 10 mm/s?
TR1	100	139	**Yes**	97.33	**Yes**
TR2	200	130	**Yes**	35.6	**Yes**
TR3	300	125	**Yes**	19.77	**Yes**
TR4	400	121	**Yes**	13.02	**Yes**
TR5	500	119	**Yes**	9.42	No
TR6	600	117	**Yes**	7.23	No
TR7	700	115	**Yes**	5.78	No
TR8	800	114	**Yes**	4.76	No
TR9	900	112	**Yes**	4.02	No
TR10	1000	111	**Yes**	3.45	No
TR11	1500	107	No	1.92	No
TR12	2000	104	No	1.26	No

The impacts at Aquatic Receptors from Blasting Operations are presented below in **Table 7.2-3**. Additional details on the calculations used to determine these results are presented in **Appendix C**. The calculations of Blastign Operations impacts on Aquatic Receptors was done such that the DFO Guideline criteria for blasting impacts were not exceeded. As expected based on its proximity to the blasting operations, **AQR4** was determined to be most impacted. The expected substrate vibration level at this receptor is equivalent to the 13 mm/s criterion (as set out by the DFO Guideline) and this impact corresponds to a maximum charge per delay of 2300 kg (with delay time not to be less than 25 ms). The maximum charge quantity per delay of 2300 kg was applied to calculate peak impact for Terrestrial Wildlife and Human Receptors, as presented above.

Table 7.2-3: Aquatic Receptor Blasting Operation Impacts Compared to Applicable Criteria

Receptor IDs	Closest Distance between Pit and Water Body (m)	Max Charge per Delay (kg)	Induced Pressure in Water (kPa)	Induced Pressure > 100 kPa?	Substrate Vibration Level – PPV (mm/s)	Vibration Level > 13 mm/s?
AQR1[1]	2461	2300	2.4	No	2	No
AQR2	1080	2300	9.1	No	7	No
AQR3	1490	2300	5.4	No	4	No
AQR4	735	2300	16.8	No	13	No
AQR5	4785	2300	0.8	No	1	No

1 AQR1 was assessed against blasting impacts from the North Pit of Year 4 of the Project. Further details on this are provided in **Section 6.2**. All other Aquatic Receptors were assessed against blasting impacts from the South pit for Year 10 of the Project.

8.0 Cumulative Effects Assessments

As discussed in **Section 1.2**, there are other existing metallurgical coal mines in the Elk Valley and Crowsnest coal fields, including the Teck Corporation's Elkview Operations (Teck) at approximately 8 km southwest of the Project. As this coal mine is the closest to the Project, it was investigated for cumulative effects on noise and vibration impacts on identified receptors.

Based on the predicted noise emissions contours presented in the noise and vibration assessment for Teck's operations, it is not expected that the receptors in this Assessment will experience noticeable compounding cumulative noise effects from the Teck operations and the Project. In terms of vibration impacts, the distances between Teck operations and the receptors in this Assessment are expected to be sufficient enough to reduce or negate cumulative ground vibration impacts associated with the blasting operations, however, as indicated in the *Noise and Vibration Management Plan*, the operational mitigation measures include NWP making all efforts to minimize potential cumulative impact by coordinating with the neighbouring mining operations so that the blasting operations do not coincide.

9.0 Noise and Vibration Management Plan

The *Noise and Vibration Management Plan* (NVMP) presented herein provides a framework of general guidance that should be implemented at the Project to reduce noise and vibration emissions.

Key noise generating activities associated with the Project include:

- Construction of site infrastructure including buildings, railway, haul routes, etc.;
- Operation of fixed equipment associated with the processing and transportation of materials (coal, waste rock, chemicals, etc.);
- Operation of mobile equipment throughout the Project Footprint (truck movements, drills, excavators, etc.);
- Blasting operations; and
- Facility decommissioning (*e.g.*, site re-contouring activities if applicable).

The findings and recommendations of this Assessment have been integrated into this NVMP to ensure the control and reduction of potential noise and vibration impact during construction, operation, and decommissioning/closure of the Project. While noise and vibration created on site is unavoidable, monitoring and control will play an important role in noise mitigation.

The NVMP is created to mitigate and manage noise levels within and surrounding the Project areas, including at Human and Wildlife Receptors. The focus of this Plan is to minimize noise impact through the application of mitigation measures including Best Management Practices (BMPs). To ensure success of the NVMP, NWP is committed to using adaptive management strategies to appropriately manage potential Project-related noise and vibration impacts.

9.1 Objectives

The objectives of this NVMP are to:

- Outline a framework for the responsible management of noise and vibration in areas within and surrounding the Project;
- Define the regulatory requirements, roles and responsibilities, reporting, and training requirements associated with the Plan;
- Provide a structure for noise and vibration management over the course of the Project;
- Establish a practice for reporting noise compliance and exceedances and a process for record keeping; and

- Establish appropriate BMPs to reduce the potential noise and vibration impacts;
- implement a noise and vibration monitoring program to determine if changes in the noise environment are still within the acceptable levels and are in accordance with the predictions; and
- Use the results from the noise monitoring program to implement, revise and/or improve noise mitigation measures, including BMPs.

The scope of the NVMP is to address noise impacts (including activities, processes, equipment and infrastructure) during all phases of the Project.

9.2 Roles and Responsibilities

Key roles and responsibilities of the *Noise and Vibration Management Plan* are outlined in **Table 9.2-1**.

Table 9.2-1: Roles and Responsibilities of the Noise and Vibration Management Plan.

Responsibilities	Lead
Overall implementation and adherence to the NWP Environmental, Health, and Safety (EHS) Policy.	NWP CEO
Overall implementation and review of the *Noise and Vibration Management Plan*, including meeting commitments outlined in the plan (mitigation measures and monitoring programs).	NWP Superintendent, Environment & Sustainability
Implementation of the NVMP during Project construction.	Project Engineering, Procurement, and Construction Management (EPCM) Lead/ Construction Manager
Implementation of the NVMP during site operations, including reporting to the NWP Superintendent, Environment and Sustainability.	Site Operations Manager
Completion of environmental awareness training and application of environmental awareness and protection measures.	NWP Superintendent, Environment & Sustainability and all employees on the Project site
Noise inspections/audits and on-site monitoring programs.	NWP Superintendent, Environment & Sustainability and selected consultants
Noise complaint assessment, including record keeping and investigation of cause.	Site Operations Manager

9.3 Reporting and Record Keeping Requirements

The NWP Superintendent, Environment & Sustainability will maintain reporting and updated records related to the *Noise and Vibration Management Plan*. Records may include the following:

- Reports completed by the EPCM Lead on noise mitigation measures;
- Annual Environmental Management Report (AEMR) detailing performance of the *Noise and Vibration Management Plan*. Report is expected to include monitoring results, use and success of BMPs/ mitigation measures, non-compliance issues, and a review of overall Plan performance (including potential recommendations for improvement);
- Monitoring reports detailing observations and completed sampling/assessments at monitoring stations set out in the Plan's monitoring programs. This may include consultant's reports and EPCM site observations;
- Reporting to the British Columbia Ministry of Environment and Climate Change Strategy on monitoring programs and any noise complaints as/if required;
- Training records of staff (i.e., training specific to the Plan); and
- Maintaining compliance and complaints records.

9.4 Training Requirements

On-site staff will be required to participate in environmental awareness training, specific to the *Noise and Vibration Management Plan*, the training will include:

- Management and protection procedures (*e.g.*, use and implementation of the Plan, establishment and maintenance of acoustic control measures); and
- Records management (*e.g.*, how to report and record acoustic assessments, *etc.*).

To supplement the environmental awareness training, a field awareness manual will be provided by NWP to all staff on-site. The manual details key components of the *Noise and Vibration Management Plan*, including protocols for mitigation measures, including operational mitigations.

9.5 Best Management Practices and Mitigation Measures

To reduce the potential noise and vibration impacts, a range of site-specific BMPs will be implemented over the course of the Project. The acoustic environment within and surrounding Project area has the potential to be impacted due to construction and operation activities related to the Project. BMPs to be implemented over the course of the Project to reduce the potential for noise-related disturbance include:

- Limit construction activities, especially those with high noise impact to daytime hours.
- Appropriately time construction activities to minimize cumulative noise levels.
- Select equipment for construction activities that is appropriate for the task.

- Ensure that construction equipment at a minimum, is fitted with standard noise-damping devices such as, mufflers, or enclosures, where possible.
- Discourage unnecessary idling of construction equipment.
- Perform regular vehicle maintenance and inspections on all Project equipment, including replacement of old and worn parts.
- Inform employees of noise impacts and potential mitigation/control measures through appropriate training.
- Install and maintain noise mitigation measures, where possible, on and around Project infrastructure. They may include silencers, acoustic louvers, and barriers.
- Notify near-by residents prior to construction activities that may generate significant noise for which mitigation may not be feasible. Appropriate scheduling and notification of nearby residents will help to minimise disruption. Residents will be notified in writing at least 24 hours prior to any activities that may cause disturbance. This should also be done for blasting operations.
- Implement the Noise Monitoring Program at representative nearby receptors to compare against the already established background noise levels and to confirm modelled noise level predictions at the receptor locations (see below for noise and vibration monitoring program).

The key sources of ground vibration are rail and Blasting Operations. Given the setback distances to nearby Human Receptors, rail operations are not expected to result in a notable ground vibration impact. Additionally, rail-induced ground vibration is not expected to have a significant impact on wildlife. For blasting operations, the following operational mitigation measures will be undertaken:

- The quantity of charge used per delay will not exceed 2,300 kg throughout the project and the time delay will not be less than 25 ms.
- NWP will coordinate with neighbouring mining operations to ensure that blasting operations do not coincide.

9.6 Monitoring Program

To assess changes in the acoustic environment over the course of the Project, site-specific monitoring will be implemented as part of the *Noise and vibration Monitoring Program*. The monitoring program details specific actions to be taken during the Project phases (site preparation and construction, operation, and decommissioning/closure) to monitor the changes in noise and vibration levels.

Monitoring is very important to the Project as it provides feedback on the effectiveness of mitigation measures and management strategies. More specifically, monitoring as part of the *Noise and Vibration Management Plan* will be used to:

- Ensure regulatory compliance for the duration of the Project;
- Set out monitoring protocols such as monitoring station locations, collection procedures, frequency, and triggers for action;
- Assist in evaluating the accuracy and adequacy of predictions made as part of EIS baseline studies; and
- Provide information to develop appropriate adaptive management strategies in a timely manner to maintain noise levels and reduce the potential for impacts on the acoustic and natural environment (including humans and wildlife).

This *Noise and Vibration Monitoring Program* is designed to provide comparable and consistent data for which to assess changes in the atmospheric environment as a result of the Project. The monitoring program will be reviewed regularly to ensure it is consistent with current legislation and to assess its effectiveness over time.

9.7 Noise and Vibration Monitoring

Periodic noise and vibration monitoring at three sensitive receptors surrounding the Project will be performed to validate the results presented in this Assessment and ensure that compliance with applicable criteria is achieved. Monitoring locations will vary throughout the life of the Project to reflect changes in the pit sizes, locations, and operations. Presented below in **Table 9.7-1** is a description of the expected monitoring locations as they vary throughout the life of the Project. Further details on the receptor locations are provided in **Section 3.2.1**. The receptor locations are selected to capture noise and vibration emissions from various stages of the Project. Receptors **R1**, **R2**, **R9**, and **R12** were selected to capture noise and vibration emissions from the CHPP and the pits. These monitoring locations change throughout the life of the Project to reflect the changes in pit operations. Receptor **R5**, which is the only location that will undergo noise and vibration monitoring throughout the entire life of the Project, was selected to capture noise and vibration emissions from the RLO area.

As described in **Section 3.2.1**, Receptors **R7** and **R10** are representative locations of possible indigenous seasonal dwellings. As such, there are currently no dwellings at these two locations and therefore, noise and vibration monitoring at these locations will not be performed. However, if an indigenous dwelling were to be established at, or in the vicinity of, either of these locations, they could be selected to undergo noise and vibration monitoring.

Table 9.7-1: Noise, vibration, and air overpressure monitoring locations

Project Year	Monitoring Location by Receptor ID
1 – 5	R2, R5, R9
5 – 10	R1, R2, R5
10 – 15	R1, R5, R12

Continuous noise monitoring to assess noise impact associated with the normal operation of the Project will be conducted on a regular basis, with data downloads at regular weekly intervals or upon receipt of a noise complaint. The monitoring of air overpressure and ground vibration will be conducted only during blasting operations (instantaneous readings).

9.7.1 Monitoring Equipment

The equipment used to perform the noise and vibration monitoring must be selected to ensure that they capture sound levels, vibration levels, and air overpressure. This may require the implementation of multiple pieces of equipment at each location or use of an integrated monitoring system. The monitoring equipment is to have valid calibration documentations and be field calibrated (where required) before and after each use as necessary.

9.7.2 Reporting

Following each noise and vibration monitoring campaign, a formal report will be completed. The reports will, at a minimum include the following components:

- Measurement locations;
- Dates of measurements;
- Instrumentation used and proof of valid calibration;
- Detailed notes on the observable sound environment at each monitoring location (i.e., audible sounds, tones, residual sounds, noticeable vibrations, etc.);
- Weather conditions during measurements (i.e., wind direction and speed, temperature, cloud conditions, etc.);
- Figures illustrating monitoring setup;
- Applicable compliance criteria at each location;
- Recorded sound, overpressure, and vibration levels; and
- Statement of compliance or non-compliance.

If an exceedance at a monitoring location is observed, appropriate NWP personnel (as specified above) will be notified immediately so that appropriate steps can be taken, including an investigation to identify the potential cause(s) of the exceedance. The investigation may include a review of Project operations and atmospheric conditions at the time of the exceedance. Once the cause for the exceedance is identified, mitigation measures for the source(s) will be developed. Subsequent monitoring at the location where exceedance was observed should be performed to ensure that the mitigation measures are effective. Records of the exceedance and all subsequent mitigation and monitoring should be kept at the site for future reference and review by regulators as required. Relevant stakeholders (i.e., residences) who could be impacted by the observed exceedances will be notified of the exceedance and all corrective measures that NWP has taken or will be taking.

9.8 Continuous Operations Noise Management

For the Continuous Operations as part of the Project, the two primary groups of noise sources (Fixed Equipment and Mobile Equipment) each require source specific management recommendations to reduce noise emissions. These recommendations are presented in the following sections by source type.

9.8.1 Fixed Equipment

For the Fixed Equipment associated with the Project, adhering to the following recommendations should aid in controlling noise and vibration emissions:

- Operate equipment as described in manufacturing instructions;
- Equipment maintenance is kept up to date; and
- Ensure equipment is not overloaded.

9.8.2 Mobile Equipment

For the Mobile Equipment associated with the Project, adhering to the following recommendations should help reduce noise and vibration emissions:

- Equipment maintenance is kept up to date;
- Grease the rail tracks of the RLO to reduce wheel squeal;
- Ensure equipment is not overloaded;
- Ensure that Clean Coal Haul Road posted speed limits are followed; and
- Whenever possible, reduce the frequency and duration of reversing equipment to reduce the use of tonal backup beepers.

9.9 Blasting Operations Noise and Vibration Management

For the Blasting Operations associated with the Project, noise and vibrations emissions can be effectively controlled through the implementation of the following recommendations:

- Keep blasting charge delay greater than 25 milliseconds (ms) to reduce the likelihood of blasting sound wave addition;
- When possible, arrange blasting hole configuration to utilize pit walls for shielding; and
- Keep maximum charge quantity per blast to 2300 kg or less.

10.0 Conclusions

This Assessment estimated noise and vibration impacts at various types of nearby receptors; Human, Terrestrial Wildlife, and Aquatic Wildlife. These impacts were determined using worst-case noise emissions scenarios for the Project, as described in **Section 5.2**. The following sections summarize the results presented in **Section 7.0**

10.1 Representative Human Receptors

The comparisons between the predicted noise and vibration impacts at the identified Human Receptors in this Assessment and the applicable criteria are presented in **Table 10.1-1**. It was determined that at **R7** and **R10**, the PSLs from Continuous Operations of the Project are surpassed. As discussed in further detail in **Section 7.1.1**, these receptors represent locations of a “representative location of a possible indigenous seasonal dwelling”. As such, there are currently no dwellings at these two locations. If mitigation measures were to be developed for these “representative locations”, compliance issues for possible future indigenous dwellings in the nearby surrounding areas could arise. Therefore, it is the recommendation of this report to postpone developing mitigation measures for either of these receptors until the time when these locations, or locations in the vicinity of these receptors, become occupied. By doing this, it will allow for a location-specific mitigation plan to be developed which can accurately target problem noise sources for each receptor. In addition, postponing the development of mitigation measures until time of occupancy will reduce the likelihood of encountering access issues to these areas (i.e., barriers or berms reducing/block access).

For the other Human Receptors for both Continuous and Blasting Operations, compliance with the respective criteria was achieved as indicated from the results presented in **Table 10.1-1**.

Table 10.1-1: Noise and Vibration Criteria Compliance Summary for Human Receptors

Receptor ID	Application Case Sound Level > PSL?	Δ% HA > 6.5 %?	L_{dn} > 75 dBA[1]?	Ground Vibration > 10 mm/s?	Air Overpressure > 120 dBL?
R1	No	No	No	No	No
R2	No	No	No	No	No
R3	No	No	No	No	No
R4	No	No	No	No	No
R5	No	No	No	No	No
R6	No	No	No	No	No
R7	**Yes**	No	No	No	No
R8	No	No	No	No	No
R9	No	No	No	No	No
R10	**Yes**	No	No	No	No
R11	No	No	No	No	No
R12	No	No	No	No	No

10.2 Wildlife Receptors

As discussed in **Sections 7.1.2** and **7.2.2**, noise and vibration impacts from the Project were assessed using an area-based approach for Terrestrial Wildlife Receptors. For Continuous Operations, this was done by modelling noise level contours emanating from the Project with an emphasis on the 55 dBA contour during daytime hours and the 45 dBA contour during nighttime hours. These results are presented in **Figure 12** and **13**, respectively. For Blasting Operations impacts on Terrestrial Wildlife Receptors, impacts were determined at various setback distances from the south pit boundary as outlined in **Table 7.2-2**. These results indicated that the threshold peak sound level from blasting of 108 dB would be surpassed at a distance of up to approximately 1,500 m from the pit. Additionally, vibration levels greater than 10 mm/s shall be achieved at distances of up to 400 m to 500 m from the pit.

For Aquatic Receptors, which are only expected to be impacted by Blasting Operations, predicted impacts are not expected to exceed the DFO Guideline criteria as shown by the results presented in **Table 7.2-3**. At **AQR4** however, predicted vibration levels are expected to be equal to the DFO Guideline criteria of 13 mm/s. Therefore, it is imperative that the maximum charge per delay of 2,300 kg not be surpassed as this will put the expected vibration level at this receptor out of compliance.

11.0 Closure

Dillon Consulting Limited (Dillon) was retained by NWP Coal Canada Ltd to prepare an Environmental Noise and Vibration Assessment for the Crown Mountain Coking Coal Project in Sparwood, British Columbia. The report is being submitted in support of an Environmental Assessment for the Project. The material in the report reflects Dillon's judgment in light of the information available to Dillon at the time of this report preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust that the report is to your satisfaction. Please do not hesitate to contact the undersigned if you have any further questions on this report.

Respectfully Submitted:

DILLON CONSULTING LIMITED

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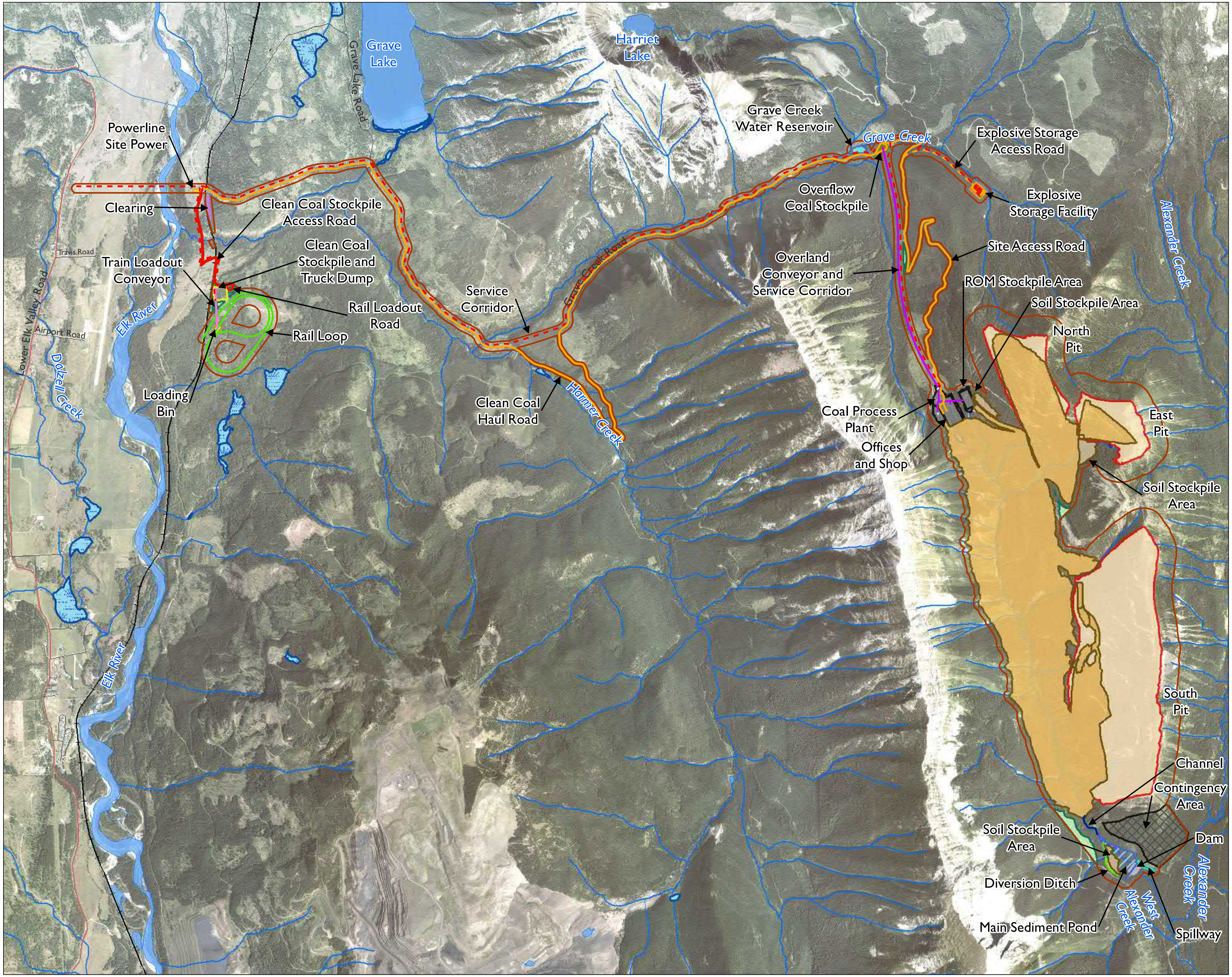
E.I.T.

Figures

Crown Mountain Coking Coal Project

FIGURE 1
PROJECT FOOTPRINT



LEGEND

- Project Footprint

Project Footprint Infrastructure

- Channel to Ultimate Pond
- Clean Coal Haul Road\Site Access
- Explosive Storage Access\Facility Road
- Rail Loadout Road
- Rail Loop
- Service Corridor
- Coal Process Plant Conveyor
- Coal Process Plant Duct
- Train Loadout Conveyor
- Waste Dump
- Mined Area
- Clean Coal Stockpile and Truck Dump
- Overflow Coal Stockpile
- Soil Stockpile Area
- Explosive Storage Facility\Pad
- Loading Bin
- Plant Site\ROM Stockpile Area
- Powerline-Site Power
- Water Reservoir
- Main Sediment Pond
- Dam
- Spillway
- Diversion Ditch
- Clearing
- Additional Area
- Contingency Area

Base Data

- Arterial Roads
- Local/Resource Roads
- Railway (Canadian Pacific)
- Watercourse
- Waterbody
- Wetland
- BC/Alberta Border

0 1 2 Kilometers

N S W E

SCALE 1:40,000

Map Drawing Information: Data Provided by Province of British Columbia, NWP Coal Canada Ltd., Dillon Consulting Limited

Map Created By: JFC/RBB
Map Checked By: LKD
Map Projection: NAD 1983 UTM Zone 11N

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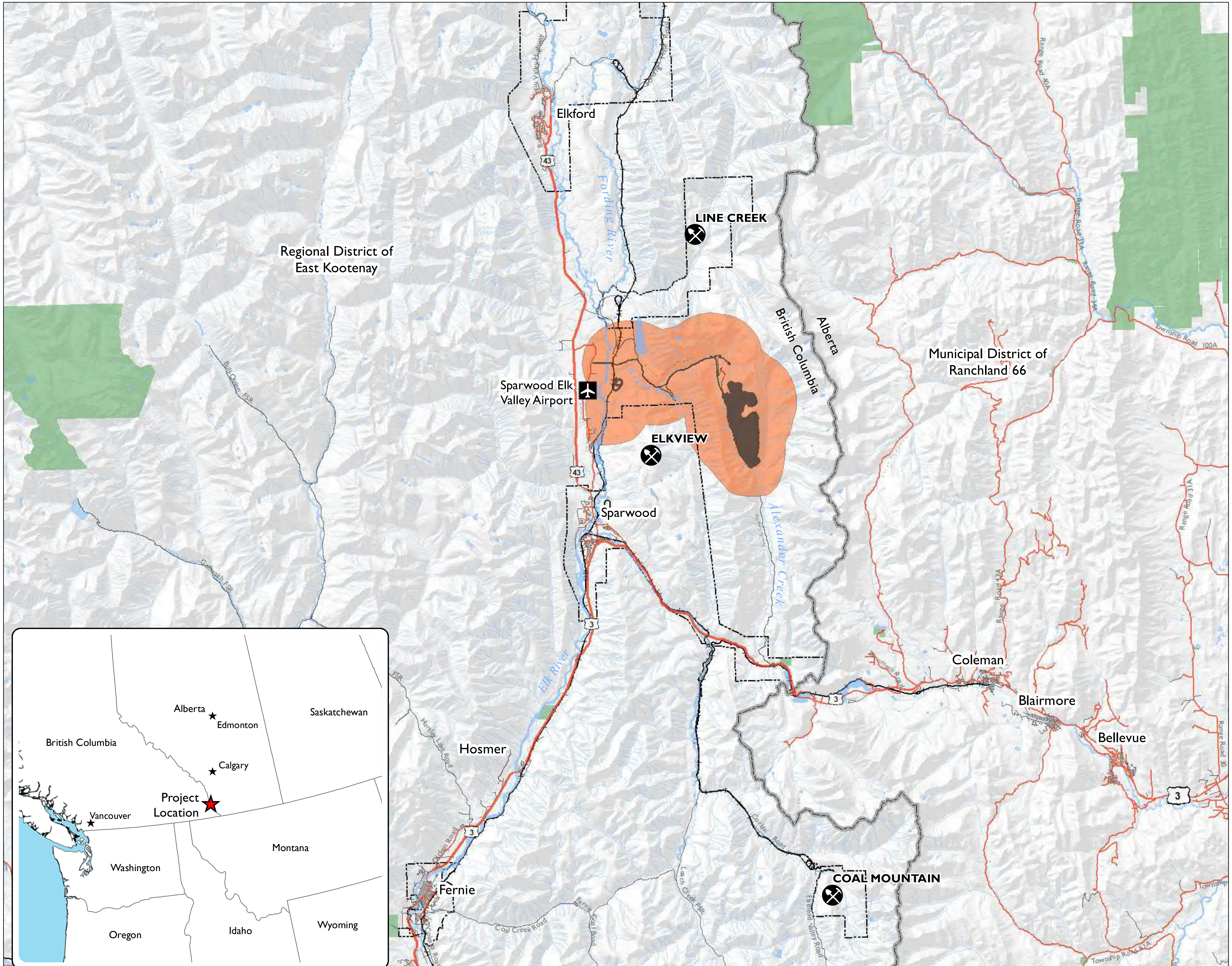
PROJECT: 12-6231
STATUS: DRAFT
DATE: 2020-12-22

Crown Mountain Coking Coal Project

Figure 2
Acoustic Local Study Area



- Acoustic Local Study Area
- Project Footprint
- Existing Operating Mines
- Highways
- Arterial Roads
- Local/Resource Roads
- Watercourses
- Lakes/Rivers
- Railway
- Municipal Boundaries
- BC/Alberta Parks and Protected Areas
- BC/Alberta Border

SCALE 1:265,000

0 2.5 5 10 km

N W E S

Map Drawing Information: Province of British Columbia,NWP Coal Canada Ltd., Dillon Consulting Limited, ESRI Base Layers, GeoGratis, CanVec. Government of Alberta.

Map Created By: RBB
Map Checked By: KAO
Map Projection: NAD 1983 UTM Zone 11N

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PROJECT: 12-6231
STATUS: DRAFT
DATE: 2020-12-22

File Location: \\42dillon\CAD\GIS\2012 and Prior\126231 Crown Mountain\Noise_and_Vibration\126231_NV_ Acoustic Local Study Area V1.mxd

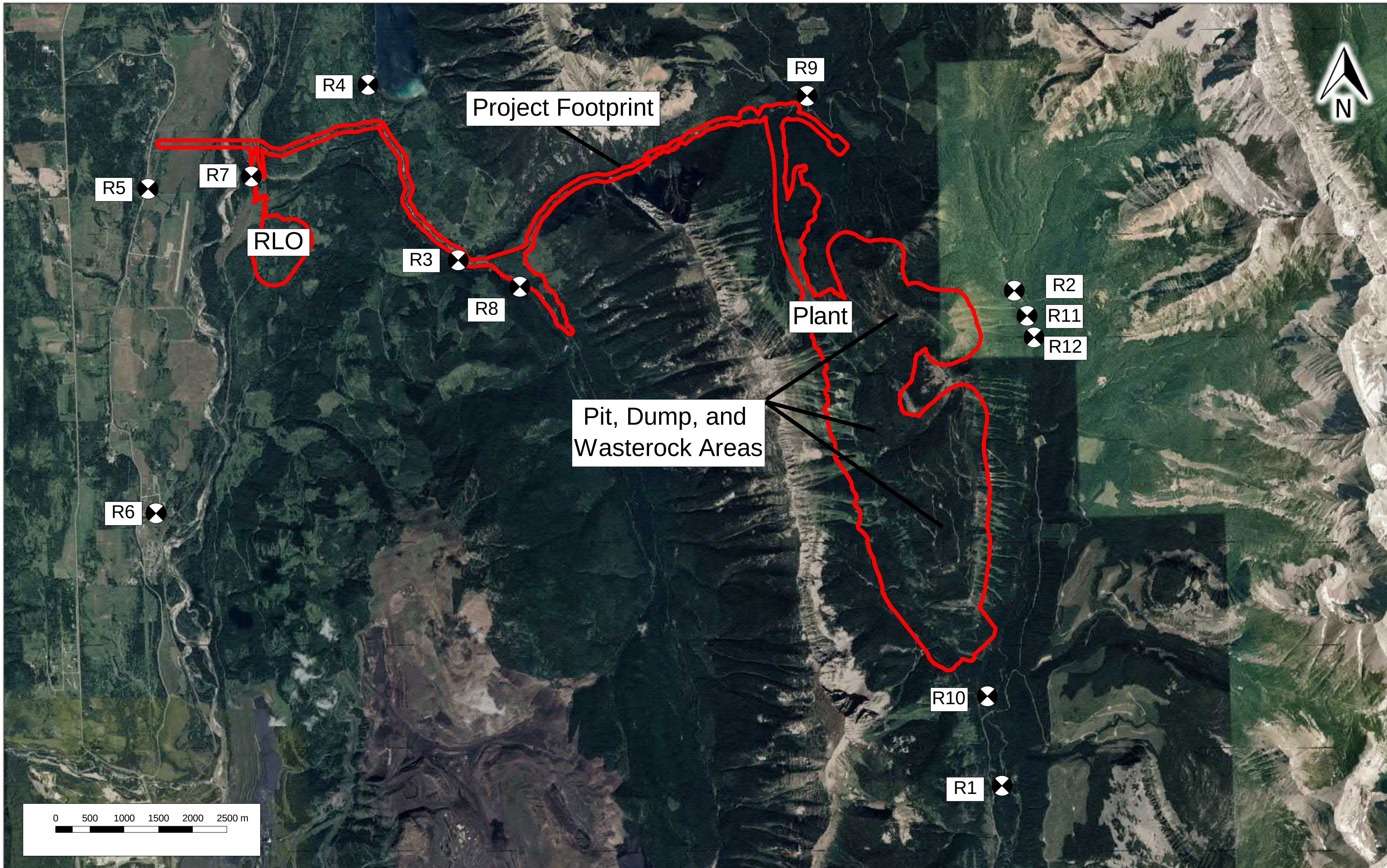

Figure 3

Project # 12-6231

February, 2021

Human Receptors

East Kootenay Region, British Columbia

DILLON CONSULTING 75 YEARS

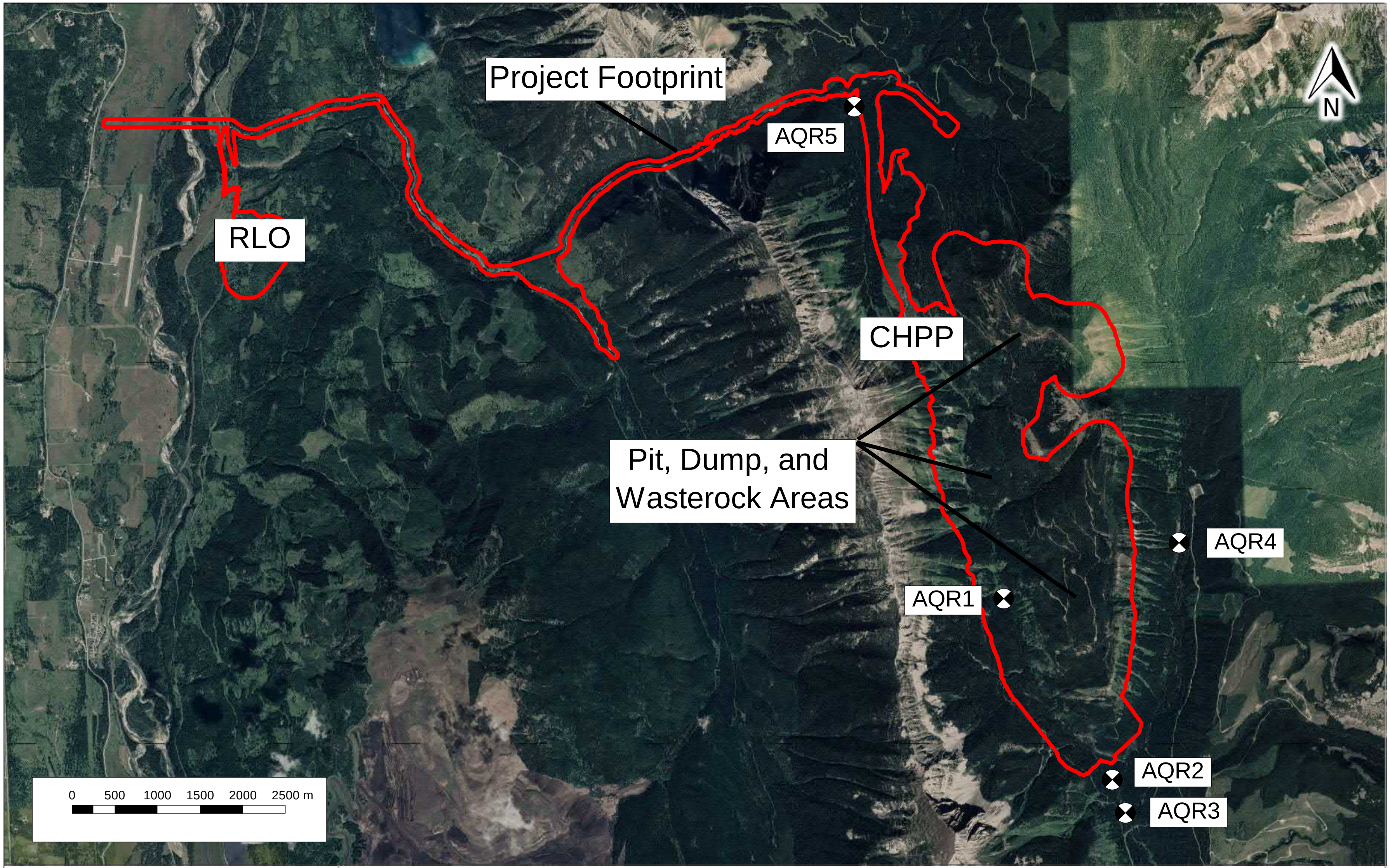

Figure 4

Project # 12-6231

February, 2021

Aquatic Receptors

East Kootenay Region, British Columbia

DILLON CONSULTING

75 YEARS

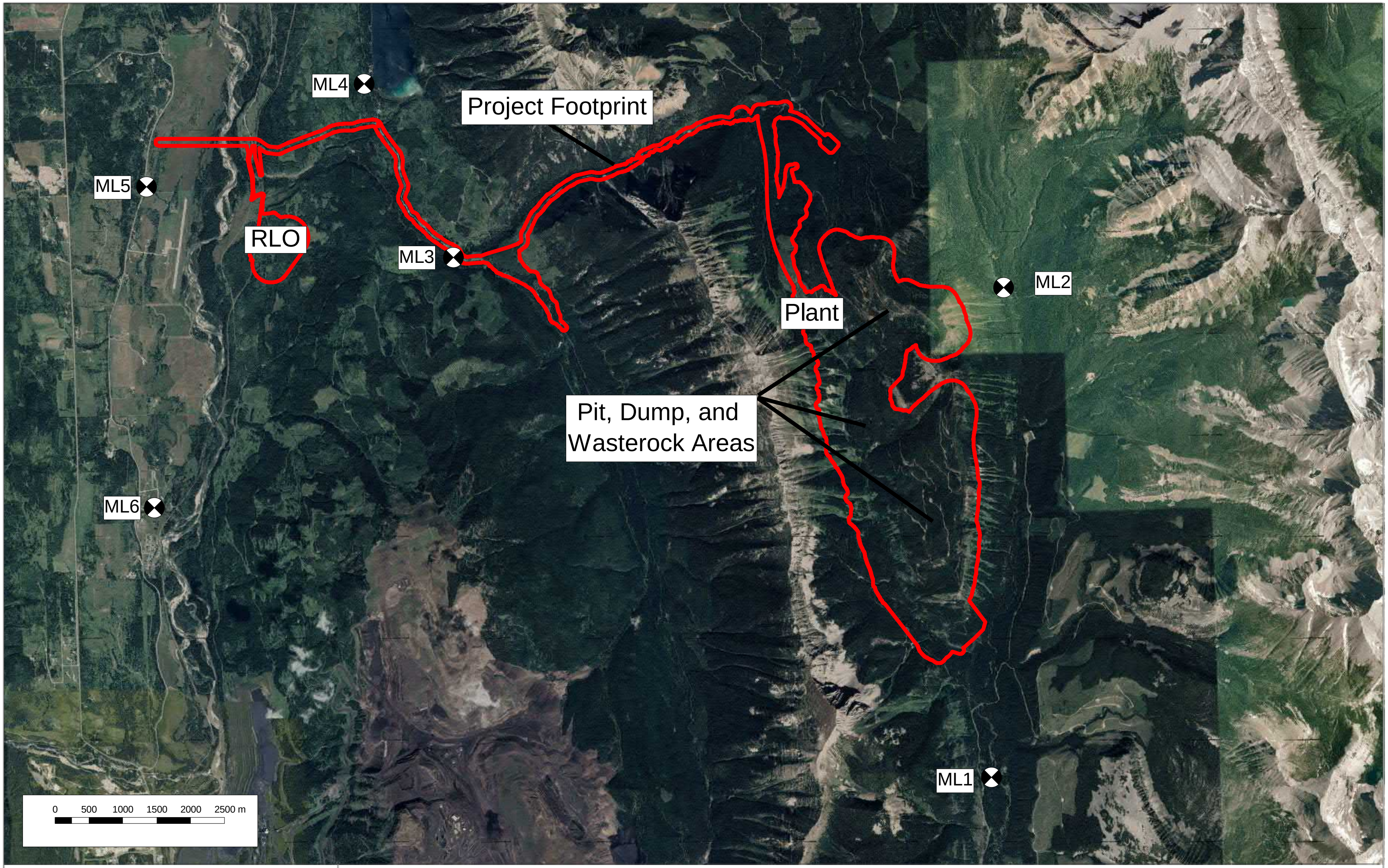

Figure 5

Project # 12-6231

February, 2021

Noise Monitoring Locations

East Kootenay Region, British Columbia

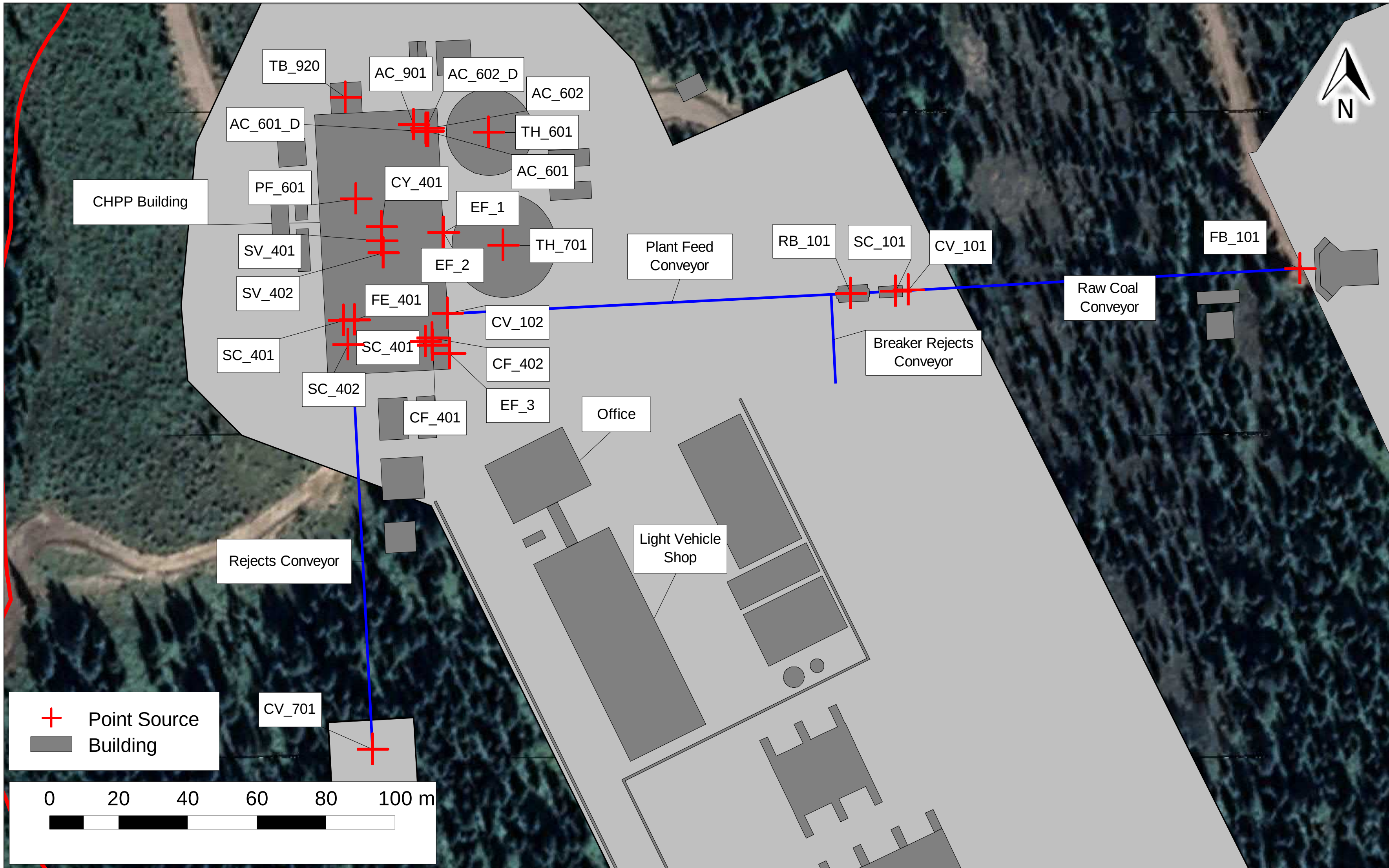

Figure 6

Project # 12-6231

February, 2021

Fixed Equipment Locations: CHPP Pad

East Kootenay Region, British Columbia

DILLON CONSULTING

75 YEARS

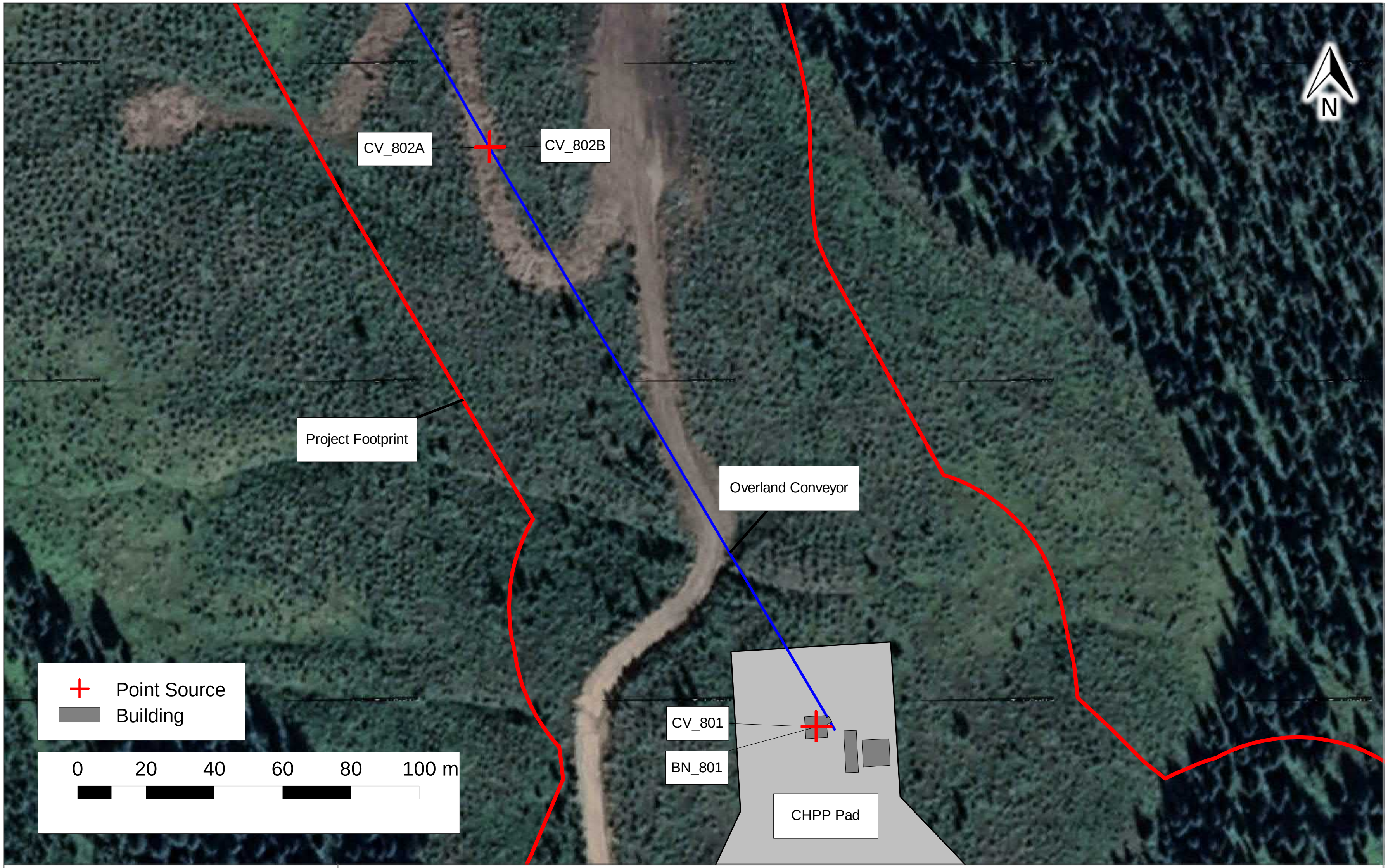

Figure 7

Project # 12-6231

February, 2021

Fixed Equipment Locations North of CHPP Pad

East Kootenay Region, British Columbia

DILLON CONSULTING

75 YEARS

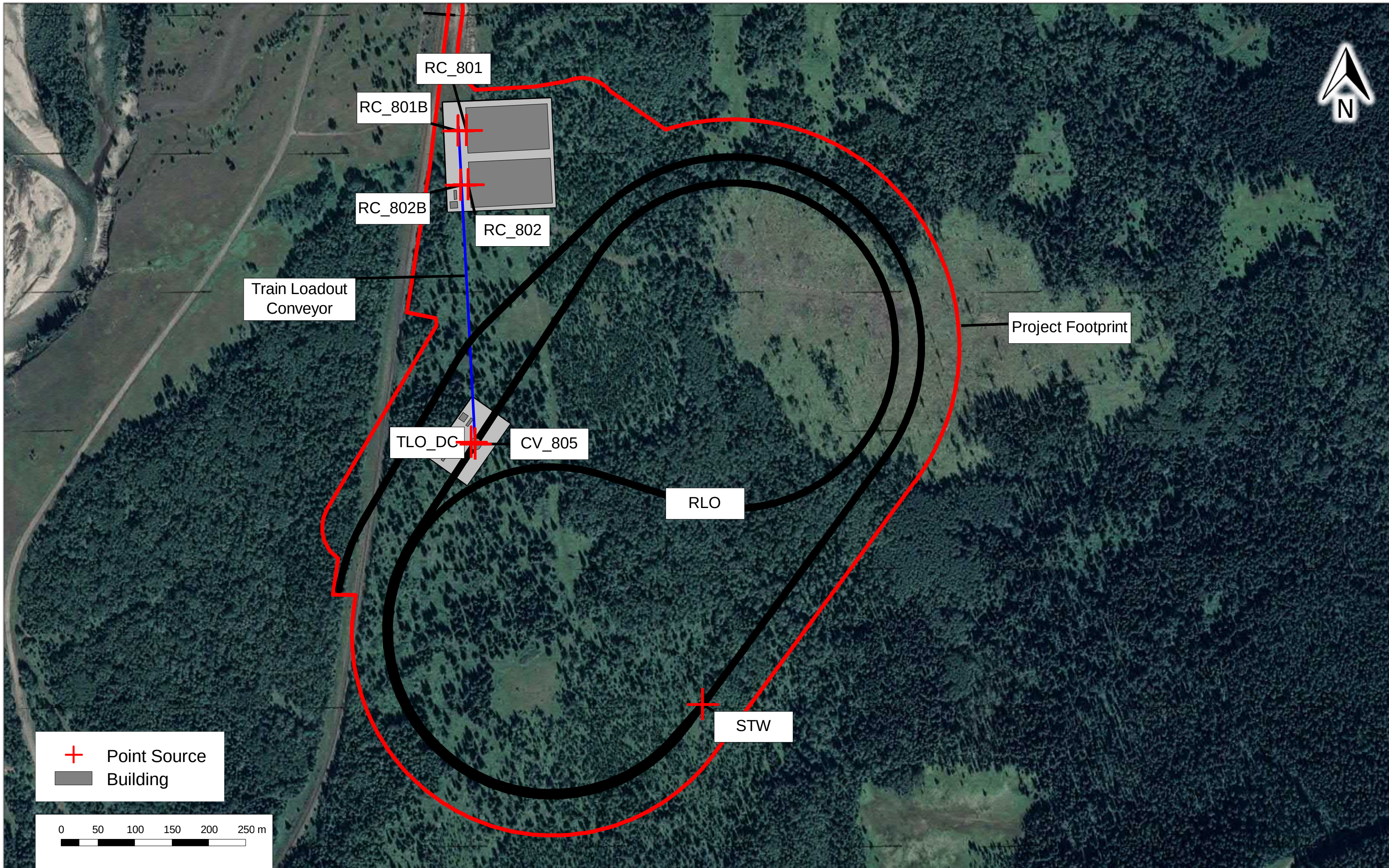

Figure 8

Project # 12-6231

February, 2021

Fixed Equipment Locations RLO

East Kootenay Region, British Columbia

DILLON CONSULTING

75 YEARS

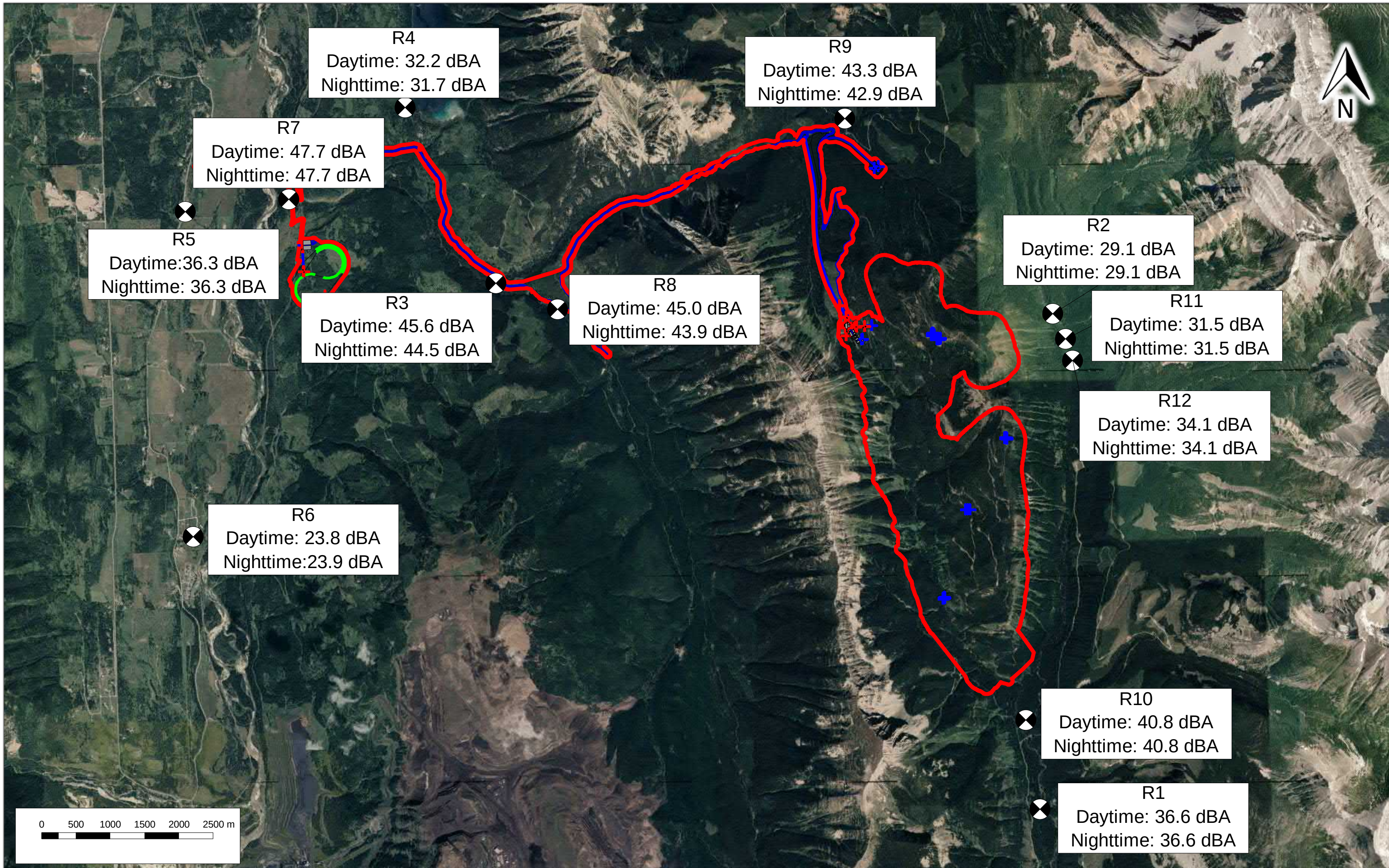

Figure 9

Project # 12-6231

February, 2021

Human Receptor Noise Impacts Continuous Operations

East Kootenay Region, British Columbia

DILLON CONSULTING

75 YEARS

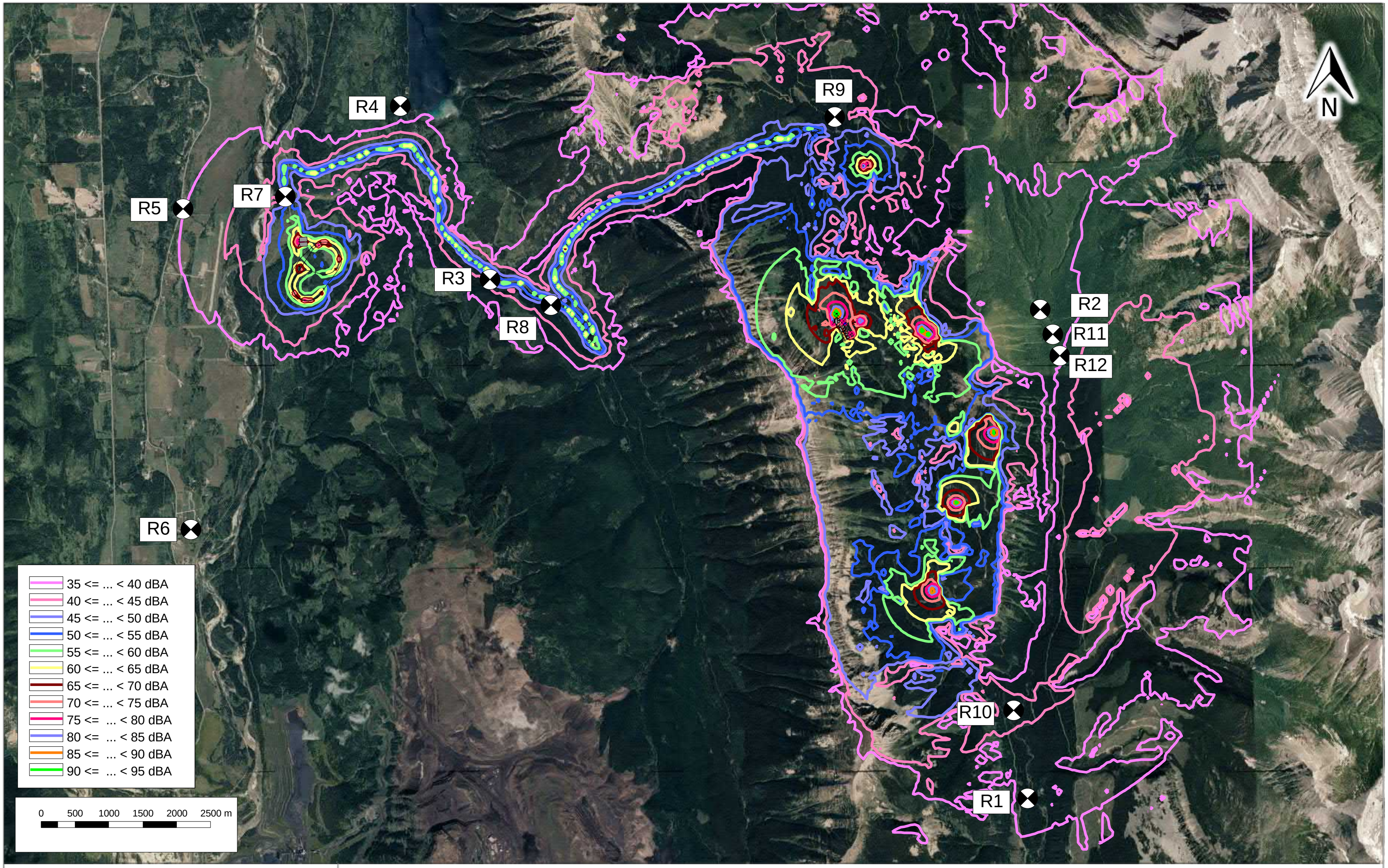

Figure 10	**Daytime Noise Contours** **Continuous Operations** **Grid Height = 1.5 m** East Kootenay Region, British Columbia
Project # 12-6231	
February, 2021	

DILLON CONSULTING

75 YEARS

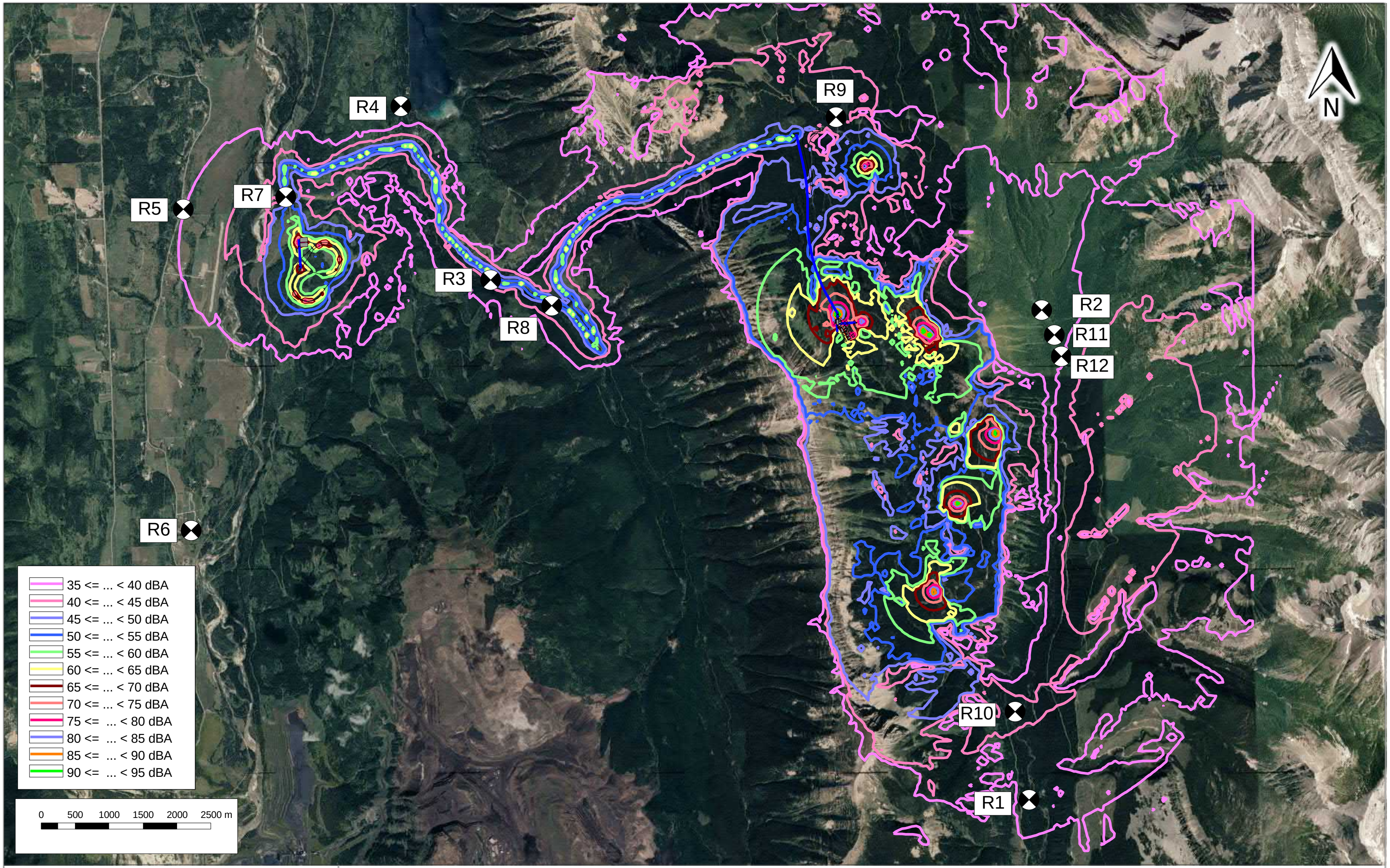

Figure 11	Nighttime Noise Contours Continuous Operations Grid Height = 1.5 m East Kootenay Region, British Columbia	DILLON CONSULTING 75 YEARS
Project # 12-6231		
February, 2021		

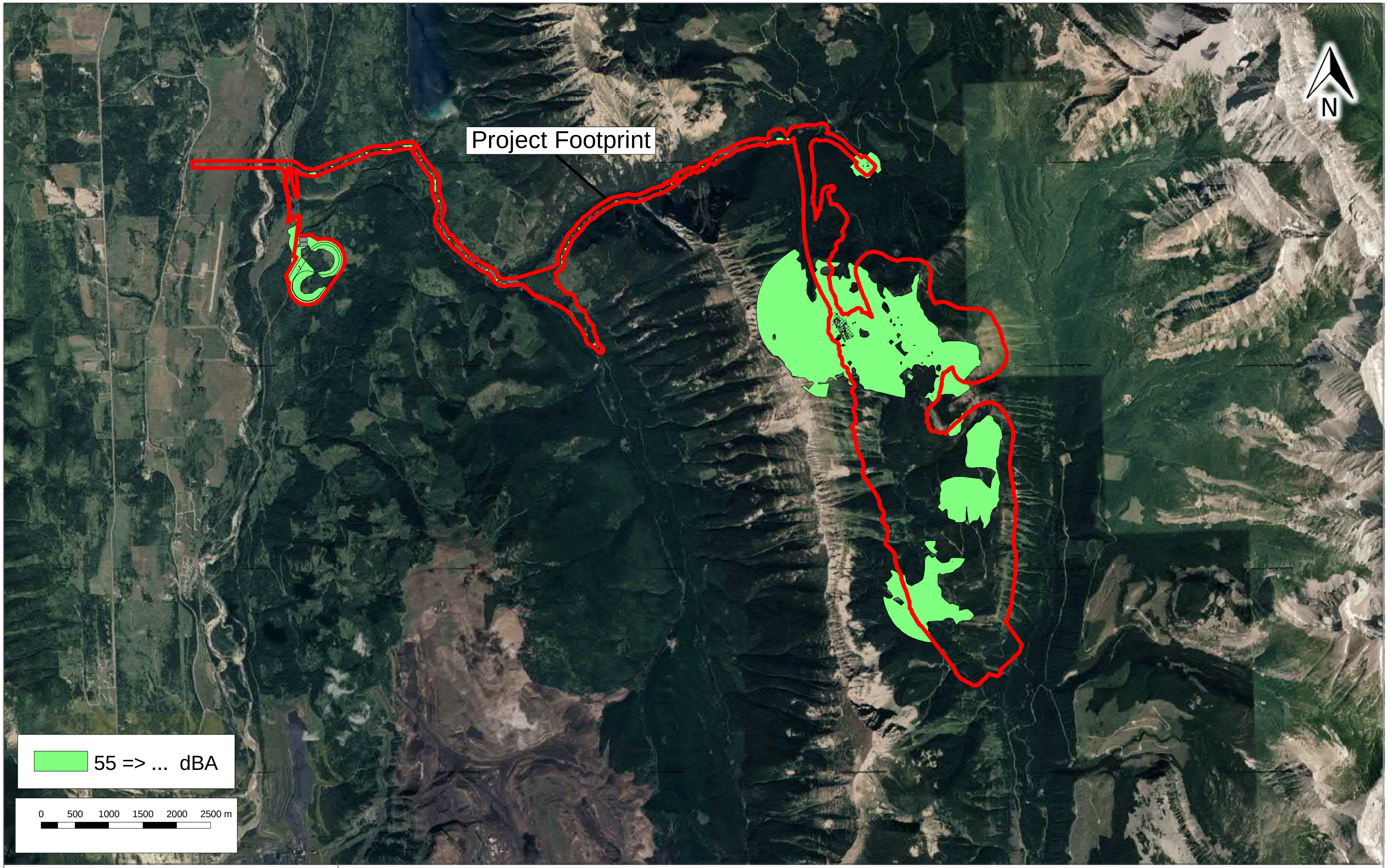

Figure 12

Project # 12-6231

February, 2021

Daytime Noise 55 dBA Contours
Continuous Operations
Grid Height = 1.5 m
East Kootenay Region, British Columbia

DILLON CONSULTING 75 YEARS

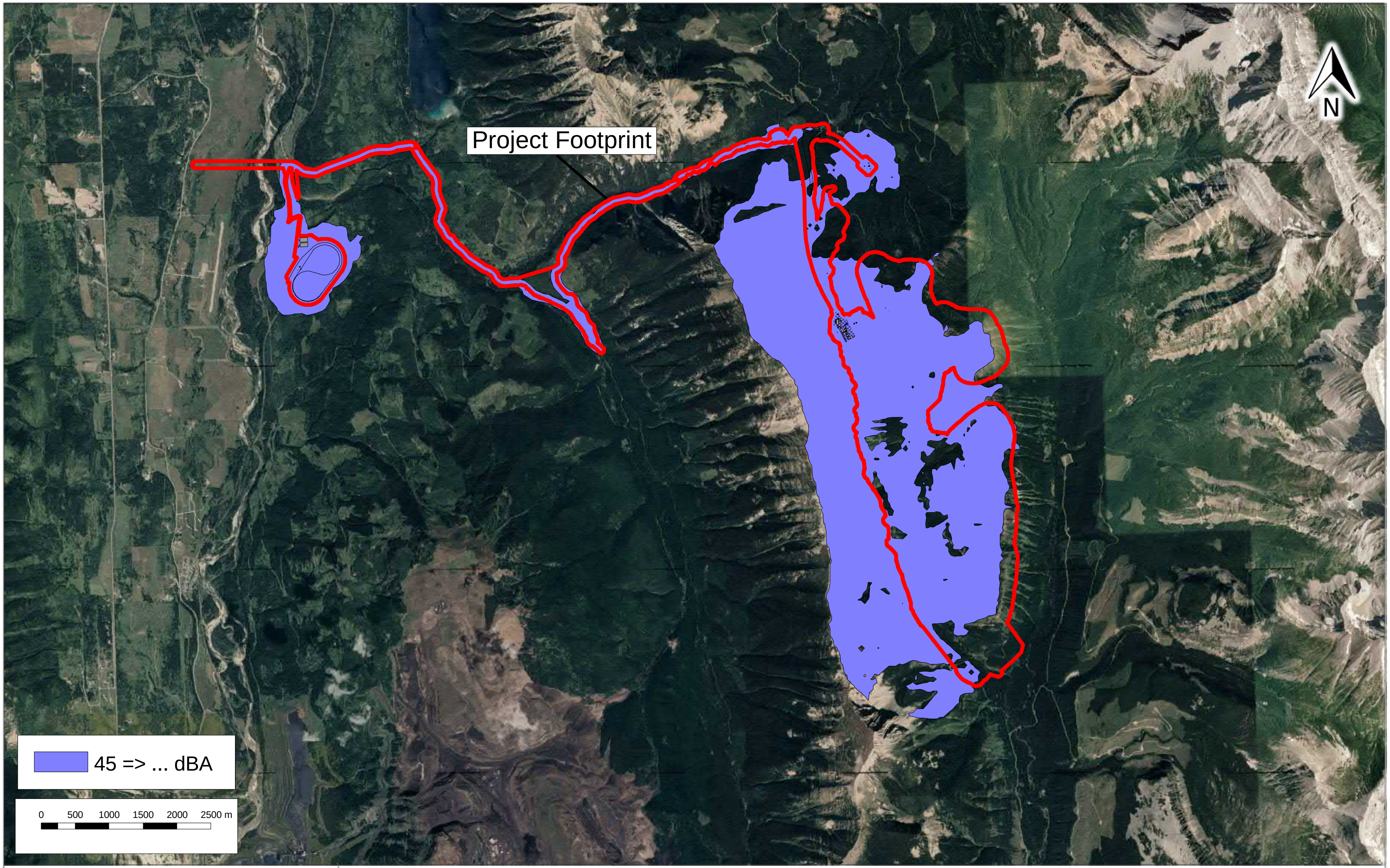

Figure 13

Project # 12-6231

February, 2021

Nighttime Noise 45 dBA Contours
Continuous Operations
Grid Height = 1.5 m

East Kootenay Region, British Columbia

DILLON CONSULTING

75 YEARS

Appendix A

Ambient Noise Monitoring Report

NWP COAL CANADA LIMITED

Noise Baseline Report

Crown Mountain Coking Coal Project

November 2018 – 12-6231

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Appendices

1.0 Introduction

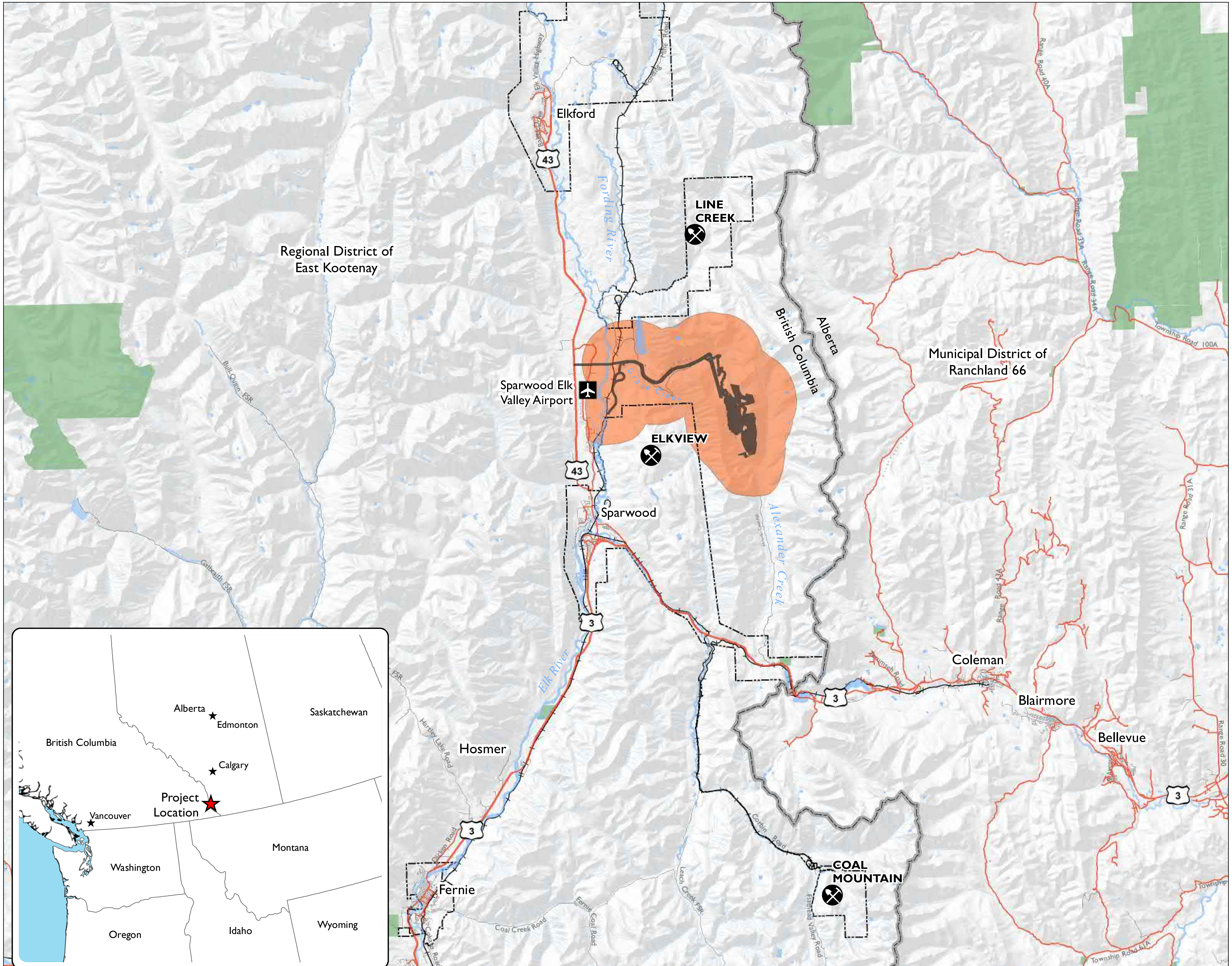
1.1 General Overview of the Project

NWP Coal Canada Limited (NWP Coal) proposes to develop the Crown Mountain Coking Coal Project (the Project) which is proposed as an open pit metallurgical coal mine within a 75 million tonne resource area. The Project is located in the Elk Valley coal field in the East Kootenay Region of southeastern British Columbia, as shown in **Figure 1**. NWP Coal (the Proponent) is a subsidiary of Jameson Resources Limited and Bathurst Resources Limited (Canada). The Project comprises six granted coal licenses and four pending license applications. The Project area is located between several existing metallurgical coal mines in the Elk Valley and Crowsnest coal fields, with Teck Corporation's Elkview 8 km southwest of the Project area and Line Creek 12 km north of the Project area. The Project area is located approximately 30 km by road from Sparwood, British Columbia.

The anticipated production capacity of the Project is 3.7 million run-of-mine tonnes (M ROMt) per annum for 16 years, not including site decommissioning. This equates to a coal production capacity of approximately 10,150 tonnes per day. The run-of-mine coal reserves are estimated to be 56 million tonnes, of which 50 million tonnes are proven and 6 million tonnes are probable. Exploration activities have indicated that the coal at the Project site is typical of coking coals produced from existing mines in the Elk Valley. The high quality metallurgical coal would be transported via railway to the Port of Vancouver, where it would be shipped overseas to be used in steelmaking.

The key project components include:

- Surface extraction areas (three pits – north pit, east pit, and south pit);
- Waste rock management areas;
- Plant area (includes raw coal stockpile area, a processing plant, and site support facilities);
- Clean coal transportation route (overland conveyor and haul road);
- Rail load-out facility and rail siding (includes various auxiliary facilities such as a guard house; light vehicle wash; drug and alcohol testing/orientation building; and a small dry);
- Power supply;
- Natural gas supply;
- Explosives storage;
- Fuel storage;
- Sewage treatment; and
- Water supply.



File Location: G:\GIS\2012 and Prior\126231 Crown Mountain\Noise Figure 1 Acoustic Local Study Area.mxd

NWP Coal Canada Ltd

Crown Mountain Coking Coal Project

Figure 1
Acoustic Local Study Area

- Acoustic Local Study Area
- Existing Operating Mines
- Watercourses
- Highways
- Arterial Roads
- Local/Resource Roads
- Project Footprint
- Lakes/Rivers
- Railway
- Municipal Boundaries
- BC/Alberta Parks and Protected Areas
- BC/Alberta Border

SCALE 1:265,000
0 2.5 5 10 km

N W E S

Map Drawing Information: Province of British Columbia,NWP Coal Canada Ltd., Dillon Consulting Limited, ESRI Base Layers, GeoGratis, CanVec. Government of Alberta.

Map Created By: RBB
Map Checked By: KAO
Map Projection: NAD 1983 UTM Zone 11N

PROJECT: 12-6231
STATUS: FINAL
DATE: 2018-11-22

1.2 Purpose and Objectives

Under the *Canadian Environmental Assessment Act* (2012), the Project is considered a designated Project under *Regulations Designating Physical Projects* since the mine will have a production capacity of more than 3,000 tonnes per day. Provincially, the Project is considered a Reviewable Project given that that production capacity of the mine will be greater than 250,000 tonnes per year of clean coal and will result in a disturbance greater than 750 hectares that was not previously permitted for disturbance. The Application Information Requirements (AIR) submitted to the Environmental Assessment Office (EAO) on April 26, 2018, specifies the information that the Proponent must provide in their Application for an Environmental Assessment Certificate (EAC) under section 16(2) of the BCEAA.

The noise baseline assessment work was conducted pursuant to the Environmental Assessment Act, S.B.C. 2002, c.43. The assessment of project effects on noise were conducted in accordance with the methodology stipulated in Section 3.0 of the AIR. The methods used to assess the potential adverse effects of the Project are based on the BC EAO's Guideline for the Selection of Valued Components and Assessment of Potential Effects (2013). Noise was selected as an intermediate Valued Component (VC) which has the potential to affect multiple receptors including wildlife and people (including local communities, Indigenous groups, and temporary residents at recreation areas).

The AIR stipulates that the Environmental Assessment Application will include an assessment of the Project effects on each identified intermediate VC. Since noise was identified as an intermediate VC, a baseline noise assessment is required as a point of reference against which potential project effects can be measured.

Section 4.1.2 of the AIR states that:

- "The assessment of Project effects on noise and vibration will:
  - Be conducted in accordance with the methodology specified in Section 3.0 of the AIR, using the organizational structure demonstrated in this Section;
  - Describe the regulatory requirements, policies, BMP, and guidance documents relevant to the management of noise and vibration levels, and compare the residual effects of the Project to these; and
  - Describe how information obtained through consultation with regulators, stakeholders, community members, and the KNC was used in the identification of issues and the overall assessment process.
- The acoustic environment will be assessed at sensitive receptors (nearby people/communities and wildlife) and include evaluation of the following measurement indicators to determine changes in the environment as a result of the Project:
  - Noise levels at receptors (e.g., wildlife habitat, residences [permanent and temporary]); and

- Vibration levels at receptors (e.g., wildlife habitat, residences [permanent and temporary])."

Section 6.1 in the Guidelines for the Preparation of an Environmental Impact Statement for the Crown Mountain Coking Coal Project stipulates that the EIS will present current ambient noise levels at key receptor points, including the results of the baseline ambient noise survey. This will assist in determining how the Project could affect the VCs.

The main objectives of the noise baseline assessment program were to:

- Measure noise levels at receptors (wildlife habitat and permanent and temporary residences) in the nearby vicinity of the proposed project site; and,
- Establish baseline noise data that can be used to assess the potential project effects.

1.3 Scope

The scope of the noise baseline study included:

- Communication with NWP Coal employees and Jameson Resource employees regarding nearby operations;
- Determination of representative noise-sensitive receptors for ambient noise monitoring;
- A field program to collect ambient noise data at the identified six (6) representative receptors in the LSA;
- A review of related data from similar projects;
- Data analysis and determination of permissible sound levels (PSLs); and,
- Preparation of baseline noise report.

2.0 Background

2.1 Fundamentals of Air-Borne Sound and Noise

2.1.1 Introduction

This section of the report provides definitions of commonly used terminologies in noise analysis and impact assessment. Subsequently, basics of noise, its characteristics and propagation are discussed.

2.1.2 Glossary

Definitions:

"Ambient Sound Levels (ASLs)" –Background sound level; the sound level that is present in the environment, produced by sources other than the "Source being investigated or assessed";

"**dBA"** – Unit of measurement of sound in "Decibels". The suffix "A" refers to the use of a weighting filter to more closely approximate the human ear's response to sound. It filters out very high and low frequencies that the human ear would not typically hear or respond to;

"FCM/RAC Guidelines" - The Federation of Canadian Municipalities and the Railway Association of Canada's, "Guidelines for New Development in Proximity to Railway Operations", 2013;

"**Herz**" – The number of sound waves cycles per second;

"**L*eq***" – A measure of a total sound energy over a specified time period, expressed as Logarithmic Energy Equivalent Continuous Sound Level; i.e. the constant sound level over the time period in question, that results in the same total sound energy as the actual varying sound;

"**L*max***" – The maximum sound level (dBA) during a single event;

"**L*eq*(*h*)**"- means a Receptor's cumulative noise exposure from all events over a one hour time period;

"L*dn*" – means a Receptor's cumulative noise exposure from all events over a full 24 hour time period. Events between 10:00 pm and 7:00 am are increased by 10 Decibels to account for greater nighttime sensitivity to noise;[1]

"**Receptor"** or **"Noise Receptor**" – A specific location or person that is receiving the sound waves emitted from a subject source;

"Sensitive Land Use" – A land use that is sensitive to noise (whether inside or outside the buildings) and that must be planned and/or designed using appropriate land use compatibility principles. Examples

[1] See Federal Transit Administration Noise and Vibration Manual for Definitions of and Logarithmic Equations for all "Leq" terms listed, Chapter 2.5.

include residential, nursing/retirement homes, hospitals, schools, childcare centres etc. In general, it includes any use where Noise is likely to cause an adverse effect of material discomfort whether inside or outside a building;[2] and

"**Source"** – A source (such as an activity or an equipment) that is generating and emitting sound waves in the air.

2.1.3 Fundamentals of Sound

2.1.3.1 What is Sound and what are its Characteristics?

Sound is most simply defined as the vibration in the air that we can hear. Vibrating surfaces (e.g., engines, drums, loudspeakers) typically produce pressure fluctuations in the air. The pressure fluctuations spread out like waves in the air, in all directions, decreasing in intensity with distance from the source. Our ears sense the pressure fluctuations and create electrical signals that our brain interprets as sound.[3]

Sound has three distinctive characteristics that the ear identifies [4]

1) Amplitude (loudness or softness) – measured in "Decibels";
2) Frequency or "Pitch" – representing a range of "low" to "high" sounding tones; Pitch is determined by frequency of wavelength, measured in cycles per second or "Hertz"; and
3) Time Patterns (variability) – intermittent sounds versus sounds of longer duration; the concept of "Leq" measures sound over a specific time period.

Sound Pressure Levels/Decibels

Our ears can hear a wide range of pressure intensities. The "Decibel" scale was developed to represent the range of audible sounds that human ears can detect in terms of **loudness or softness**. The Decibel scale represented as "dB" measures the sound pressure level in Decibels. 0 Decibels represents the threshold of hearing. 120-130 Decibels represents the upper end of sound (i.e. **loudest**) that can be painful or highly uncomfortable.[5]

Figure 2 (Adapted from Figure 2-11 in Transit Noise and Vibration Assessment by the Federal Transit Administration (FTA) provides sound levels of typical noise sources and the associated human response.

[2] City of Ottawa, "Environmental Noise Control Guidelines", Glossary definition, "Noise Sensitive Land Use", p. 7.
[3] See discussion in "SoundSmart: City of Vancouver Noise Control Manual", Introduction and Appendix A.1
[4] Federal Transit Administration: Transit Noise and Vibration Impact Assessment, Section 2.1 Fundamentals of Noise, 2006, p. 2-2
[5] City of Vancouver, Appendix A.2

Each increase in sound level by approximately 10 dB results in roughly doubling of perception of loudness.

The number of sound sources at the same location also impacts the amplitude (logarithm addition is used). For example, where two sound sources of the same decibel level are added, the decibel level increases by approximately 3 decibels. Two buses at **70 dB** noise level each will result in a combined noise level of **73 dB**. Where two sources with different decibel levels are added, a logarithmic addition is used (e.g., 60 dB + 64 dB = 65.5 dB) (See FTA, "Decibel Addition", p.2-3 including Chart in Figure 2.2).

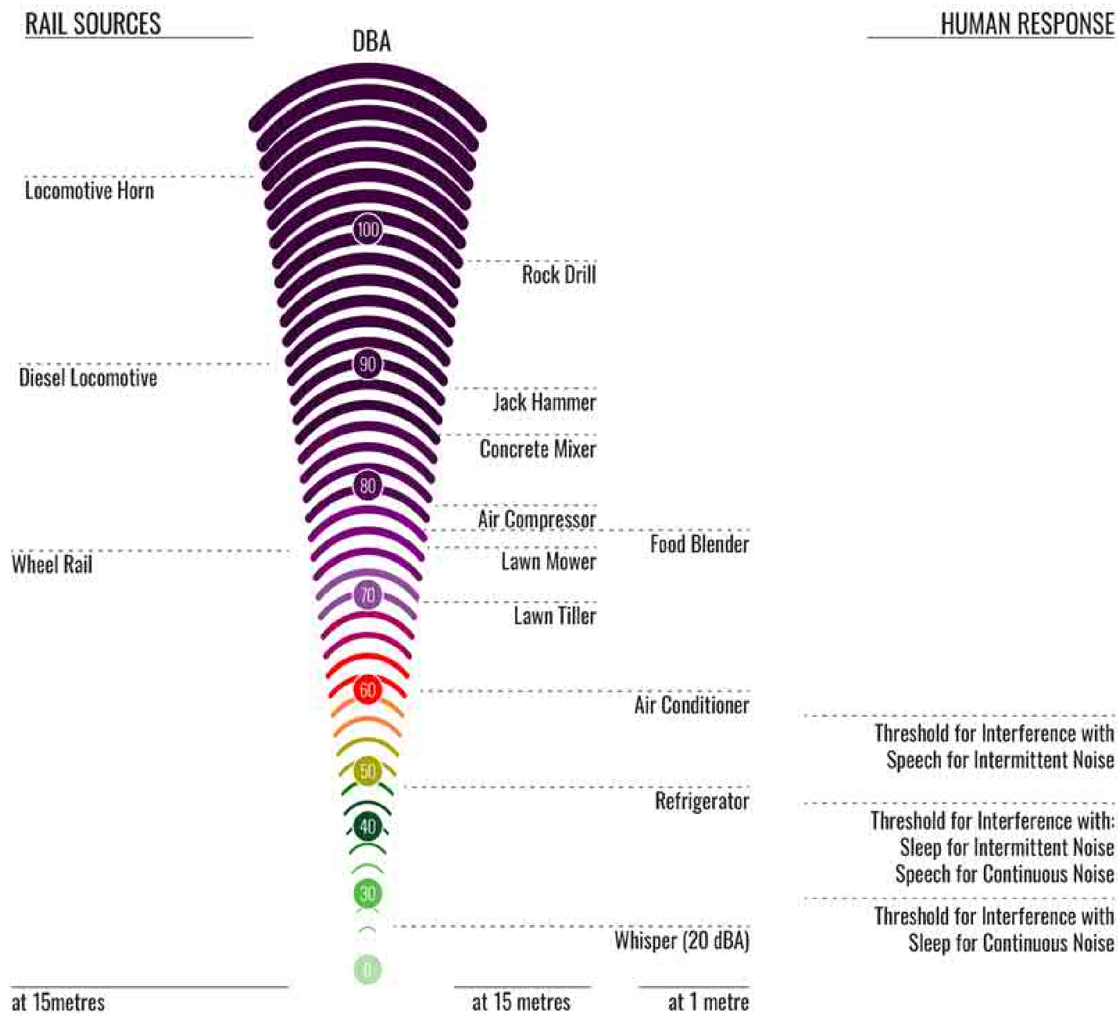
Wind and air temperature can impact sound propagation through atmosphere through refraction due to variation or gradient in wind speed and temperature at different heights about ground. Wind can also contribute to background noise as a result of interacting with various surfaces / obstacles in its path.

Frequency or Pitch

The ear is sensitive to a wide range of frequencies or "Pitches" from very low (e.g., fog horn) to very high (e.g., jingling keys, whistle). **The wavelength (described in terms of Hertz) determines the Pitch.** The pitch our ears can detect ranges from a low of 20-30 cycles per second (Hertz) to 18,000 + cycles per second (Hertz). Ears are most sensitive to sounds in 700 to 5000 Hertz range. Sound perceived at the Receptor is often made from a combination of frequencies, blended together in a spectrum. To mimic the ear's sensitivity, sound measurement instruments contain an electronic filter known as "A-weighting". The resulting sound levels are known as A-Weighted sound levels, expressed in A-weighted decibels or "dBA".[6]

[6] Ibid., Appendix A.3

Figure 2: Typical Rail and Non-Rail Sound Levels



Time Patterns

Some noise sources generate continuous noise over extended period of time, such as traffic noise from a highway. Such sources constitute the ambient noise levels. ASLs are typically low-level and vary slowly. Sounds of short duration which vary noticeably from one moment to next are easily distinguished over the ASLs. Examples of intermittent sound include pass-by trains, squealing brakes, a car horn, aircraft flyovers or emergency vehicle sirens.[7] As such, different noise related parameters are defined to describe a noise environment. They are explained in detail below:

- Lmax – Represents the maximum sound level, (measured in dBA) during a single event (e.g., an intermittent event). It is important to note that Lmax does not take into account the number and duration of events over a specific time period.
- "Leq(1h)" – Corresponds to the cumulative contribution of sound (in dBA) from all individual events/sources over a one hour time period. The fluctuating sound levels over a period of one hour are converted into an average equivalent sound level. Leq(1h) is sometimes used to establish sound limits by regulators or governmental bodies as it takes into account cumulative events over a specified time period.
- Ldn calculates the cumulative noise exposure from all events over a full 24 hour time period. Noise levels for activities/sources between 10 pm and 7 am are increased by 10 dB to account for greater nighttime sensitivity to noise. Fluctuating sounds are replaced by a constant sound equivalent value over the duration of 24 hours.

2.1.3.2 Sound Behaviour

As previously indicated, sound travels as pressure waves through the air. Sound behaviour can be described in terms of a "Source-Pathway-Receptor" framework:

- A Source generates sound waves; the sound levels depend upon the type of Source and its operating characteristics;
- Sound travels along a path between the Source and Receptor; sound levels can be attenuated by factors including distance and intervening objects; and
- At the Receptor, sound combines from all Sources to determine the sound levels.

Sound levels are impacted by three main factors:[8]

- Divergence: Sound levels attenuate with increasing distance due to divergence. The attenuation can be as high as 6 dBA per the doubling of distance.
- Absorption/diffusion Sound waves can be absorbed by soft and absorptive surfaces including vegetation-covered ground; and
- Shielding – Sound waves can be interrupted by vegetation, terrain, man-made barriers, or other buildings/ obstacles. Sound waves can still reach the Receptor by bending around objects or through gaps that may exist in a barrier.

[7] FTA Manual, "Time Patterns" p.2-6
[8] FTA Manual, p.2-10-11

Sound waves demonstrate diverse behaviours:

- As wavelength decreases, the frequency/Pitch increases**;**
- Long wavelength sound (Low-Pitched) – tends to bend around everyday objects, and therefore it is much more difficult to shield Receptors from low pitched sound with noise walls or other barriers. Low pitched sounds also travel more easily through solid materials;
- Low-Frequency (Long wavelength) sound can induce vibration in light-weight items in buildings that give the perception of ground-borne vibration;
- High-pitched sounds can squeeze through cracks and gaps more easily than long wavelength/ low frequency sounds; and
- Sound waves in dense high-rise areas can echo and bounce back and forth between buildings – this is known as the canyon effect.

How is Sound Measured?

Sound is measured with "sound level meters" (SLM). SLM's include a microphone, electronic amplifier and filter, display meter, and often a digital memory for logging sound level data over time.[9]

2.1.4 Noise Levels and Interference

2.1.4.1 What is Noise?

Sound is considered "Noise" when it is "unwanted" sound. It is usually unwanted because it interferes with human activity or causes an annoyance. Examples include interference with sleep, conversation, listening to music or TV. "Noisiness" to a Receptor depends not just upon "loudness" (Decibel level) or Pitch, but also on a range of personal and subjective factors related to the Noise Receptor/individual.

2.1.4.2 Some Sounds are "More Noisy" Than Others

Numerous attributes of sound (nature and time patterns) can increase the Receptor's perception of "noisiness" including:[10]

- Loudness – especially as the Decibel level increases;
- Frequency/Pitch – especially at peak perception range between 500-7000 Hertz;
- Presence of pure tones (i.e. squeal of wheels);
- Impulsive sound components – sounds which have sudden onsets and which rise substantially above background ASLs are often judged to be more noisy;
- Intermittency, irregularity, or rhythmic nature of sound;
- Duration of sound (i.e. for intermittent sounds, noisiness is judged to increase with duration); and
- Time of day or night, day of week or season of year.

[9] City of Vancouver, Appendix A.6;
[10] City of Vancouver, Appendix A.8

2.1.4.3 Personal Factors Influencing Perceived Noisiness and Negative Response to Noise

Personal, subjective factors and attitudes of the Receptor influence how "Noisy" a sound level is judged to be. Factors include: [11]

- Age and state of health of the Receptor;
- Activities Receptor is engaged in (i.e. sleep, relaxation);
- ASLs;
- Previous experience with the noise in question;
- Perceptions regarding the necessity or usefulness of the activity creating the noise; and
- Attitudes toward or involvement with the maker of the noise Source.

The attitudes of the Receptor to the noise can include both individual attitudes as well as attitudes of the community. A community may have expectations regarding acceptable levels of noise in their area.

2.1.4.4 Sensitive Uses

Some land uses are more "sensitive" to noise due to the various Noise factors identified above (i.e. age, health, activities engaged in etc.). "Sensitive Land Uses" comprise uses where Noise is likely to cause an *adverse effect* or material discomfort to Receptors. Examples of Sensitive land use include:

- Residential developments;
- Seasonal residences;
- Nursing/Retirement residences;
- Schools and educational institutions;
- Childcare Centres;
- Places of worship; and
- Hospitals.

It is important that Sensitive Land use is planned and designed using appropriate land use compatibility principles.

2.1.4.5 Negative Effects of Noise on People

Even modest levels of Noise can have a profound negative effect on people's health, well-being and quality of life. It can produce psychological and physiological effects such as fatigue due to sleep deprivation. Specifically, Noise can:

- Cause awakening;
- Alter sleep pattern;
- Reduce percentage and total time in REM sleep;
- Affect slow wave sleep;

[11] Ibid. Appendix A.9

- Increase body movement; and
- Change cardio vascular responses.

These interferences can affect mood and performance the next day, and may have longer term effects. This is particularly the case for sensitive groups such as young children where it can decrease their ability to learn and can impact their long-term health. The effects of Noise on child cognition can include:

- Reduced attention span;
- Difficulties in concentrating;
- Poorer discrimination and perception of speech;
- Poorer memory of complex spoken information; and
- Poorer reading ability and school performance.

2.1.4.6 Interference Thresholds

Studies and research have determined the precise levels at which Noise interferes with essential human activities (i.e. sleeping, speaking). Leading research has been completed by authorities including the US EPA, the US Federal Transit Authority, the World Health Organization and New South Wales Government Department of Planning to determine the threshold levels of sound that “interfere" with necessary human activities. The “interference” thresholds have been used by many jurisdictions to provide guidance for maximum sound levels, especially with respect to Sensitive Land Uses.

Research has determined that the Noise threshold for interference with common activities is very low. Some of the interference noise levels are presented below:

Interference with Sleep

Noise can interfere with sleep by delaying falling asleep, causing lighter sleep stages, and/or awaking a person from sleep. The threshold for interference with sleep inside a typical household is:

- 30 dBA for continuous noise; and
- 45 dBA for intermittent noises.

The threshold for continuous noise to interrupt sleep is low because levels of only 30 dBA can prevent persons from falling asleep. Once a person is asleep, louder intermittent noises are often required to disturb people by waking them from their sleep. Above these threshold levels, the likelihood of awakening or degradation of sleep quality increases.[12]

[12] City of Vancouver, p. 5-6 and Appendix p. A-5.

Speech Communication

If Noise levels reach or exceed the sound levels of speech, they can interfere with speech communication as words can be misunderstood. Noise level thresholds for speech interference are

- 45 dBA for steady noises and
- 55 dBA for intermittent noise.[13]

Annoyance

Annoyance is often a by-product of the direct interference of activities such as sleep, speech, or relaxation. However, annoyance may also occur as a result of the physical characteristics and subjective Receptor variables described above including age and health of the individual.

As a result of the research determining the thresholds of noise interference with various human activities, many guidelines for maximum allowable sound levels have been developed by leading authorities such as the US EPA, US FTA, New South Wales Government, CMHC, FCM/RAC, Province of Ontario, City of Ottawa.

2.1.5 Residential and Sensitive Land Uses

Studies indicate that noise issues become more significant when dealing with residential development, because people tend to be more sensitive to these issues in the context of their own homes. People may be less sensitive to Noise in other environments such as the daytime work place where equipment and machinery may be operating. Issues are also more significant because Noise levels can seem more pronounced when compared to activities in the home such as sleeping,[14] listening to soft music or TV or quiet conversations.

Certain groups of people are more sensitive to Noise than others, including the elderly, children, patients in hospitals etc. As previously indicated, certain activities are more sensitive to Noise such as sleeping.

Therefore, the regulatory agencies have put in place Noise regulation toward land uses and noise to minimize potential adverse impacts on noise sensitive receptors. The City of Ottawa has generally defined a “Noise Sensitive Land Use” as “any land use where environmental noise is likely to cause *an adverse effect* or material discomfort.” The City of Ottawa and other authorities include a wide range of land uses ranging from residential to hospitals, nursing/retirement residences, schools, daycare centres, etc.

[13] Ibid., Appendix p. A-5.
[14] FCM/ RAC Guidelines, p. 20-21.

3.0 Study Area

3.1 Local Study Area

As per the AIR, potential effects on the acoustic environment, including vibrations, will be assessed within the Project footprint and within the acoustic Local Study Area (LSA), as shown in **Figure 1**. The boundary of the acoustic LSA is based on identified sensitive receptors, such as the District of Sparwood and environments within a 3-km radius of the Project footprint to be inclusive of terrestrial environments (e.g., wildlife habitat). As well, the acoustic LSA includes areas used for recreation (e.g., hunting) that could be impacted by noise and vibration levels.

The Project area, and therefore the acoustic LSA is a greenfield site in the Kootenays, and is a combination of the Montane Spruce and Engelmann Spruce (Subalpine Fir) geoclimatic zones. The acoustic LSA extends across the Lower Elk Valley Road to the west, which is a moderately dense residential area. The northern extent of the LSA overlaps with Grave Creek and Grave Lake with a campground and residential area around Grave Lake. The eastern and southern extents of the LSA are densely forested and mountainous with a small number of seasonal cabins and campgrounds.

There are several existing metallurgical coal mines in the Elk Valley and Crowsnest coal fields, with Teck Corporation's Elkview 8 km southwest of the Project area and Line Creek 12 km north of the Project area. Therefore, the acoustic LSA may be impacted by the noise emitted by these nearby mines.

Additionally, the CP mainline and the Sparwood/Elk Valley Airport are within the LSA which affect the acoustic environment in the Project area.

The Project area is mainly used for recreational purposes, with the exception of a small number of residences around Grave Lake and a residential area on the Lower Elk Valley Road. Recreational fishermen and campers were observed in the area at the time of the noise monitoring.

3.2 Receptors

The British Columbia Oil and Gas Commission (OGC) Noise Control Best Practices Guideline (2009) refers to noise at the point of the receptor (at a dwelling), rather than at the source itself. Therefore, the monitoring equipment was set up at multiple receptors which were both seasonal and permanent dwellings. The locations of receptors were selected to be in close proximity to the Project and the associated noise generating activities (e.g., haul route). The descriptions of the receptors is provided in **Table 1** below:

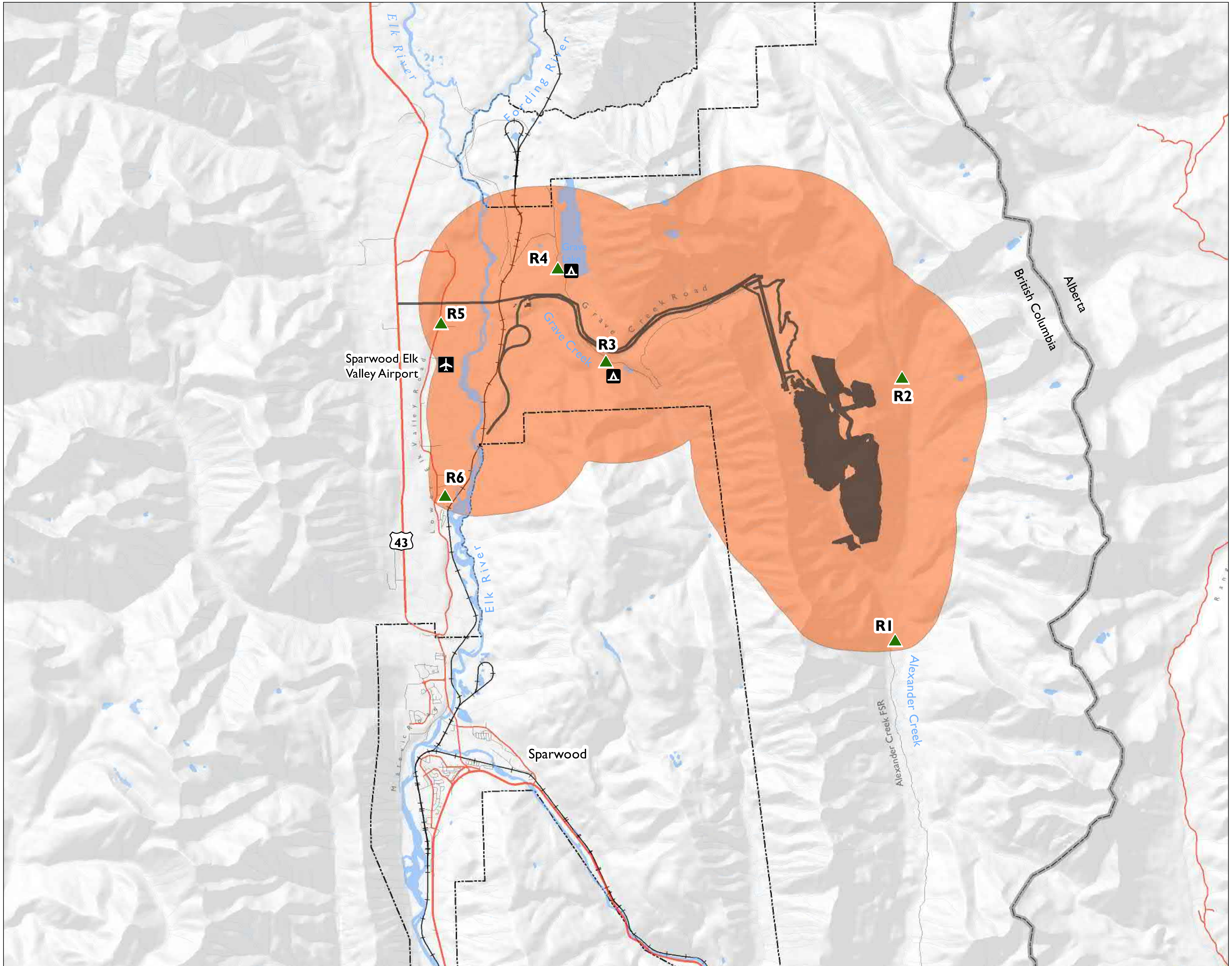
The receptor locations are illustrated in **Figure 3**.

Table 1: Receptor Description

Monitoring Station	UTM Coordinates	Description of Receptor Location
Receptor 1 Podransky Cabin	11 U, 5514686 mN, 664397 mE	- Approximately 10 m north of the road approaching the Podransky Cabin and 220 m west of the Podransky Cabin. - Approximately 145 m east of the Alexander Creek Forest Service Road. - Within a forested area, 45 m east of Alexander Creek.
Receptor 2 Snowmobile Cabin[1]	11 U, 5521812 mN, 664578 mE	- Off of a small unnamed road which splits from the Alexander Creek Forest Service Road at a helipad. The road crosses a small stream before reaching the snowmobile cabin. - Approximately 15 m southwest of a snowmobile cabin. - Within a forested area.
Receptor 3 Campground	11 U, 5522250 mN, 656550 mE	- Approximately 17 m north of a small campground which is located approximately 85 m southwest of the Grave Creek Forest Service Road. - Within a forested area, approximately 60 m east of Grave Creek and 2.0 km southwest of Grave Lake.
Receptor 4 Grave Lake Residences	11 U, 5524777 mN, 655247mE	- Approximately 15 m west of Grave Lake Road. - Approximately 200 m northwest of Grave Lake Campground and Boat Launch and approximately 150 m west of the residences along Grave Lake (across the road). - Within a forested area.
Receptor 5 5568 Lower Elk Valley Road	11 U, 5523283 mN, 652077mE	- In the backyard of 5568 Lower Elk Valley Road. - Approximately 1.7 km west of the CN line and 600 m northwest of the end of the runway at the nearby Sparwood/Elk Valley Airport. - Set up in a tree with long grasses beneath, long grasses and trees throughout the backyard.
Receptor 6 8882 Hidden Springs Road	11 U, 5518610 mN, 652190 mE	- In the backyard of 8882 Hidden Springs Road. - Approximately 250 m northwest of the CN line and 3.15 km southwest of the runway at the nearby Sparwood/Elk Valley Airport. - Set up at the base of a tree near the fence in the backyard. The backyard has multiple trees and a small water feature approximately 30-40 m away from the meter (not loud).

[1] Approximate UTM coordinates.

DILLON CONSULTING



NWP Coal Canada Ltd

Crown Mountain Coking Coal Project

Figure 3
Noise Receptor Locations

- Acoustic Local Study Area
- Noise Receptor Locations
- Watercourses
- Highways
- Arterial Roads
- Local/Resource Roads
- Project Footprint
- Lakes/Rivers
- Railway
- Municipal Boundaries
- BC/Alberta Parks and Protected Areas
- BC/Alberta Border
- Campground

SCALE 1:100,000
0 2.5 5 km
N W E S

Map Drawing Information: Province of British Columbia,NWP Coal Canada Ltd., Dillon Consulting Limited, ESRI Base Layers, GeoGratis, CanVec. Government of Alberta.

Map Created By: RBB
Map Checked By: KAO
Map Projection: NAD 1983 UTM Zone 11N

DILLON CONSULTING

PROJECT: 12-6231
STATUS: FINAL
DATE: 2018-11-22

File Location: G:\GIS\2012 and Prior\126231 Crown Mountain\Noise Figure 3 Noise Receptor Locations.mxd

4.0 Methodology

4.1 Monitoring Methodology

An ambient noise monitoring program consisted of gathering hourly A-weighted sound level equivalents (i.e., Leq(A)) on a continuous basis at the nearest representative receptors. A-weighted decibels are defined as "the sound level as measured on a sound level meter using a setting that emphasized the middle frequency components similar to the frequency response of the human ear at levels typical of rural backgrounds in mid frequencies" (BC OGC 2009). Six (6) receptors locations were chosen, near residences, cabins, and campgrounds. The noise monitoring was conducted between August 21st and 28th, 2017 (inclusive).

The ambient noise monitoring program was completed using six (6) Rion NL-22 Type II noise level meters. The instruments were calibrated in the laboratory. Certificates of Calibration, including instrument serial numbers are provided in **Appendix A**. Measurement methodology was based on CAN/CSA-ISO 1996-1 and the Ontario Ministry of the Environment, Conservation and Parks (MECP) noise publication document NPC-103 (1978). The NL-22 units were equipped with an environmental enclosure, an external battery and a wind screen to protect the microphone from wind and precipitation. The units were either on the ground locked to a tree or hanging from a tree using a chain and lock, with the microphone hanging from a branch to prevent an animal from being able to reach the microphone. The set-up of the sound meters are shown in the photograph log in **Appendix B**.

The units were setup to log hourly A-weighted sound level equivalent (LeqA) as well as other statistical values of measured levels such as peak, max / min and 90th percentiles (L90). Each monitoring period was at least 60 hours, with the shortest monitoring period being 66 hours (Receptors 4 and 6) and the longest monitoring period being 86 hours (Receptor 5).

Weather data for the noise measurement time periods was obtained from the Sparwood Station (Environment Canada), which was the closest meteorological station to the receptor locations. The following weather parameters were recorded:

- Temperature (°C);
- Relative Humidity (%);
- Wind Direction (10s degrees); and,
- Wind Speed (km/h).

The range of these parameters for each day of monitoring is presented in **Table 2**.

Table 2: Weather Parameters for Monitoring Days

Date	Temperature Range (°C)	Average Relative Humidity (%)	Wind Direction Range (10s deg)	Wind Speed Range (km/h)
August 21, 2017	3.8 – 24.3	52	1 – 36	3 – 16
August 22, 2017	7.1 – 29.5	50	1 – 36	3 – 18
August 23, 2017	6.6 – 30	46	1 – 36	3 – 20
August 24, 2017	14.6 – 25.1	42	10 – 26	1 – 27
August 25, 2017	6.6 – 22.6	40	1 – 36	1 – 17
August 26, 2017	1.8 – 26.5	44	1 – 36	1 – 20
August 27, 2017	4.1 – 30.3	44.6	1 – 36	2 – 21
August 28, 2017	6 – 31.5	45.6	0 – 36	1 – 16

The Sparwood weather station is located at the Sparwood Airport and is located approximately 14 km away from Receptor 1, 12 km away from Receptor 2, 4 km away from Receptor 3, 4 km away from Receptor 4, 1 km away from Receptor 5, and 4 km away from Receptor 6.

The following information was recorded in the field when the equipment was set up, checked, and disassembled:

- Noise meter identifier;
- Start time;
- Location of the receptor placement including GPS points;
- Record of conversations with residents;
- Explanation of selected receptor location;
- Audible sources observed nearby;
- Battery status and length of time recording (when checking and disassembling the meters);
- State of microphone and meter (dry or wet); and,
- Stop time.

It is assumed that coal mining operations at Teck Corporation’s Elkview 8 km southwest of the Project area and Line Creek 12 km north of the Project area were ongoing during the ambient noise monitoring.

4.2 Monitoring Locations

The following ambient noise monitoring locations were setup:

4.2.1 Receptor 1 – Podransky Cabin

The unit was chained to the base of a tree, with the microphone hanging from a tree branch above. Due to occupants in the Podransky Cabin at the time of the noise measurements, the meter was set up approximately 200 m from the cabin in order to minimize the noise interference from the cabin. This location was selected since it is the closest permanent residence to the proposed project area.

4.2.2 Receptor 2 – Snowmobile Cabin

The unit was chained to the base of a tree, with the microphone hanging from a tree branch above. This location was selected since the snowmobile cabin is the only residence (seasonal or permanent) in the area and is in close proximity to the proposed project area.

4.2.3 Receptor 3 – Campground

The unit was chained to the mid-section of a tree with the microphone sticking horizontally outside of the pelican case. This location was selected to capture the ambient noise in the campground area, which is adjacent to the proposed haul road (Grave Creek Forest Service Road). There were no campers at the campground during the meter set up or take-down, as well as when the meter was checked throughout the monitoring period.

4.2.4 Receptor 4 – Grave Lake Residences

The unit was chained to the base of a tree, with the microphone hanging from a tree branch above. This location was selected to capture the ambient noise near the Grave Lake Campground and Boat Launch as well as it being in close proximity to the residences on the western side of Grave Lake. Attempts were made to set up the meter in the yard of one of the residences on the west side of Grave Lake, however residents were either not home or did not give permission to set up the meter on their property. The Grave Lake Campground and Boat Launch was very busy at the time of the noise monitoring and there was a risk of tampering with the equipment if it was set up in the campground. Therefore, a discreet location in the forest across Grave Lake Road was chosen.

4.2.5 Receptor 5 – 5568 Lower Elk Valley Road

The unit was chained to the mid-section of a tree in the backyard of 5568 Elk Valley Road, with the microphone hanging from a tree branch above. The microphone was hung from a branch higher up the tree to avoid the dog living at the residence from reaching it. There was a dog kennel on the adjacent property approximately 50 m east of the receptor. Attempts were made to find another yard in which to set up the meter (farther away from the kennel), however residents were either not home or did not give permission to set up the meter on their property. This location was selected to capture the ambient noise in the residential area on Lower Elk Valley Road.

4.2.6 Receptor 6 – 8882 Hidden Springs Road

The unit was chained to the base of a tree, in the backyard of 8882 Hidden Springs Road, with the microphone hanging from a tree branch above. The microphone was hung from a branch higher up the tree to avoid the dog living at the residence from reaching it. This location was selected to capture the ambient noise in the residential area on Hidden Springs Road and Lower Elk Valley Road.

4.3 British Columbia Oil and Gas Commission (BC OGC) Noise Control Best Practices Guidelines

The BC OGC Noise Control Best Practices Guidelines (the Guide; BC OGC 2009) provides an assessment methodology where the ASL is compared against the PSL for each receptor selected near the Project area. The receptors were selected to be compliant with the BC OGC criteria. Generally, receptors were within 1.5 km of the facility operations.

The PSL is determined for the nearest dwellings and is assigned to those dwelling units (BC OGC 2009). The PSL is calculated as follows:

Permissible Sound Level = Basic Sound Level + Daytime Adjustment + Class A Adjustment + Class B Adjustment

The average rural ASL has been determined to be 35 dBA Leq at night (BC OGC 2009). Therefore, the basic sound level (BSL) is determined to be 40 dBA (1-hour Leq), which is used to calculate PSL. The BSL for each receptor is determined according to proximity to transportation noise sources and dwelling density and summarized in **Table 3**.

According to the BC OGC (2009), the daytime adjustment is 10 dBA Leq above the nighttime BSL since daytime BSLs are commonly 10 dBA higher than nighttime levels and higher noise levels during nighttime are considered less acceptable.

Each receptor is then assumed to be 5 dBA less than the BSL (for both nighttime and daytime BSLs) (BC OGC 2009). The BSL and ASL for nighttime and daytime hours are shown in **Table 3** below.

Table 3: Basic Sound Levels (BSLs) for daytime and nighttime hours

Receptor ID	Category1	Dwelling Unit Density/Quarter Section of Land	BSLs for daytime hours (dBA)	BSLs for nighttime hours (dBA)	Average Daytime ASL (dBA)	Average Nighttime ASL (dBA)
R1	1	1-8 dwellings	50	40	45	35
R2	1	1-8 dwellings	50	40	45	35
R3	1	1-8 dwellings	50	40	45	35
R4	1	9-160 dwellings	53	43	48	38
R5	1	9-160 dwellings	53	43	48	38
R6	2	9-160 dwellings	58	48	53	43

[1]Category 1 – dwelling units more than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 2 - dwelling units more than 30 m but less than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 3 - dwelling units less than 30 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.

5.0 Results

5.1 Crown Mountain Measured Noise Data

The gathered noise data was analyzed for average, maximum and minimum LeqA and L90, for both daytime hours (7 am to 10 pm) and nighttime hours (10 pm to 7 am). The results are summarized on **Tables 4** and **5**. Hourly results can be found in **Appendix C**.

Table 4: Measured Leq Levels (dBa) – Average, Max and Min

Monitoring Location	Measured Hourly Sound Pressure Levels (dBA)					
	Daytime[1]			Nighttime[2]		
	Leq avg	Leq max	Leq min	Leq avg	Leq max	Leq min
R1	38.1	44.3	36.2	36.9	37.6	36.1
R2	47.0	54.3	46.5	46.6	46.8	46.4
R3	46.8	60.3	44.6	46.1	46.6	45.7
R4	35.9	48.8	26.3	28.9	35.3	21.6
R5	48.8	56.0	36.7	39.5	47.4	32.4
R6	45.6	54.0	38.5	44.2	54.8	38.8

[1] Daytime hours are between 7:00 am and 10:00 pm

[2] Nightime hours are between 10:00 pm and 7:00 am.

Table 5: Measured L90 Levels (dBa) – Average, Max, and Min

Monitoring Location	Measured Hourly Sound Pressure Levels (dBA)					
	Daytime[1]			Nighttime[2]		
	L90 avg	L90 max	L90 min	L90 avg	L90 max	L90 min
R1	36.2	44.8	34.6	36.6	37.2	35.9
R2	46.5	46.9	46.2	46.5	46.6	46.2
R3	46.8	46.9	43.7	45.8	46.3	45.4
R4	27.9	34.0	23.4	24.2	29.4	20.5
R5	37.7	47.6	29.0	33.0	36.4	30.1
R6	40.0	44.0	37.3	38.6	40.9	37.6

[1] Daytime hours are between 7:00 am and 10:00 pm

[2] Nighttime hours are between 10:00 pm and 7:00 am.

The average Leq (shown in **Table 4**, above) for each receptor was compared to the average ASLs for both the nighttime andfdaytime daytime periods. These comparisons are presented in **Table 6**, below.

Table 6: Average Measured Nighttime and Daytime Leq Compared to Average ASLs

Monitoring Location	Measured Daytime[1] Leq (dBA)	Average Daytime[1] ASL (dBA)	Measured Nighttime[2] Leq (dBA)	Average Nighttime[2] ASL (dBA)
R1	38.1	45	**36.9**	35
R2	***47.0***	45	***46.6***	35
R3	***46.8***	45	***46.1***	35
R4	35.9	48	28.9	38
R5	***48.8***	48	***39.5***	38
R6	45.6	53	***44.2***	43

[1] Daytime hours are between 7:00 am and 10:00 pm

[2] Nighttime hours are between 10:00 pm and 7:00 am.

Bold/Italicized values indicate higher than the average ASL at that receptor.

The measured sound levels at all receptors with the exception of R4 are higher than the anticipated average ASLs during nighttime hours. The measured sound levels at R2, R3, and R5 are also higher than BC OGC average ASLs during daytime hours. A difference of less than 3 dBA compared to the average ASL is considered an acceptable degree of variation in outdoor environments.

The measured daytime A-weighted sound level Leq values for receptors R1 and R4 are less than 40 dBA, indicating quiet or low ambient noise levels. The measured daytime A-weighted Leq values for receptors R2, R3, R5 and R6 are in mid to high 40's range, indicating that the ambient noise environment at these receptors are moderately quiet during both daytime and nighttime hours.

For receptors R5 and R6, the average L90 values are noticeably lower than the Leq values. This is indicative of noise impact from relatively high impacting noise sources and for short durations, such as a train pass-by or an aircraft flyover which is anticipated since receptors 5 and 6 are the closest receptors to the CN line and the Sparwood/Elk Valley Airport.

5.2 Permissible Sound Level Determination

The PSL is calculated as described in **Section 4.3**. The PSLs will be used as the noise performance criteria for each of the representative receptors. The cumulative noise impact associated with the proposed project will be compared against the performance criteria to determine compliance or need for implementation of noise mitigation measures.

BSLs for each receptor is determined in accordance with the Guide and summarized in **Table 3**. Daytime adjustment of 10 dBA above the nighttime levels (**Table 3**) is included in the analysis. Class A adjustments are based on nature of the activity and/or actual sound levels. Class A1, the seasonal activity adjustment (wintertime condition), is 0 to +5 dBA Leq. For the purpose of this assessment, the Class A1 adjustment is considered to be 0 as seasonal adjustment is not warranted. Class A2 adjustment (i.e., ambient monitoring adjustment) is between -10 dBA and +10 dBA and is determined based on the difference between measured ASL and the Guide's average ASL. A difference of less than 3 dBA is considered a normal degree of variation in the outdoor environment. As such, the average ASL for receptors R1, R5, and R6 were considered validated according to BC OGC. For receptors R2, R3, and R4 where the difference between the measured ASL and the average ASL is greater than 3 dB, the PSL and average ASL has been adjusted as per **Section 4.3** and summarized in **Table 7**.

The Class B adjustment in the Guide is for temporary activities and is not relevant to this assessment.

Table 7: Resulting PSL for Nighttime after Adjustments Applied

Receptor ID	BSL (dBA)	Adjustments (dBA)			PSL (dBA)	Resulting ASL (dBA)
		Class A1	Class A2	Class B		
R1	40	-	-	-	40	35
R2	40	-	10	-	50	45
R3	40	-	10	-	50	45
R4	43	-	-9	-	34	29
R5	43	-	-	-	43	38
R6	48	-	-	-	48	43

Table 8 summarizes the Average Measured Nighttime and Daytime Leq Compared against the adjusted ASLs.

Table 8: Average Measured Nighttime and Daytime Leq Compared to PSLs

Monitoring Location	Measured Daytime[1] Leq (dBA)	Daytime[1] PSL (dBA)	Measured Nighttime[2] Leq (dBA)	Nighttime[2] PSL (dBA)
R1	38.1	50	36.9	40
R2	47.0	60	46.6	50
R3	46.8	60	46.1	50
R4	35.9	44	28.9	34
R5	48.8	53	39.5	43
R6	45.6	58	44.2	48

[1] Daytime hours are between 7:00 am and 10:00 pm

[2] Nightime hours are between 10:00 pm and 7:00 am

6.0 Discussion and Conclusion

In this study the BSLs for daytime and nighttime were determined in accordance to the *British Columbia Noise Control Best Practices Guideline.* The adjusted BSLs for R1 to R6 were determined to be 40 dBA, 40 dBA, 43 dBA, 43 dBA, and 48 dBA, respectively, during nighttime hours, and 50 dBA, 50 dBA, 53 dBA, 53 dBA, and 58 dBA, respectively, during daytime hours, based on proximity to transportation and dwelling density. The resulting BC OGC average ASLs are 5 dBA lower than the BSLs for each receptor both during nighttime hours and daytime hours. The BSLs along with the established adjustments for daytime and ambient monitoring were used to calculate the PSLs for each of the representative receptors in this study. The PSLs will be used as the performance criteria when assessing the noise impact from the proposed facility/ operations on the nearby representative receptor locations.

The assessment of compliance is done through predictive noise modelling and includes all dominant noise sources at the proposed facility. Compliance is achieved if the modelling results demonstrate that the predicted noise levels at the representative receptors are at or less than the established PSLs. If there are exceedances, noise mitigation measures would be required in order to achieve compliance.

The established PSLs for the representative receptors are presented in **Table 8**.

7.0 Closure

This ambient noise monitoring report has been prepared based on information provided by NWP Coal Canada Limited or available to Dillon at the time of preparing this report. This report is intended to provide a reasonable review of available information within an agreed work scope, schedule and budget. This report was prepared by Dillon for the sole benefit of NWP Coal Canada Limited Inc. The material in the report reflects Dillon's judgment in light of the information available to Dillon at the time of this report preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

8.0 References

British Columbia Environmental Assessment Office. (2013). Guideline for the Selection of Valued Components and Assessment of Potential Effects.

BC Oil and Gas Commission. (2009). British Columbia Noise Control Best Practice Guideline.

Ontario Ministry of the Environment, Conservation and Parks. (1978). Model Municipal Noise Control By-Law Publication NPC-103.

Appendix A

Instrumentation

CERTIFICATE of CALIBRATION

Make : RION Co. Ltd

Model : NL-22

Descr. : Sound Level Meter Type 2

Serial # : 00773200

Asset # : DCL-01

Reference # : 140942

Customer : Dillon Consulting Limited
Oakville, ON

P. Order :

Cal. status : Received in spec's, no adjustment made.

Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.

Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.

Our calibration system complies with the requirements of ISO-17025 standard, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.

<Original signed by>

Calibrated : Sep 10, 2015

By :

Cal. Due : Sep 10, 2017

T. Beilin

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-216 J-512

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
Phone : 905 565 1584 Fax: 905 565 8325
http: // www.navair.com
e-Mail: navair @ navair.com

CERTIFICATE of CALIBRATION

Make : RION Co. Ltd

Reference # : 140943

Model : NL-22

Customer : Dillon Consulting Limited
Oakville, ON

Descr. : Sound Level Meter Type 2

Serial # : 01073403

P. Order :

Asset # : DCL-02

Cal. status : Received in spec's, no adjustment made.
Cal.cycle as per customer.

Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.

Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.

Our calibration system complies with the requirements of ISO-17025 standard, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.

Calibrated : Sep 10, 2015

By : <Original signed by>

T. Beilin

Cal. Due : Sep 10, 2017

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-216 J-512

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
Phone : 905 565 1584 Fax: 905 565 8325
http: // www.navair.com
e-Mail: navair @ navair.com

CERTIFICATE of CALIBRATION

Make : RION Co. Ltd

Reference # : 140944

Model : NL-22

Customer : Dillon Consulting Limited
Oakville, ON

Descr. : Sound Level Meter Type 2

Serial # : 00773199

P. Order :

Asset # : DCL-03

Cal. status : Received in spec's, no adjustment made.
Cal.cycle as per customer.

Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.

Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.

Our calibration system complies with the requirements of ISO-17025 standard, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.

<Original signed by>

Calibrated : Sep 10, 2015

By :

Cal. Due : Sep 10, 2017

T. Beilin

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-216 J-512

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
Phone : 905 565 1584 Fax: 905 565 8325
http: // www.navair.com
e-Mail: navair @ navair.com

CALTEC
ISO REGISTERED

50 Steeles Ave. E. Unit 10, Milton ON, L9T 4W9, Canada
Tel: 905-875-2606, Fax: 905-875-3832
service@caltec.ca - www.caltec.ca
Toll Free: 1-888-608-3113

CERTIFICATE OF CALIBRATION

Customer: SS WILSON ASSOCIATES
Equipment: RION - SOUND LEVEL METER
Model: NL-22
ID: D

Certificate No: C091815-35
Next Due Date: SEPT 18, 2016
Serial No: 00362597

Unit Condition: As Found: GOOD
Adjustment/Repair Required: YES

Lab Conditions: Temperature: 22 °C ±2
Humidity: 50 % RH ± 20

The equipment described above has been calibrated and tested using standards traceable to the National Institute of Standards and Technology NIST.
E09 Sound Level Calibrator
E23 Function generator

UUT (Unit Under Test)

Test Point	dB Range	UUT As Found	UUT As Left	Tolerance In/out
94.0 dB-A	LOW	93.0	94.2	IN
114.0 dB-A	HIGH	112.8	114.0	IN
94.0 dB-C	LOW	93.0	94.2	IN
114.0 dB-C	HIGH	112.7	113.9	IN

NOTE: Calibrated unit.

<Original signed by>

Calibrated by: AC
Calibration Date: SEPT 18, 2015

Signature:

CALTEC
ISO REGISTERED

50 Steeles Ave. E. Unit 10, Milton ON, L9T 4W9, Canada
Tel: 905-875-2606, Fax: 905-875-3832
service@caltec.ca - www.caltec.ca
Toll Free: 1-888-608-3113

CERTIFICATE OF CALIBRATION

Customer: SS WILSON ASSOCIATES
Equipment: RION - SOUND LEVEL METER
Model: NL-22
ID: C

Certificate No: C091815-34
Next Due Date: SEPT 18, 2016
Serial No: 00773195

Unit Condition:
As Found: GOOD
Adjustment/Repair Required: YES

Lab Conditions:
Temperature: 22 °C ±2
Humidity: 50 % RH ± 20

The equipment described above has been calibrated and tested using standards traceable to the National Institute of Standards and Technology NIST.
E09 Sound Level Calibrator
E23 Function generator

UUT (Unit Under Test)

Test Point	dB Range	UUT As Found	UUT As Left	Tolerance In/out
94.0 dB-A	LOW	95.3	94.1	IN
114.0 dB-A	HIGH	115.0	113.8	IN
94.0 dB-C	LOW	95.3	94.0	IN
114.0 dB-C	HIGH	114.9	113.7	IN

NOTE: Calibrated unit.

<Original signed by>

Calibrated by: AC
Calibration Date: SEPT 18, 2015

Signature: ____________

CALTEC
ISO REGISTERED

50 Steeles Ave. E. Unit 10, Milton ON, L9T 4W9, Canada
Tel: 905-875-2606, Fax: 905-875-3832
service@caltec.ca - www.caltec.ca
Toll Free: 1-888-608-3113

CERTIFICATE OF CALIBRATION

Customer: SS WILSON ASSOCIATES
Equipment: RION - SOUND LEVEL METER
Model: NL-22
ID: G

Certificate No: C091815-38
Next Due Date: SEPT 18, 2016
Serial No: 00794238

Unit Condition:
As Found: GOOD
Adjustment/Repair Required: YES

Lab Conditions:
Temperature: 22 °C ±2
Humidity: 50 % RH ± 20

The equipment described above has been calibrated and tested using standards traceable to the National Institute of Standards and Technology NIST.
E09 Sound Level Calibrator
E23 Function generator

UUT (Unit Under Test)

Test Point	dB Range	UUT As Found	UUT As Left	Tolerance In/out
94.0 dB-A	LOW	91.4	94.2	IN
114.0 dB-A	HIGH	111.2	114.0	IN
94.0 dB-C	LOW	91.3	94.1	IN
114.0 dB-C	HIGH	111.1	113.9	IN

NOTE: Calibrated unit.

<Original signed by>

Calibrated by: AC
Calibration Date: SEPT 18, 2015

Signature: ________________

SS WILSON ASSOCIATES
Consulting Engineers

September 28, 2018

Dillon Consulting Limited
800- 235 Yorkland Boulevard
Toronto, Ontario
M2J 4Y8

Dear Mr. Iravani,

Re: Certificate of Calibration for RION Sound Level Meter
SSWA Equipment – Rented to Dillion Consulting Ltd.

Dillon Consulting Limited rented the following equipment:

- RION NL-22 SOUND LEVEL METER Serial No. 00794238
- RION NL-22 SOUND LEVEL METER Serial No. 00773195
- RION NL-22 SOUND LEVEL METER Serial No. 00362597

SS Wilson Associates confirms that the above Sound Level Meter was calibrated and tested using RION NC-74 Calibrator. This calibrator was certified for calibration using the standards that are certified by or traceable to the National Research Council of Canada NRC or this National Institute of Standards and Technology NIST and now meets or exceeds the manufacturer's specifications. The calibration for RION NC-74, Serial No. 35094465 was completed at Calibration Technologies Ltd. In Milton, Ontario on July 6, 2017.

The certificate for calibration of the Rion Sound Level Meter Calibrator NC-74, Serial No. 35094465 used for the above noted equipment rental is No. 0070617-41.

Best regards,

<Original signed by>

Hazem Gidamy, M.Eng.P.Eng.
Principal

SSWA INC. 15 Wertheim Court, Suite 211, Richmond Hill, Ontario, L4B 3H7
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Appendix B

Sound Meter Set Up Photo Log

Photo 1: Receptor 1

GPS Location: 11 U Northing 5514686, Easting 664397

Photo 2: Receptor 1

GPS Location: 11 U Northing 5514686, Easting 664397

Photo 3: Receptor 2

GPS Location: 11 U Northing 5521812, Easting 664578

Photo 4: Receptor 2

GPS Location: 11 U Northing 5521812, Easting 664578

DILLON CONSULTING	SITE PHOTOGRAPHS - RECEPTORS	PROJECT NO. 12-6231
	Crown Mountain Coking Coal Project	PHOTO NO.
August 2017	Noise Baseline Assessment	1-4

Photo 5: Receptor 3

GPS Location: 11 U Northing 5522250, Easting 656550

Photo 6: Receptor 3

GPS Location: 11 U Northing 5522250, Easting 656550

Photo 7: Receptor 4

GPS Location: 11 U Northing 5524777, Easting 655247

Photo 8: Receptor 5

GPS Location: 11 U Northing 5523283, Easting 652077

DILLON CONSULTING	SITE PHOTOGRAPHS - RECEPTORS	PROJECT NO. 12-6231
	Crown Mountain Coking Coal Project	PHOTO NO.
August 2017	Noise Baseline Assessment	5-8

Photo 9: Receptor 5

GPS Location: 11 U Northing 5523283, Easting 652077

Photo 10: Receptor 6

GPS Location: 11 U Northing 5518610, Easting 652190

Photo 11: Receptor 6

GPS Location: 11 U Northing 5518610, Easting 652190

Photo 12: Receptor 6

GPS Location: 11 U Northing 5518610, Easting 652190

DILLON CONSULTING	SITE PHOTOGRAPHS - RECEPTORS	PROJECT NO. 12-6231
	Crown Mountain Coking Coal Project	PHOTO NO.
August 2017	Noise Baseline Assessment	9-12

Appendix C

Measured Hourly Sound Levels

Monitoring Location 1

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA05	LA10	LA50	LA90	LA95	Lppeak
1	2017-08-25 18:58	1:00:00	43.9	79.5	74.3	35.4	44.3	39.1	36.4	35.9	35.8	112.9
2	2017-08-25 19:58	1:00:00	38.1	73.7	56.2	35.8	39.4	37.7	36.6	36.3	36.2	76.9
3	2017-08-25 20:58	1:00:00	36.2	71.8	44.5	35.7	36.5	36.4	36.1	35.9	35.9	66
4	2017-08-25 21:58	1:00:00	36.1	71.7	40.4	35.6	36.4	36.3	36.1	35.9	35.9	64.4
5	2017-08-25 22:58	1:00:00	36.2	71.8	44.7	35.6	36.3	36.3	36.1	35.9	35.9	68.1
6	2017-08-25 23:58	1:00:00	36.5	72.1	46.1	35.8	36.7	36.5	36.3	36.1	36.1	69.9
7	2017-08-26 0:58	1:00:00	36.4	72	40.1	35.8	36.7	36.6	36.3	36.1	36.1	67.9
8	2017-08-26 1:58	1:00:00	36.4	72	37.1	35.8	36.6	36.5	36.3	36.2	36.1	61.9
9	2017-08-26 2:58	1:00:00	37	72.6	46.6	35.9	37.8	37	36.6	36.3	36.3	64
10	2017-08-26 3:58	1:00:00	36.8	72.4	37.6	36.3	37	36.9	36.7	36.5	36.5	63.6
11	2017-08-26 4:58	1:00:00	36.7	72.3	40	36.3	37	36.9	36.7	36.5	36.5	72.5
12	2017-08-26 5:58	1:00:00	37.2	72.8	47.1	36.2	38.1	37.1	36.7	36.5	36.5	63.8
13	2017-08-26 6:58	1:00:00	40.7	76.3	68.1	36.2	37.4	37	36.7	36.5	36.4	87.1
14	2017-08-26 7:58	1:00:00	37	72.6	39.7	36.3	37.3	37.2	36.9	36.6	36.6	65.1
15	2017-08-26 8:58	1:00:00	38.1	73.7	48.1	36.9	38.9	38.8	38	37.4	37.2	63.7
16	2017-08-26 9:58	1:00:00	38.8	74.4	41.1	37.4	39.5	39.3	38.7	38.2	38	68.7
17	2017-08-26 10:58	1:00:00	41.5	77.1	60.1	35.4	47.6	39.3	36.9	36.1	35.9	83
18	2017-08-26 11:58	1:00:00	38.5	74.1	59.4	34.9	39.7	38.8	36.3	35.5	35.4	79.7
19	2017-08-26 12:58	1:00:00	36.8	72.4	49	34.5	39.4	38	35.9	35.2	35.1	75.9
20	2017-08-26 13:58	1:00:00	37.1	72.7	48.7	34.2	40.3	38.5	35.7	34.9	34.8	73.4
21	2017-08-26 14:58	1:00:00	37.5	73.1	49.8	34.3	40.6	39.1	36.1	34.9	34.8	85.8
22	2017-08-26 15:58	1:00:00	38.6	74.2	64.8	34.3	38.4	37.4	35.5	34.9	34.8	83
23	2017-08-26 16:58	1:00:00	37	72.6	50.6	34.7	38.4	37.5	36.6	35.3	35.1	73
24	2017-08-26 17:58	1:00:00	37.9	73.5	47.2	36.7	38.9	38.5	37.8	37.3	37.3	68
25	2017-08-26 18:58	1:00:00	37.4	73	46.4	36.2	38.4	37.8	37.1	36.7	36.6	72.4
26	2017-08-26 19:58	1:00:00	37.4	73	52.9	36.1	37.8	37.3	36.8	36.4	36.4	75.8
27	2017-08-26 20:58	1:00:00	37.1	72.7	56.1	36.1	37.3	37	36.7	36.4	36.4	85.3
28	2017-08-26 21:58	1:00:00	36.6	72.2	38.4	36.2	36.8	36.8	36.6	36.5	36.4	63.4
29	2017-08-26 22:58	1:00:00	36.9	72.5	45	36.4	37.1	37	36.8	36.6	36.6	68
30	2017-08-26 23:58	1:00:00	36.7	72.3	37.4	36.2	37	36.9	36.7	36.5	36.5	65.9
31	2017-08-27 0:58	1:00:00	36.9	72.5	38.8	36.3	37.2	37.1	36.8	36.7	36.6	68.6
32	2017-08-27 1:58	1:00:00	36.8	72.4	37.6	36.3	37.1	37.1	36.8	36.6	36.5	59.4
33	2017-08-27 2:58	1:00:00	37	72.6	37.8	36.4	37.2	37.2	36.9	36.7	36.7	69.7
34	2017-08-27 3:58	1:00:00	37.2	72.8	38.4	36.6	37.6	37.5	37.1	36.9	36.9	66.4
35	2017-08-27 4:58	1:00:00	37.1	72.7	38.2	36.7	37.4	37.3	37.1	36.9	36.9	64.1
36	2017-08-27 5:58	1:00:00	37.6	73.2	42.2	36.9	38	37.9	37.6	37.2	37.2	67.2

Daytime hours (7 am to 10 pm)

Night time hours (10 pm to 7 am)

Monitoring Location 1

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA05	LA10	LA50	LA90	LA95	Lppeak
37	2017-08-27 6:58	1:00:00	38.6	74.2	55.3	36.6	39	38.1	37.3	36.9	36.9	77.3
38	2017-08-27 7:58	1:00:00	37.3	72.9	56.4	36.2	37.6	37.3	36.8	36.5	36.4	82.2
39	2017-08-27 8:58	1:00:00	38.2	73.8	41.8	37	38.7	38.6	38.3	37.4	37.3	71.3
40	2017-08-27 9:58	1:00:00	39.4	75	50.6	38.4	40	39.6	39.1	38.8	38.8	77.1
41	2017-08-27 10:58	1:00:00	38	73.6	51.5	35.7	39.6	39.2	37.6	36.6	36.5	70.4
42	2017-08-27 11:58	1:00:00	36.8	72.4	54	34.7	37.6	37	36	35.3	35.2	71.6
43	2017-08-27 12:58	1:00:00	44.3	79.9	71.8	34.6	39.6	37.6	35.7	35.2	35.1	91.3
44	2017-08-27 13:58	1:00:00	37.3	72.9	56.6	34.7	39.1	37.9	36	35.3	35.2	77.3
45	2017-08-27 14:58	1:00:00	36.4	72	52.9	34.2	38.3	37.1	35.4	34.9	34.8	78.8
46	2017-08-27 15:58	1:00:00	37	72.6	48.7	34.5	41.5	37.9	35.7	35.1	34.9	69.8
47	2017-08-27 16:58	1:00:00	37.3	72.9	45.1	35.1	38.8	38	37	36	35.8	74.3
48	2017-08-27 17:58	1:00:00	38	73.6	45.9	36.9	39	38.7	37.8	37.3	37.3	67.8
49	2017-08-27 18:58	1:00:00	37.6	73.2	45.4	36.9	38.2	37.9	37.5	37.2	37.1	78
50	2017-08-27 19:58	1:00:00	37	72.6	42.4	36.4	37.4	37.3	37	36.7	36.6	67.2
51	2017-08-27 20:58	1:00:00	36.9	72.5	42	36.3	37.4	37.1	36.8	36.6	36.5	66.8
52	2017-08-27 21:58	1:00:00	37	72.6	37.7	36.4	37.2	37.2	36.9	36.7	36.6	61.3
53	2017-08-27 22:58	1:00:00	37.4	73	47.6	36.6	37.8	37.5	37.2	37	36.9	71.8
54	2017-08-27 23:58	1:00:00	37.3	72.9	38.4	36.6	37.5	37.5	37.2	37	36.9	64.7
55	2017-08-28 0:58	1:00:00	37.2	72.8	38.2	36.6	37.4	37.4	37.1	36.9	36.8	62.4
56	2017-08-28 1:58	1:00:00	37.2	72.8	39	36.7	37.5	37.4	37.1	36.9	36.9	63.9
57	2017-08-28 2:58	1:00:00	37.2	72.8	37.9	36.6	37.4	37.4	37.2	37	37	62.5
58	2017-08-28 3:58	1:00:00	37.2	72.8	38.1	36.4	37.6	37.5	37.2	36.9	36.8	62.6
59	2017-08-28 4:58	1:00:00	37.1	72.7	38.2	36.5	37.6	37.5	37	36.8	36.8	68.2
60	2017-08-28 5:58	1:00:00	37.6	73.2	51.4	36.7	37.6	37.5	37.2	37	37	70.2
61	2017-08-28 6:58	1:00:00	39.2	74.8	56.9	36.3	40.2	38	36.8	36.6	36.6	75.3
62	2017-08-28 7:58	1:00:00	37.3	72.9	44.9	36.5	38	37.6	37.1	36.8	36.8	69.1
63	2017-08-28 8:58	1:00:00	38.3	73.9	44.4	37.3	39	38.6	38.2	37.8	37.6	71.7
64	2017-08-28 9:58	1:00:00	39	74.6	49.8	37.9	39.7	39.3	38.8	38.3	38.2	76.5
65	2017-08-28 10:58	1:00:00	38.5	74.1	48	36.4	39.7	39.4	38.2	37.1	37	68.1
66	2017-08-28 11:58	1:00:00	39.3	74.9	66.3	34.7	37.5	37.1	36.1	35.2	35.1	82.8
67	2017-08-28 12:58	1:00:00	36.6	72.2	45.5	34.3	39.4	37.9	35.7	35	34.8	71.3
68	2017-08-28 13:58	1:00:00	36.3	71.9	51.6	34	38.3	37.3	35.3	34.6	34.5	75.7
69	2017-08-28 14:58	1:00:00	38.5	74.1	53.5	34.1	42.2	40.6	36.7	35.1	34.9	75.4
70	2017-08-28 15:58	1:00:00	38.6	74.2	53.2	34.5	40.5	38.1	35.6	35.1	35	74.3
71	2017-08-28 16:58	1:00:00	41.4	77	51	34.7	47.7	46.8	36.7	35.4	35.2	74.8
72	2017-08-28 17:58	0:48:57	48.1	82.8	75.8	37.1	48.2	47	45.5	44.8	37.8	99.9

Max LAeq	44.3	Max L90	38.8
Min LAeq	36.2	Min L90	34.6
Ave LAeq	38.11163	Ave L90	36.21628

Ave LAeq	36.93704	Ave L90	36.62222
Max LAeq	37.6	Max L90	37.2
Min LAeq	36.1	Min L90	35.9

Monitoring Location 2

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA05	LA10	LA50	LA90	LA95	Lppeak
1	2017-08-22 10:40	1:00:00	54.3	89.9	84.7	36.8	48.3	47.4	47.1	46.9	46.8	113.5
2	2017-08-22 11:40	1:00:00	47	82.6	51	46.3	47.4	47.2	47	46.7	46.7	75.1
3	2017-08-22 12:40	1:00:00	46.8	82.4	48	46.1	47	47	46.7	46.5	46.4	79.1
4	2017-08-22 13:40	1:00:00	46.8	82.4	52	45.7	47.4	47.1	46.7	46.4	46.3	82.6
5	2017-08-22 14:40	1:00:00	46.8	82.4	48.1	46.1	47.2	47.1	46.7	46.4	46.4	80.9
6	2017-08-22 15:40	1:00:00	47.1	82.7	48.4	46.1	47.5	47.4	47	46.7	46.6	86.4
7	2017-08-22 16:40	1:00:00	47.1	82.7	49.7	46.4	47.5	47.4	47	46.8	46.7	84.3
8	2017-08-22 17:40	1:00:00	46.9	82.5	48.9	46.3	47.2	47.1	46.9	46.7	46.7	78
9	2017-08-22 18:40	1:00:00	46.8	82.4	50.2	46.3	47	47	46.8	46.6	46.6	72.4
10	2017-08-22 19:40	1:00:00	46.8	82.4	47.9	46.3	46.9	46.9	46.7	46.6	46.6	67.8
11	2017-08-22 20:40	1:00:00	46.8	82.4	53.5	46.3	47	46.9	46.7	46.6	46.6	78.5
12	2017-08-22 21:40	1:00:00	46.7	82.3	47.6	46.3	46.9	46.9	46.7	46.6	46.5	72.3
13	2017-08-22 22:40	1:00:00	46.7	82.3	47.2	46.3	46.9	46.9	46.7	46.6	46.5	70.2
14	2017-08-22 23:40	1:00:00	46.7	82.3	47.1	46.2	46.9	46.9	46.7	46.6	46.5	71.3
15	2017-08-23 0:40	1:00:00	46.7	82.3	47.1	46.3	46.9	46.9	46.7	46.6	46.6	68.4
16	2017-08-23 1:40	1:00:00	46.7	82.3	47.2	46.3	46.9	46.9	46.7	46.6	46.5	70.1
17	2017-08-23 2:40	1:00:00	46.8	82.4	50.3	46.4	46.9	46.9	46.8	46.6	46.6	69.4
18	2017-08-23 3:40	1:00:00	46.8	82.4	47.2	46.2	46.9	46.9	46.8	46.6	46.6	67.3
19	2017-08-23 4:40	1:00:00	46.8	82.4	47.1	46.3	46.9	46.9	46.7	46.6	46.6	69.5
20	2017-08-23 5:40	1:00:00	46.8	82.4	48.3	46.4	47	46.9	46.8	46.6	46.6	67.4
21	2017-08-23 6:40	1:00:00	46.8	82.4	50.6	46.4	47	46.9	46.8	46.7	46.6	68.7
22	2017-08-23 7:40	1:00:00	46.8	82.4	49.4	46.3	47	46.9	46.8	46.6	46.6	70.7
23	2017-08-23 8:40	1:00:00	46.8	82.4	49.2	46.3	46.9	46.9	46.7	46.6	46.5	67.7
24	2017-08-23 9:40	1:00:00	48.6	84.2	75	46.5	48.4	47.5	47	46.8	46.7	109.1
25	2017-08-23 10:40	1:00:00	47	82.6	55.6	46.1	47.3	47.2	46.9	46.7	46.6	81.5
26	2017-08-23 11:40	1:00:00	46.9	82.5	53.8	46.1	47.3	47.1	46.7	46.5	46.4	78.1
27	2017-08-23 12:40	1:00:00	46.7	82.3	48.8	45.8	47.1	47	46.6	46.4	46.3	73.1
28	2017-08-23 13:40	1:00:00	46.7	82.3	52.7	45.7	47.3	47	46.6	46.2	46.2	90.1
29	2017-08-23 14:40	1:00:00	46.7	82.3	53.7	45.7	47.1	47	46.6	46.3	46.2	79.7
30	2017-08-23 15:40	1:00:00	47	82.6	53.5	45.8	47.9	47.5	46.8	46.4	46.3	77.5
31	2017-08-23 16:40	1:00:00	46.8	82.4	50.7	46	47.6	47.2	46.7	46.4	46.3	78.5
32	2017-08-23 17:40	1:00:00	46.7	82.3	49.2	45.9	47	46.9	46.6	46.4	46.4	78.7
33	2017-08-23 18:40	1:00:00	46.6	82.2	47.1	46.1	46.8	46.7	46.6	46.4	46.4	72
34	2017-08-23 19:40	1:00:00	46.6	82.2	50.6	46.1	46.9	46.8	46.6	46.4	46.3	72.6
35	2017-08-23 20:40	1:00:00	46.6	82.2	47.3	46.1	46.8	46.8	46.6	46.4	46.3	69.3

Daytime hours (7 am to 10 pm)

Night time hours (10 pm to 7 am)

Monitoring Location 2

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA05	LA10	LA50	LA90	LA95	Lppeak
36	2017-08-23 21:40	1:00:00	46.6	82.2	47.2	46	46.8	46.7	46.5	46.4	46.3	68.6
37	2017-08-23 22:40	1:00:00	46.6	82.2	48.9	46.1	46.8	46.7	46.6	46.4	46.3	71.6
38	2017-08-23 23:40	1:00:00	46.6	82.2	47	46.1	46.7	46.7	46.5	46.4	46.3	64.8
39	2017-08-24 0:40	1:00:00	46.7	82.3	55.1	46.1	46.9	46.8	46.6	46.4	46.4	79
40	2017-08-24 1:40	1:00:00	46.7	82.3	47.1	46.1	46.9	46.8	46.6	46.5	46.4	68
41	2017-08-24 2:40	1:00:00	46.7	82.3	49.5	46.1	47	46.9	46.7	46.5	46.4	73.6
42	2017-08-24 3:40	1:00:00	46.7	82.3	47.9	46.2	47	46.9	46.7	46.5	46.5	72.9
43	2017-08-24 4:40	1:00:00	46.8	82.4	48.2	46.1	47	47	46.7	46.5	46.5	91.5
44	2017-08-24 5:40	1:00:00	46.7	82.3	48.2	46.2	46.9	46.9	46.7	46.5	46.5	68.5
45	2017-08-24 6:40	1:00:00	46.7	82.3	53.5	46.1	46.9	46.8	46.6	46.5	46.4	81.2
46	2017-08-24 7:40	1:00:00	46.7	82.3	50.8	46.1	47	46.8	46.6	46.5	46.4	80.6
47	2017-08-24 8:40	1:00:00	46.5	82.1	49.7	46	46.7	46.6	46.5	46.3	46.3	73.4
48	2017-08-24 9:40	1:00:00	46.6	82.2	51	46	46.9	46.8	46.5	46.3	46.3	82.1
49	2017-08-24 10:40	1:00:00	48.8	84.4	76.2	45.9	47.8	47.3	46.5	46.3	46.2	109.2
50	2017-08-24 11:40	1:00:00	46.7	82.3	49.8	45.9	47.6	47.1	46.5	46.2	46.2	79.4
51	2017-08-24 12:40	1:00:00	47	82.6	55.3	45.8	48.4	47.6	46.4	46.2	46.1	83
52	2017-08-24 13:40	1:00:00	47.5	83.1	54.3	45.9	49.8	48.8	46.9	46.4	46.3	86.2
53	2017-08-24 14:40	1:00:00	48	83.6	56.4	46	50.9	49.6	47.1	46.5	46.4	86.9
54	2017-08-24 15:40	1:00:00	48.2	83.8	57.7	46	51.2	49.6	47.4	46.6	46.4	99.9
55	2017-08-24 16:40	1:00:00	47.2	82.8	56.2	46	48.4	48.1	46.8	46.5	46.4	91.2
56	2017-08-24 17:40	1:00:00	47.4	83	54.1	45.9	49.3	48.4	46.9	46.5	46.4	87.1
57	2017-08-24 18:40	1:00:00	46.9	82.5	50.1	45.9	47.9	47.5	46.7	46.4	46.3	85.9
58	2017-08-24 19:40	1:00:00	46.7	82.3	49.1	46	47.1	46.9	46.6	46.4	46.3	86.1
59	2017-08-24 20:40	1:00:00	46.7	82.3	48.8	45.8	47.2	47	46.6	46.3	46.3	79
60	2017-08-24 21:40	1:00:00	46.5	82.1	47.1	45.7	46.8	46.7	46.5	46.3	46.2	76.4
61	2017-08-24 22:40	1:00:00	46.5	82.1	47.5	46	46.8	46.7	46.5	46.3	46.3	72.8
62	2017-08-24 23:40	1:00:00	46.5	82.1	47.1	45.9	46.7	46.6	46.4	46.3	46.2	67.6
63	2017-08-25 0:40	1:00:00	46.4	82	47.5	45.9	46.6	46.5	46.4	46.2	46.2	66.2
64	2017-08-25 1:40	1:00:00	46.5	82.1	48.5	46	46.7	46.6	46.5	46.3	46.2	73.6
65	2017-08-25 2:40	1:00:00	46.5	82.1	47.1	46	46.8	46.7	46.5	46.3	46.3	66.1
66	2017-08-25 3:40	1:00:00	46.5	82.1	47.2	45.9	46.7	46.7	46.5	46.4	46.3	72.2
67	2017-08-25 4:40	1:00:00	46.6	82.2	47	46.1	46.8	46.7	46.6	46.4	46.4	64.2
68	2017-08-25 5:40	1:00:00	46.5	82.1	47.5	46.1	46.7	46.7	46.5	46.4	46.3	74.4
69	2017-08-25 6:40	1:00:00	50.4	86	78.9	46	46.7	46.6	46.5	46.4	46.3	97.7
70	2017-08-25 7:40	0:44:33	49	83.3	72.3	46	47.8	46.7	46.5	46.4	46.3	106.2

Max LAeq	50.4		Max L90	46.8
Min LAeq	46.5		Min L90	46.2
Ave LAeq	47.07805		Ave L90	46.46098
Ave LAeq	46.64074		Ave L90	46.45926
Max LAeq	46.8		Max L90	46.6
Min LAeq	46.4		Min L90	46.2

Monitoring Location 3

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA01	LA50	LA90	LA95	LA99	Lppeak
1	2017-08-22 14:11	1:00:00	57.4	93	90.3	38.6	66	45.2	44.8	44.7	44.5	124
2	2017-08-22 15:11	1:00:00	45.3	80.9	48.2	44.2	46.4	45.1	44.8	44.7	44.5	96.1
3	2017-08-22 16:11	1:00:00	45.3	80.9	48.9	44.3	47	45.2	44.7	44.6	44.5	90.9
4	2017-08-22 17:11	1:00:00	45.8	81.4	53.1	44.2	48.6	45.6	44.8	44.7	44.5	98.1
5	2017-08-22 18:11	1:00:00	46.3	81.9	49	44.7	48.1	46.1	45.5	45.4	45.1	91.1
6	2017-08-22 19:11	1:00:00	47.3	82.9	57.3	46.4	48	47.3	46.9	46.8	46.7	79.5
7	2017-08-22 20:11	1:00:00	47.2	82.8	59.5	46.3	48.6	47.1	46.8	46.7	46.6	87.4
8	2017-08-22 21:11	1:00:00	46.9	82.5	47.8	46.2	47.4	46.9	46.7	46.6	46.5	75.9
9	2017-08-22 22:11	1:00:00	46.6	82.2	47.2	45.8	47	46.6	46.3	46.2	46.1	65.2
10	2017-08-22 23:11	1:00:00	46.4	82	47.1	45.9	46.8	46.3	46.1	46.1	46	63.2
11	2017-08-23 0:11	1:00:00	46.2	81.8	46.7	45.7	46.5	46.2	46	46	45.9	64.7
12	2017-08-23 1:11	1:00:00	46.2	81.8	48.4	45.6	46.6	46.1	45.9	45.9	45.8	67.8
13	2017-08-23 2:11	1:00:00	46.2	81.8	46.9	45.7	46.6	46.2	46	45.9	45.9	64.9
14	2017-08-23 3:11	1:00:00	46.1	81.7	47.2	45.6	46.5	46.1	46	45.9	45.9	67.2
15	2017-08-23 4:11	1:00:00	46.2	81.8	47	45.7	46.5	46.1	46	45.9	45.9	65.2
16	2017-08-23 5:11	1:00:00	46.2	81.8	47.5	45.7	46.6	46.1	46	45.9	45.9	70.5
17	2017-08-23 6:11	1:00:00	46.2	81.8	47.6	45.7	46.6	46.1	46	45.9	45.8	68.9
18	2017-08-23 7:11	1:00:00	46.1	81.7	47.1	45.7	46.4	46.1	46	45.9	45.9	66.7
19	2017-08-23 8:11	1:00:00	46.3	81.9	54.6	45.7	46.9	46.2	46	45.9	45.8	70.7
20	2017-08-23 9:11	1:00:00	47	82.6	52.8	45.8	48	46.8	46.5	46.4	46	75.1
21	2017-08-23 10:11	1:00:00	45.9	81.5	50.1	45.2	47	45.8	45.6	45.5	45.4	71.8
22	2017-08-23 11:11	1:00:00	45.8	81.4	51.3	44.9	47.7	45.7	45.4	45.4	45.1	84.9
23	2017-08-23 12:11	1:00:00	60.3	95.9	92.6	43.5	65.3	45.4	44.4	44.1	43.9	123.9
24	2017-08-23 13:11	1:00:00	44.6	80.2	52.6	43.5	46.6	44.4	44.1	44	43.8	89.4
25	2017-08-23 14:11	1:00:00	44.9	80.5	57.9	43.3	50.6	44.3	43.9	43.8	43.6	105.4
26	2017-08-23 15:11	1:00:00	45	80.6	55.6	43.1	50.5	44.4	43.7	43.6	43.4	100.4
27	2017-08-23 16:11	1:00:00	44.9	80.5	54.7	43.2	49.2	44.5	43.9	43.8	43.5	99
28	2017-08-23 17:11	1:00:00	44.9	80.5	47.3	43.4	46.7	44.7	44.1	43.9	43.6	87.8
29	2017-08-23 18:11	1:00:00	46.1	81.7	47.6	44.2	47.3	46.2	45	44.8	44.5	91.6
30	2017-08-23 19:11	1:00:00	46.7	82.3	48	45.3	47.5	46.6	46.1	46	45.7	89.3
31	2017-08-23 20:11	1:00:00	46.5	82.1	54	45.6	47.2	46.4	46.1	46	45.9	71
32	2017-08-23 21:11	1:00:00	46.2	81.8	52.6	45.5	47	46.2	45.9	45.8	45.7	74.8
33	2017-08-23 22:11	1:00:00	46	81.6	47.1	45.3	46.5	46	45.7	45.6	45.5	67.8
34	2017-08-23 23:11	1:00:00	45.9	81.5	47.4	45.1	46.9	45.8	45.5	45.4	45.3	75.9
35	2017-08-24 0:11	1:00:00	45.8	81.4	54	45	46.2	45.7	45.4	45.4	45.3	77.7
36	2017-08-24 1:11	1:00:00	46.1	81.7	49.9	45.3	47	46	45.7	45.6	45.5	73.6
37	2017-08-24 2:11	1:00:00	46.1	81.7	53.3	45.4	47.3	46.1	45.8	45.8	45.6	75.7

Daytime hours (7 am to 10 pm)

Night time hours (10 pm to 7 am

Monitoring Location 3

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA01	LA50	LA90	LA95	LA99	Lppeak
38	2017-08-24 3:11	1:00:00	45.9	81.5	46.6	45.2	46.3	45.8	45.6	45.5	45.4	68.7
39	2017-08-24 4:11	1:00:00	46	81.6	46.8	45.3	46.4	45.9	45.7	45.6	45.5	77
40	2017-08-24 5:11	1:00:00	46.1	81.7	48.8	45.4	46.7	46	45.8	45.7	45.6	70
41	2017-08-24 6:11	1:00:00	46.3	81.9	49.2	45.7	46.9	46.3	46.1	46	45.9	81.8
42	2017-08-24 7:11	1:00:00	46.5	82.1	47.8	45.8	47.3	46.5	46.2	46.2	46.1	73.1
43	2017-08-24 8:11	1:00:00	46.4	82	50	45.4	47	46.3	46	45.9	45.7	79.8
44	2017-08-24 9:11	1:00:00	60.2	95.8	93.2	44.9	64.8	46.3	45.7	45.6	45.3	124
45	2017-08-24 10:11	1:00:00	45.8	81.4	50.1	44.9	47.6	45.6	45.2	45.2	45.1	90
46	2017-08-24 11:11	1:00:00	45.7	81.3	52.1	44.7	49.4	45.5	45.1	45.1	45	95.9
47	2017-08-24 12:11	1:00:00	45.6	81.2	50.3	44.4	48.2	45.4	44.9	44.8	44.6	100.5
48	2017-08-24 13:11	1:00:00	45.9	81.5	54.2	44.5	48.8	45.4	44.9	44.8	44.7	94.2
49	2017-08-24 14:11	1:00:00	46.4	82	57.9	44.4	53.7	45.5	44.9	44.8	44.6	104.4
50	2017-08-24 15:11	1:00:00	46.5	82.1	57	44.3	53.5	45.3	44.9	44.8	44.5	102.2
51	2017-08-24 16:11	1:00:00	46.3	81.9	56.4	44.3	52.9	45.4	44.8	44.7	44.5	99.3
52	2017-08-24 17:11	1:00:00	46.8	82.4	59.5	44.4	55.2	45.5	44.9	44.8	44.6	99.3
53	2017-08-24 18:11	1:00:00	45.9	81.5	57.5	44.2	49.9	45.4	44.8	44.6	44.4	94.2
54	2017-08-24 19:11	1:00:00	46	81.6	47.6	44.8	47.1	46	45.3	45.2	45	87.6
55	2017-08-24 20:11	1:00:00	46.5	82.1	48.4	45.3	47.3	46.5	46	45.8	45.6	85.4
56	2017-08-24 21:11	1:00:00	46.4	82	47.3	45.2	47	46.4	46	45.9	45.6	73.5
57	2017-08-24 22:11	1:00:00	46.4	82	47.5	45.7	47.1	46.4	46.1	46.1	45.9	74.8
58	2017-08-24 23:11	1:00:00	46.1	81.7	46.7	45.5	46.5	46	45.8	45.8	45.7	64.1
59	2017-08-25 0:11	1:00:00	46	81.6	46.6	45.4	46.4	46	45.8	45.7	45.6	74.7
60	2017-08-25 1:11	1:00:00	46.3	81.9	47.1	45.4	46.9	46.2	46	45.9	45.7	87.8
61	2017-08-25 2:11	1:00:00	46	81.6	51.1	45.3	46.7	45.9	45.6	45.6	45.5	79.5
62	2017-08-25 3:11	1:00:00	45.9	81.5	46.4	45.2	46.2	45.9	45.6	45.6	45.5	72.7
63	2017-08-25 4:11	1:00:00	45.8	81.4	47.5	45.2	46.4	45.8	45.6	45.5	45.4	67.3
64	2017-08-25 5:11	1:00:00	45.7	81.3	47.4	45	46	45.7	45.4	45.3	45.2	65.6
65	2017-08-25 6:11	1:00:00	45.8	81.4	57.9	45.2	47.4	45.6	45.4	45.4	45.3	72.8
66	2017-08-25 7:11	1:00:00	45.6	81.2	56.2	45	46.7	45.5	45.3	45.3	45.2	69.7
67	2017-08-25 8:11	1:00:00	46.1	81.7	59.1	44.9	53.2	45.5	45.3	45.2	45.1	81
68	2017-08-25 9:11	1:00:00	46.2	81.8	59.3	45.1	48.7	45.9	45.5	45.4	45.3	74.6
69	2017-08-25 10:11	0:16:56	58.2	88.3	81.3	33.2	73	45.4	45.1	45	34	121.4

Daytime hours (7 am to 10 pm)

Max LAeq	60.3	Max L90	46.8
Min LAeq	44.6	Min L90	43.6
Ave LAeq	46.7525	Ave L90	45.2125

Ave LAeq	46.09259	Ave L90	45.74815
Max LAeq	46.6	Max L90	46.2
Min LAeq	45.7	Min L90	45.3

Monitoring Location 4

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA05	LA10	LA50	LA90	LA95	Lppeak
1	2017-08-22 15:19	1:00:00	48.8	84.4	71.8	26.9	52.5	44.6	35.4	30.5	29.2	103.9
2	2017-08-22 16:19	1:00:00	37.6	73.2	49.7	26.5	42.1	40.8	35.8	32	31	84.8
3	2017-08-22 17:19	1:00:00	38.5	74.1	61.8	26.4	42.2	40	34.7	29.8	28.8	98.5
4	2017-08-22 18:19	1:00:00	39.7	75.3	67.3	24.4	41.8	38.8	33.3	26.8	26	88.6
5	2017-08-22 19:19	1:00:00	30.8	66.4	51.5	23.8	33.5	31.2	27	25	24.7	74.9
6	2017-08-22 20:19	1:00:00	36.4	72	64	23.9	33.4	31.1	25.9	25	24.8	84.2
7	2017-08-22 21:19	1:00:00	30.5	66.1	53.9	23.6	37.3	34.6	25.3	24.4	24.2	78
8	2017-08-22 22:19	1:00:00	29.6	65.2	55.3	23.2	27.5	26.9	25.3	24.3	24.1	81.4
9	2017-08-22 23:19	1:00:00	24.7	60.3	30.4	21.9	26.3	26	24.5	22.8	22.6	65.8
10	2017-08-23 0:19	1:00:00	26.9	62.5	40.6	22.7	31.3	28.5	25.2	23.8	23.4	65.7
11	2017-08-23 1:19	1:00:00	28.7	64.3	52.1	22.4	34.7	31.6	24.3	23.4	23.2	71.3
12	2017-08-23 2:19	1:00:00	25.6	61.2	34.5	21.3	28.6	27.1	25	23.6	22.3	60.4
13	2017-08-23 3:19	1:00:00	27.9	63.5	37.4	23	32	30.8	25.7	24.2	24	65.2
14	2017-08-23 4:19	1:00:00	28.4	64	41	23	31.2	30.3	27.4	24.1	23.8	70.2
15	2017-08-23 5:19	1:00:00	35.3	70.9	58	26.4	40.8	38.5	30.7	27.7	27.2	77.3
16	2017-08-23 6:19	1:00:00	34.9	70.5	51.5	28	38.6	37.2	32.5	29.4	28.8	77.5
17	2017-08-23 7:19	1:00:00	33.3	68.9	47.2	28.8	35.8	35.1	32.6	30.6	30.1	76.6
18	2017-08-23 8:19	1:00:00	30.8	66.4	44	25.2	33.2	32.6	30.2	27.7	27.1	66.1
19	2017-08-23 9:19	1:00:00	30	65.6	52.9	23	32.4	30.2	26.2	24.4	24.2	88.2
20	2017-08-23 10:19	1:00:00	27.9	63.5	42.9	23.5	31.1	28.9	25.9	24.5	24.3	70.8
21	2017-08-23 11:19	1:00:00	36.5	72.1	61.6	23.1	37.3	33.9	25.7	24.2	23.9	79.9
22	2017-08-23 12:19	1:00:00	40.8	76.4	64.9	23.8	42.4	38.6	30.8	25	24.7	94.5
23	2017-08-23 13:19	1:00:00	35	70.6	53.6	25.4	39.9	36.9	32	28.2	27.2	85.2
24	2017-08-23 14:19	1:00:00	39.6	75.2	61.5	26.7	43.3	42	36.2	30.4	29	86.1
25	2017-08-23 15:19	1:00:00	39.3	74.9	53.8	25.4	43.8	42.7	37.4	32.7	31	84.2
26	2017-08-23 16:19	1:00:00	39.5	75.1	57.8	26.2	43.4	40.8	35.7	29.7	28.5	87.3
27	2017-08-23 17:19	1:00:00	34.9	70.5	48.5	24.7	39.4	37.6	32.4	27.5	26.6	87.7
28	2017-08-23 18:19	1:00:00	38.6	74.2	58.6	24	44.5	39.2	29.1	25.9	25.2	90.9
29	2017-08-23 19:19	1:00:00	32.7	68.3	55.3	25.1	34.6	32.7	29	26.7	26.3	81.8
30	2017-08-23 20:19	1:00:00	35.8	71.4	59.3	23.9	37.1	33.4	27.4	25.4	25.1	82.8
31	2017-08-23 21:19	1:00:00	34.7	70.3	57.1	23.6	41.5	38.9	26.3	25.1	24.9	77.6
32	2017-08-23 22:19	1:00:00	27.2	62.8	40.7	24	29.8	28.8	26.4	25	24.8	71.1
33	2017-08-23 23:19	1:00:00	28	63.6	41.5	22.3	31.3	30.4	27	23.8	23.2	72.1
34	2017-08-24 0:19	1:00:00	30.8	66.4	54.4	20.9	34.8	30.4	23.1	21.9	21.6	72.5
35	2017-08-24 1:19	1:00:00	28.8	64.4	39.4	22.8	35	30.9	26.5	24.3	24	74.5

Daytime hours (7 am to 10 pm)

Night time hours (10 pm to 7 am

Monitoring Location 4

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA05	LA10	LA50	LA90	LA95	Lppeak
36	2017-08-24 2:19	1:00:00	33.9	69.5	56.9	22.4	38.4	36	28.3	24.8	23.5	75.5
37	2017-08-24 3:19	1:00:00	27.8	63.4	36.7	22.6	32.1	30.6	26.5	23.8	23.4	64.4
38	2017-08-24 4:19	1:00:00	26.7	62.3	34.9	23.6	29.3	28.3	26.2	24.5	24.3	69.1
39	2017-08-24 5:19	1:00:00	28.5	64.1	41.4	24.2	32.5	31.2	26.9	25.3	25.1	75.2
40	2017-08-24 6:19	1:00:00	32.8	68.4	52.2	25.5	35.7	33.5	28.7	26.7	26.4	74.5
41	2017-08-24 7:19	1:00:00	33.5	69.1	51	26	36.7	35.1	30.3	27.8	27	70.5
42	2017-08-24 8:19	1:00:00	33.5	69.1	56.4	22.3	36.6	35.2	31.1	24.1	23.2	84.3
43	2017-08-24 9:19	1:00:00	41.7	77.3	72.6	22.7	41.8	38.5	30.1	23.9	23.4	106.5
44	2017-08-24 10:19	1:00:00	38.7	74.3	51	28.7	43.9	42.2	35.7	31	30.3	86.4
45	2017-08-24 11:19	1:00:00	37.5	73.1	59.1	26.9	41.3	40.1	35.5	30.3	29	89.5
46	2017-08-24 12:19	1:00:00	38.9	74.5	55.9	29	42.7	41.7	36.4	31	30.1	88.5
47	2017-08-24 13:19	1:00:00	37.6	73.2	55.1	28	42	40.4	35.3	31.4	30.8	85
48	2017-08-24 14:19	1:00:00	38.5	74.1	53.2	30.3	43.1	41.5	36.4	32.7	31.8	92.6
49	2017-08-24 15:19	1:00:00	38.6	74.2	50.9	26.8	43.4	41.5	36.4	31.2	29.9	92.4
50	2017-08-24 16:19	1:00:00	40	75.6	58.9	30	44.8	43.2	37.6	32.8	32	88.5
51	2017-08-24 17:19	1:00:00	40.8	76.4	61.7	28.4	45.1	43.3	37.2	31.8	30.8	92.7
52	2017-08-24 18:19	1:00:00	40.4	76	51.7	30.9	45	43.5	38.6	34	33.4	85.4
53	2017-08-24 19:19	1:00:00	38.3	73.9	52.7	25.6	43.7	42	34.1	28.2	26.9	87.7
54	2017-08-24 20:19	1:00:00	36	71.6	60	24.3	40.7	37.8	28.4	25.6	25.2	78.1
55	2017-08-24 21:19	1:00:00	29.2	64.8	44.5	22.7	32.8	31.3	26.9	24	23.6	79.6
56	2017-08-24 22:19	1:00:00	29.6	65.2	51.3	21.6	33.4	32.3	27	23.4	22.8	67.3
57	2017-08-24 23:19	1:00:00	26	61.6	38.2	22.5	29.3	28.2	24.9	23.6	23.3	68.9
58	2017-08-25 0:19	1:00:00	29.3	64.9	41.5	23.8	32.6	31.2	28.4	25.1	24.7	79.2
59	2017-08-25 1:19	1:00:00	34.2	69.8	57.3	24	37	32.7	25.7	24.8	24.7	78.3
60	2017-08-25 2:19	1:00:00	29.5	65.1	45.6	20.9	31.5	25.3	23.5	21.8	21.5	77.2
61	2017-08-25 3:19	1:00:00	21.6	57.2	31.6	19.7	22.8	22.5	21.4	20.5	20.4	61.3
62	2017-08-25 4:19	1:00:00	27	62.6	52.6	19.7	31.6	28.1	23.1	21.8	21.4	70.5
63	2017-08-25 5:19	1:00:00	26.8	62.4	46.9	21.2	28.7	28.2	25.6	22.7	22.4	61.9
64	2017-08-25 6:19	1:00:00	29	64.6	43.3	25.1	32.3	30.8	28	26.4	26.2	67.2
65	2017-08-25 7:19	1:00:00	31.7	67.3	53.7	26.2	34.8	33.2	30	28.2	27.8	73.5
66	2017-08-25 8:19	1:00:00	35.3	70.9	56	22.6	38.8	32.9	26.9	23.9	23.5	79.4
67	2017-08-25 9:19	1:00:00	26.3	61.9	40.1	22.6	30.1	28	24.8	23.4	23.2	68.9
68	2017-08-25 10:19	0:29:32	46.3	78.8	74.1	22.5	46.3	37.9	24.8	23.4	23.3	98.7

Max LAeq	41.7		Max L90	34
Min LAeq	26.3		Min L90	23.4
Ave LAeq	35.88205		Ave L90	27.85385
Ave LAeq	28.87037		Ave L90	24.2037
Max LAeq	35.3		Max L90	29.4
Min LAeq	21.6		Min L90	20.5

Monitoring Location 5

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA01	LA50	LA90	LA95	LA99	Lppeak
1	2017-08-21 20:18	1:00:00	54.9	90.5	74.3	30.9	68.5	36.5	32.8	32.4	31.7	92.2
2	2017-08-21 21:18	1:00:00	41	76.6	62.9	31.9	53.2	34.3	32.8	32.6	32.2	81.8
3	2017-08-21 22:18	1:00:00	40	75.6	60.2	30.6	52.3	34.1	31.6	31.3	30.9	83.4
4	2017-08-21 23:18	1:00:00	32.8	68.4	45.3	30.5	38.8	32.1	31.4	31.2	30.9	76.2
5	2017-08-22 0:18	1:00:00	37.5	73.1	61.8	30.6	48.5	31.8	31.3	31.1	30.8	78.2
6	2017-08-22 1:18	1:00:00	40.8	76.4	66.3	30.6	48	34	32	31.4	31	83.4
7	2017-08-22 2:18	1:00:00	33	68.6	37.7	30.9	35.1	32.8	32	31.8	31.4	66.9
8	2017-08-22 3:18	1:00:00	34.1	69.7	44.1	31.3	37.5	33.8	32.7	32.4	32	73.1
9	2017-08-22 4:18	1:00:00	47	82.6	74.5	32.1	55.3	36.2	34	33.5	32.7	90.3
10	2017-08-22 5:18	1:00:00	43.3	78.9	63.7	32.6	56	36.4	34.1	33.8	33.2	82.2
11	2017-08-22 6:18	1:00:00	43.5	79.1	62.9	34	54.9	37.5	35.6	35.2	34.8	87.1
12	2017-08-22 7:18	1:00:00	47.9	83.5	67.5	34.6	60.5	38.7	36.1	35.8	35.3	83.3
13	2017-08-22 8:18	1:00:00	48	83.6	67.9	28.7	60.7	35.3	30.6	30.1	29.3	86.2
14	2017-08-22 9:18	1:00:00	44	79.6	63.1	28.1	57.8	32.3	29	28.7	28.4	86.2
15	2017-08-22 10:18	1:00:00	44	79.6	67.2	28.6	57.2	32.3	30	29.7	29.1	86.2
16	2017-08-22 11:18	1:00:00	43.1	78.7	65.1	28.7	57.3	32.2	29.8	29.6	29.2	89.9
17	2017-08-22 12:18	1:00:00	41.2	76.8	64.3	28.9	54	35.5	30.8	30.1	29.4	97.7
18	2017-08-22 13:18	1:00:00	47.5	83.1	67.6	32.8	58.3	43.8	38.5	36.9	34.8	103.9
19	2017-08-22 14:18	1:00:00	46.8	82.4	60.4	37.2	54.1	44.9	40.8	40.2	38.7	107.7
20	2017-08-22 15:18	1:00:00	51.8	87.4	78.9	39.2	58.7	48.9	45	43.2	40.4	111.6
21	2017-08-22 16:18	1:00:00	52.3	87.9	71	41.6	60.7	50	45.8	44.4	42.8	109.3
22	2017-08-22 17:18	1:00:00	55.3	90.9	71	40.1	64.7	51.2	45.5	44.2	42.6	108.2
23	2017-08-22 18:18	1:00:00	55	90.6	76.5	34.3	68.3	44.7	38.6	37.4	35.8	103.4
24	2017-08-22 19:18	1:00:00	51.2	86.8	71.3	31.7	64.5	40	34.5	33.6	32.8	90.2
25	2017-08-22 20:18	1:00:00	51.1	86.7	79	31.1	63.4	38.1	32.7	32.2	31.6	92.6
26	2017-08-22 21:18	1:00:00	43.9	79.5	63.6	31.2	56.1	34.2	32.3	31.9	31.5	86.6
27	2017-08-22 22:18	1:00:00	37.3	72.9	60	32.9	41.6	35.8	34	33.7	33.5	76.8
28	2017-08-22 23:18	1:00:00	38.6	74.2	62.4	32.8	47.8	35.2	33.7	33.5	33.2	83.3
29	2017-08-23 0:18	1:00:00	36.6	72.2	59.4	33.1	42	35.3	34	33.7	33.4	77.1
30	2017-08-23 1:18	1:00:00	40.4	76	62	33	49.5	34.7	33.7	33.6	33.3	79.8
31	2017-08-23 2:18	1:00:00	34.2	69.8	37.2	31.9	36.1	34	33.2	33	32.3	72.2
32	2017-08-23 3:18	1:00:00	36.1	71.7	57.1	32.5	42	34.6	33.4	33.2	33	76.3
33	2017-08-23 4:18	1:00:00	40.2	75.8	65.1	33.5	49.2	35.6	34.5	34.2	33.8	85.3
34	2017-08-23 5:18	1:00:00	47.4	83	66.1	34.1	58.7	41.6	36.4	35.7	35	85.4
35	2017-08-23 6:18	1:00:00	46.5	82.1	66.5	35.3	57.6	38.7	36.3	36	35.6	87.8

Daytime hours (7 am to 10 pm)

Night time hours (10 pm to 7 am

Monitoring Location 5

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA01	LA50	LA90	LA95	LA99	Lppeak
36	2017-08-23 7:18	1:00:00	46.5	82.1	70.4	33.6	59.2	38.2	35.8	35.5	35	88.6
37	2017-08-23 8:18	1:00:00	47.5	83.1	69	32	61.1	36.7	33.9	33.4	32.8	86.9
38	2017-08-23 9:18	1:00:00	46.7	82.3	69.9	29.2	58.4	36.7	32.3	31.7	30.3	86.6
39	2017-08-23 10:18	1:00:00	42.2	77.8	62.4	29.9	54.1	35.2	31.6	31.2	30.4	84.7
40	2017-08-23 11:18	1:00:00	45.5	81.1	64.1	30.2	55.3	38.3	31.8	31.5	30.9	105.2
41	2017-08-23 12:18	1:00:00	50.8	86.4	63.5	38.4	59.6	48.7	42.3	41.2	39.6	111.6
42	2017-08-23 13:18	1:00:00	49.6	85.2	59.9	38.1	57	47.8	43.7	42.9	41.6	110.3
43	2017-08-23 14:18	1:00:00	50.7	86.3	69.6	38.1	58.9	48.3	42.5	41.1	39.3	110.4
44	2017-08-23 15:18	1:00:00	52.2	87.8	65.3	40.3	59.6	50.4	44.8	43.4	41.4	110.2
45	2017-08-23 16:18	1:00:00	50.4	86	64	34.9	59.5	47.6	42.3	39.8	36.7	109.5
46	2017-08-23 17:18	1:00:00	50.7	86.3	73.3	29.8	63	42.4	33.4	32	30.9	105
47	2017-08-23 18:18	1:00:00	49.9	85.5	71.2	29.3	63.4	36.5	32.3	31.7	30.8	92.9
48	2017-08-23 19:18	1:00:00	46.5	82.1	69	31.7	56.1	41.1	35.7	34.9	33	106.7
49	2017-08-23 20:18	1:00:00	46.7	82.3	73.5	30.7	56.8	39.4	33.5	32.4	31.5	103.3
50	2017-08-23 21:18	1:00:00	48.1	83.7	75.5	30.4	59	40.1	32	31.5	30.9	97.3
51	2017-08-23 22:18	1:00:00	33.2	68.8	54.1	30.1	39.2	31.5	30.8	30.6	30.4	78.8
52	2017-08-23 23:18	1:00:00	34.9	70.5	53.6	29.9	46.6	31.7	30.7	30.5	30.3	74.1
53	2017-08-24 0:18	1:00:00	40.7	76.3	67.2	30.6	50.9	32.5	31.6	31.4	31.1	85.3
54	2017-08-24 1:18	1:00:00	40.2	75.8	61.6	30.6	51.1	33	31.4	31.2	30.9	84
55	2017-08-24 2:18	1:00:00	41.6	77.2	63	31.7	52.5	34.7	32.6	32.3	32	83.5
56	2017-08-24 3:18	1:00:00	34.1	69.7	52.5	30.4	40.4	33	31.5	31.1	30.8	78.2
57	2017-08-24 4:18	1:00:00	42.6	78.2	68.9	32.2	53.6	35.5	33.3	32.9	32.6	90.4
58	2017-08-24 5:18	1:00:00	44.7	80.3	67.2	33.7	57.9	37.3	35.2	34.9	34.3	92.5
59	2017-08-24 6:18	1:00:00	46.5	82.1	67	32.9	59.7	37	34.7	34.2	33.5	84.6
60	2017-08-24 7:18	1:00:00	45	80.6	64.8	32.5	58.7	37.1	34.5	33.9	33.3	90.8
61	2017-08-24 8:18	1:00:00	49.2	84.8	74	33	58.8	43.9	37	35.7	34.2	108.8
62	2017-08-24 9:18	1:00:00	49.4	85	66.7	32.2	59.3	46.4	35.9	34.7	33	107.3
63	2017-08-24 10:18	1:00:00	50.4	86	59.8	41.6	57.6	49	45.6	45	43.9	108.5
64	2017-08-24 11:18	1:00:00	53.5	89.1	68.3	38	62.3	51.3	47.4	46.2	39.9	111.4
65	2017-08-24 12:18	1:00:00	53	88.6	63.3	41.5	60	51.4	47.6	46.6	43.3	110.4
66	2017-08-24 13:18	1:00:00	53	88.6	64.4	40.8	60.6	51	45.4	43.9	42.1	110.5
67	2017-08-24 14:18	1:00:00	52.9	88.5	65.9	35.4	61.2	50.7	44.2	40.9	37.2	111.6

Monitoring Location 5

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA01	LA50	LA90	LA95	LA99	Lppeak
68	2017-08-24 15:18	1:00:00	50.5	86.1	70.6	35.3	59.9	45.1	39.4	38.4	36.6	113.7
69	2017-08-24 16:18	1:00:00	54.1	89.7	70.6	37.5	64.2	50.2	43.6	42.1	40	113.8
70	2017-08-24 17:18	1:00:00	55.5	91.1	74.6	39.4	64.4	51.6	44.4	43.1	41	114
71	2017-08-24 18:18	1:00:00	56	91.6	70	39.6	66.3	52.1	46.4	45	43	112.9
72	2017-08-24 19:18	1:00:00	54	89.6	68.5	38.9	62.1	51.1	43.5	42.2	40.4	110.4
73	2017-08-24 20:18	1:00:00	51.7	87.3	70	35	62	47.8	41.9	40	36.6	110.4
74	2017-08-24 21:18	1:00:00	46.1	81.7	60.8	32.1	53.6	43.5	37.5	36.5	34.8	101.9
75	2017-08-24 22:18	1:00:00	43.9	79.5	59.3	31.4	54	38.9	34	33.3	32.4	110.1
76	2017-08-24 23:18	1:00:00	38.9	74.5	52.1	30.2	49.5	34.9	31.9	31.6	31	99.8
77	2017-08-25 0:18	1:00:00	33.5	69.1	45.4	30.6	38.9	32.7	31.5	31.3	30.9	90.9
78	2017-08-25 1:18	1:00:00	39.6	75.2	59.4	30.7	49.8	33.7	32.1	31.8	31.2	92.1
79	2017-08-25 2:18	1:00:00	34.2	69.8	48.9	29.8	45.6	32.3	30.9	30.6	30.1	82.6
80	2017-08-25 3:18	1:00:00	32.4	68	48.9	29	39.1	31.4	30.1	29.9	29.6	72
81	2017-08-25 4:18	1:00:00	43.2	78.8	66.9	30.3	54.6	34.7	31.9	31.2	30.8	87.2
82	2017-08-25 5:18	1:00:00	43.5	79.1	66	32.2	55.7	36	33.9	33.5	32.9	93.4
83	2017-08-25 6:18	1:00:00	43.8	79.4	61.1	32.4	55.6	36.9	34.8	33.8	32.9	83.4
84	2017-08-25 7:18	1:00:00	43.9	79.5	64.9	34.3	56.4	38.5	36.5	36	35.3	86.4
85	2017-08-25 8:18	1:00:00	42.4	78	62.1	29.7	54.5	36.1	31.4	30.8	30.3	85.9
86	2017-08-25 9:18	1:00:00	36.7	72.3	55.2	28.7	48.5	31.2	29.6	29.3	29	83.2
87	2017-08-25 10:18	1:00:00	53	88.6	75.3	30.4	62.1	48.5	33.3	32.2	31.1	109
88	2017-08-25 11:18	0:01:13	63.9	82.5	79.8	48.9	77.2	58.1	52.5	51.3	49.4	112

Max LAeq	56		Max L90	46.6
Min LAeq	36.7		Min L90	28.7
Ave LAeq	48.768		Ave L90	36.746
Ave LAeq	39.46667		Ave L90	32.62222
Max LAeq	47.4		Max L90	36
Min LAeq	32.4		Min L90	29.9

Monitoring Location 6

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA05	LA10	LA50	LA90	LA95	Lppeak
1	2017-08-22 16:28	1:00:00	47.9	83.5	70	41	52	49.9	45.3	43.1	42.6	107
2	2017-08-22 17:28	1:00:00	49.1	84.7	75.3	38.7	50.7	49	44.5	41.5	40.7	106.4
3	2017-08-22 18:28	1:00:00	42.2	77.8	51.7	39	45	44.1	41.3	40.1	39.9	100.5
4	2017-08-22 19:28	1:00:00	45.4	81	67.2	37.7	45.6	43.6	40.6	38.8	38.4	87.2
5	2017-08-22 20:28	1:00:00	41	76.6	51.1	38.2	43.4	42.3	40.5	39.3	39	85.3
6	2017-08-22 21:28	1:00:00	53.6	89.2	69.5	38.3	63.9	46.7	40.6	38.9	38.8	96.5
7	2017-08-22 22:28	1:00:00	47.4	83	71.7	38.5	50	47.6	40.1	39.1	38.9	102.4
8	2017-08-22 23:28	1:00:00	39.6	75.2	46.5	37.9	41.4	40.7	39.2	38.5	38.4	76
9	2017-08-23 0:28	1:00:00	47.4	83	65	37.7	44.3	40.5	39.2	38.3	38.2	89.1
10	2017-08-23 1:28	1:00:00	47.8	83.4	65.8	37.9	45.1	40.8	39.1	38.6	38.5	89.4
11	2017-08-23 2:28	1:00:00	38.9	74.5	44	37.6	40.2	39.7	38.7	38.2	38.1	73.4
12	2017-08-23 3:28	1:00:00	38.9	74.5	49.3	37.5	40.4	39.6	38.6	38.1	38	70.2
13	2017-08-23 4:28	1:00:00	53.1	88.7	70.4	38.3	62.3	47.7	40.6	39	38.7	97
14	2017-08-23 5:28	1:00:00	54.8	90.4	71.8	38.6	64.1	50.9	41.4	39.6	39.3	95.4
15	2017-08-23 6:28	1:00:00	41.4	77	48.4	38.6	43.9	42.9	40.7	39.7	39.5	85.6
16	2017-08-23 7:28	1:00:00	41.3	76.9	51	37.6	43.6	42.9	40.6	39.1	38.5	85.2
17	2017-08-23 8:28	1:00:00	38.6	74.2	43.6	37.1	40.2	39.6	38.3	37.8	37.6	83.5
18	2017-08-23 9:28	1:00:00	38.5	74.1	48.8	36.9	39.8	39.2	38.3	37.7	37.6	81.4
19	2017-08-23 10:28	1:00:00	43.8	79.4	57.2	36.3	52.6	42.4	38.5	37.5	37.3	93.1
20	2017-08-23 11:28	1:00:00	43.8	79.4	56.4	37.2	47.5	46.6	42.6	39.6	39	102.5
21	2017-08-23 12:28	1:00:00	45.7	81.3	57.7	39	50.1	48.1	44.1	41.7	41.2	105.4
22	2017-08-23 13:28	1:00:00	42.9	78.5	53.3	36.6	46.8	45.8	41.5	38.9	38.4	103.2
23	2017-08-23 14:28	1:00:00	44.9	80.5	68.2	38	49	47.5	42.4	39.9	39.3	105.3
24	2017-08-23 15:28	1:00:00	45.1	80.7	56.3	38.2	48.8	47.9	43.7	41	40.2	103.5
25	2017-08-23 16:28	1:00:00	44.8	80.4	61.8	37.3	49.5	47.9	42.3	39.5	38.8	109.8
26	2017-08-23 17:28	1:00:00	47.2	82.8	64.9	38.2	53.9	47.8	41.2	39.5	39.1	104.8
27	2017-08-23 18:28	1:00:00	46.6	82.2	61.7	38.1	55.3	46.6	41.3	39.8	39.5	106
28	2017-08-23 19:28	1:00:00	41.4	77	53.9	37.2	44.3	42.9	40.6	38.7	38.1	100
29	2017-08-23 20:28	1:00:00	40	75.6	51.3	37	43.2	41.6	38.9	38	37.8	90.8
30	2017-08-23 21:28	1:00:00	51.1	86.7	67.5	37.4	60.8	45.4	38.9	38.1	37.9	95
31	2017-08-23 22:28	1:00:00	47.7	83.3	72.9	37	50.2	47.7	39.2	37.8	37.6	103.6
32	2017-08-23 23:28	1:00:00	39.2	74.8	47.9	37	41.8	40.7	38.6	37.6	37.5	93.5
33	2017-08-24 0:28	1:00:00	51.9	87.5	67.4	36.7	61.8	44.8	38.5	37.7	37.5	96.9
34	2017-08-24 1:28	1:00:00	39.5	75.1	43.6	37.7	40.6	40.3	39.5	38.6	38.4	74.2
35	2017-08-24 2:28	1:00:00	52.2	87.8	67.7	37.4	62.4	43.9	39.5	38.5	38.2	94.6

Daytime hours (7 am to 10 pm)

Night time hours (10 pm to 7 am

Monitoring Location 6

Address	Time	Measurement Time	LAeq	LAE	LAmax	LAmin	LA05	LA10	LA50	LA90	LA95	Lppeak
36	2017-08-24 3:28	1:00:00	39.4	75	44.6	37.6	40.6	40.1	39.2	38.5	38.3	73.1
37	2017-08-24 4:28	1:00:00	39.9	75.5	50.2	37.5	42.4	41.2	39	38.4	38.3	96.1
38	2017-08-24 5:28	1:00:00	41.6	77.2	50.4	37.5	44.8	43.4	40.9	38.8	38.5	99
39	2017-08-24 6:28	1:00:00	43.8	79.4	49.7	39.2	46.8	46.1	43.1	40.9	40.5	100.2
40	2017-08-24 7:28	1:00:00	41.2	76.8	48.8	38	44.1	43	40.4	38.9	38.7	96.7
41	2017-08-24 8:28	1:00:00	44	79.6	69	37.8	46	44.8	41.7	39.8	39.1	101.9
42	2017-08-24 9:28	1:00:00	45	80.6	57.2	37.7	50	48.4	43	39.7	39	103.5
43	2017-08-24 10:28	1:00:00	49.9	85.5	65.2	38.4	57.8	49.9	43.7	41	40.4	102.3
44	2017-08-24 11:28	1:00:00	54	89.6	70.4	39.6	61.6	59	45.4	41.9	41.4	106.8
45	2017-08-24 12:28	1:00:00	47.8	83.4	63.3	40.6	51.8	50.4	46.2	43.5	43	111.5
46	2017-08-24 13:28	1:00:00	49.8	85.4	61.2	40.9	54	52.4	48.2	43.9	42.8	111.8
47	2017-08-24 14:28	1:00:00	52.1	87.7	66.1	40.1	58.3	55.4	48.1	42.6	41.8	110.3
48	2017-08-24 15:28	1:00:00	50.2	85.8	62.9	39.7	55.8	53.3	47.3	43.4	42.7	111.3
49	2017-08-24 16:28	1:00:00	49.9	85.5	64.3	41.9	55.1	52.8	47	44	43.3	111.2
50	2017-08-24 17:28	1:00:00	53.1	88.7	67.6	40.9	59.7	57.1	48.2	43.6	42.9	112.5
51	2017-08-24 18:28	1:00:00	49.8	85.4	62.6	38.3	55.6	53.6	45.4	40.7	40.1	108.3
52	2017-08-24 19:28	1:00:00	43	78.6	54.6	37.6	47.4	45.3	40.8	38.8	38.5	101.2
53	2017-08-24 20:28	1:00:00	50.1	85.7	68.1	37.5	58.3	45.3	40.3	38.4	38.2	98.3
54	2017-08-24 21:28	1:00:00	41.3	76.9	54.1	37.3	44.4	42.8	39.5	38.1	37.9	97.4
55	2017-08-24 22:28	1:00:00	47.5	83.1	73.6	38.5	49.8	47.8	41.2	39.6	39.3	101.3
56	2017-08-24 23:28	1:00:00	41.6	77.2	50.7	37.7	45.5	44.1	40.3	38.6	38.4	100.4
57	2017-08-25 0:28	1:00:00	39.1	74.7	44.1	37.2	40.5	40	38.9	38	37.8	93.2
58	2017-08-25 1:28	1:00:00	51.9	87.5	67.1	37.4	62.2	45.5	39.8	38.3	38	97.4
59	2017-08-25 2:28	1:00:00	38.8	74.4	47.3	36.7	40.6	40	38.5	37.7	37.5	89.7
60	2017-08-25 3:28	1:00:00	39.5	75.1	44	37.5	40.7	40.3	39.3	38.6	38.4	83.4
61	2017-08-25 4:28	1:00:00	49.4	85	65.7	37.2	58.7	44.8	38.6	37.8	37.7	88.3
62	2017-08-25 5:28	1:00:00	40.6	76.2	54.4	37.4	43.2	41.6	39.2	38.1	38	76.8
63	2017-08-25 6:28	1:00:00	40.7	76.3	50.2	37.3	43.7	42.6	39.9	38.6	38.3	86.6
64	2017-08-25 7:28	1:00:00	42	77.6	50.9	37.6	46	44.4	40.8	38.7	38.4	75.2
65	2017-08-25 8:28	1:00:00	41.4	77	57.3	36.9	43.8	42.5	39.3	37.8	37.6	85.1
66	2017-08-25 9:28	1:00:00	39.1	74.7	45.9	36.3	42.3	41.4	38.2	37.3	37	96
67	2017-08-25 10:28	1:00:00	49.6	85.2	65.9	38.7	53.8	50.9	45.2	41.6	41	108.8
68	2017-08-25 11:28	0:09:36	49.6	77.2	70.1	40.3	54.8	50.5	43.6	41.9	41.4	104.1

Max LAeq	54
Min LAeq	38.5
Ave LAeq	45.64872

Max L90	44
Min L90	37.3
Ave L90	39.97692

Ave LAeq	44.20741
Max LAeq	54.8
Min LAeq	38.8

Ave L90	38.56296
Max L90	40.9
Min L90	37.6

Appendix B

Health Canada Noise Criteria Calculations

Table B-1: Health Canada Noise Criteria and Calculations

Receptor ID	Baseline L_{eq} (Ambient - Without Project)		Baseline L_{dn} (dBA)	Quiet Rural Area (Yes/No)	Adjusted Baseline L_{dn} (dBA)	%HA Project (RL) +Baseline	Operation L_{eq} Impact		Operation Ldn (dBA)	Adjusted Operation L_{dn} (RL)	Adjusted Operation L_{dn} (dBA)	HA% Project (RL) +Baseline	Δ%HA= (%HA (Project (RL) + Baseline)) - (%HA Baseline)	Δ%HA Exceeding 6.5%? (Yes / No)
	L_{eq} (0700-2200) (dBA) (L_d)	L_{eq} (2200-0700) (dBA) (L_n)					L_{eq} (0700-2200) (dBA) (L_d)	L_{eq} (2200-0700) (dBA) (L_n)						
R1	38.1	36.9	50.6	Yes	60.6	8.3	36.6	36.6	49.3	59.3	63.0	11.1	2.8	No
R2	47	46.6	59.7	No	59.7	7.4	29.1	29.1	41.8	41.8	59.7	7.5	0.1	No
R3	46.8	46.1	59.4	No	59.4	7.2	45.6	44.5	58.1	58.1	61.8	9.6	2.4	No
R4	35.9	28.9	47.9	Yes	57.9	5.9	32.2	31.7	44.8	54.8	59.6	7.4	1.4	No
R5	48.8	39.5	60.7	No	60.7	8.4	36.3	36.3	49.0	49.0	61.0	8.7	0.3	No
R6	45.6	44.2	58.1	No	58.1	6.1	23.4	23.4	36.6	36.6	58.1	6.1	0.0	No
R7	48.8	39.5	60.7	No	60.7	8.4	47.7	47.7	60.4	60.4	63.6	11.8	3.4	No
R8	46.8	46.1	59.4	No	59.4	7.2	45	43.9	57.5	57.5	61.6	9.3	2.2	No
R9	47	46.6	59.7	No	59.7	7.4	43.3	42.9	56.0	56.0	61.2	8.9	1.5	No
R10	38.1	36.9	50.6	Yes	60.6	8.3	40.8	40.8	53.5	63.5	65.3	14.5	6.1	No
R11	47	46.6	59.7	No	59.7	7.4	31.5	31.5	44.2	44.2	59.8	7.5	0.1	No
R12	47	46.6	59.7	No	59.7	7.4	34.1	34.1	46.8	46.8	59.9	7.6	0.2	No

Appendix C

Blasting Operations Impact Calculations

Appendix C – Blasting Operation Ground Vibration and Overpressure Calculations

GROUND VIBRATION - TERESTRIAL WILDLIFE AND HUMAN RECEPTORS

Ground vibration is expressed as Peak Particle Velocity (PPV) in mm/s (or cm/s). Based on specifications of the area (Maxxam study for a nearby coal mine, 2015) area-specific parameters (see below) are incorporated in the equation as follows:

$$PPV = K\left(\frac{R}{W^c}\right)^{\beta}$$

R = Distance to nearest sensitive receptor (m) = 2,738 m (for R1)
W = Maximum charge weight per delay (kg) = 2,300 kg
K = 1181 Site specific parameter – based on data from a nearby coal mine (Maxxam, 2015)
β = -1.45 Site specific parameter – based on data from a nearby coal mine (Maxxam, 2015)
c = 0.3728 Site specific parameter – based on data from a nearby coal mine (Maxxam, 2015)

PPV = 1181 x $(2738 / (2300)^{0.3728})^{-1.45}$ = 0.8 mm/s [target criterion: 10 mm/s]

AIR OVERPRESSURE- TERESTRIAL WILDLIFE AND HUMAN RECEPTORS

The overpressure is typically expressed as 'Peak Sound Pressure Level' (PSPL/L_{peak}) in dBL, and calculated using the following equation:

$$PSPL = M\left(\frac{R}{\sqrt[3]{W}}\right)^{e}$$

R = Distance to nearest sensitive receptor (m) = 2,738 m (for R1)
W = Maximum charge weight per delay (kg) = 2,300 kg
M = 168 Site specific parameter – based on data from a nearby coal mine (Maxxam, 2015)
e = -0.095 Site specific parameter – based on data from a nearby coal mine (Maxxam, 2015)

PSPL = 168 x $(2738 / (2300)^{1/3})^{-0.095}$ = 101 dB [target criterion: 125 dBL]

SUBSTATE VIBRATION AND INDUCED WATER PRESSURE – AQUATIC WILDLIFE RECEPTORS

Equations and calculations below are based on the *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* (DFO, 1998).

Equation (A)

Equation (A) describes the transfer of shock pressure from the substrate to the water.

$$P_W = \frac{2(Z_W / Z_R)P_R}{1+(Z_W / Z_R)}$$

where:

P_W = pressure (kPa) in water
P_R = pressure (kPa) in substrate
Z_W = acoustic impedance of water
Z_R = acoustic impedance of substrate

Equation (B)

Equation (B) describes the relationship between acoustic impedance and the density and velocity of the medium through which the compressional wave travels.

$$Z_W/Z_R = \frac{D_W C_W}{D_R C_R}$$

where:

D_W = density of water = 1 g•cm^{-3}
D_R = density of the substrate in g•cm^{-3}
C_W = compressional wave velocity in water
= 146,300 cm•s^{-1}
C_R = compressional wave velocity in substrate in cm•s^{-1}

Equation (C)

Equation (C) describes the relationship between the peak particle velocity (V_R) and the pressure, density and compressional wave velocity in the substrate.

$$V_R \quad = \quad \frac{2P_R}{D_R C_R}$$

Equation (D)

Equation (D) represents the scaled distance relationship and is used to equate the peak particle velocity to charge weight and distance.

$$V_R \quad = \quad 100\,(R/W^{.5})^{-1.6}$$

where:

V_R = peak particle velocity in cm•s^{-1}
R = distance to the detonation point in m
W = charge weight per delay in kg

D_w = 1 g/cm^3

D_R = Rock Density = 2.64 g/cm3 (as per DFO Guideline)

C_R = Wave Velocity in Rock = 457,200 cm/s

C_w = Wave Velocity in Water = 146,300 cm/s

P_w = [2 x (1 g/cm^3 x 146300 cm/s) / (2.64 g/cm^3 x 457200 cm/s) P_R] / [1 + ((1 g/cm^3 x 146300) / (2.64 g/cm^3 x 457200 cm/s)]

P_w = 0.216 P_R

P_R corresponding to 100 kPa in water:

PR = 100 kPa / 0.216 = 462.51 kPa = 4625112.8 g.cm/s^2

R = 735 m (distance to closest water body)

$V_R = 2P_R / D_R C_R$ = 2 x 4625112.8 g.cm/s^2 / 2.64 x 457200 = 7.66 cm/s = 76.6 mm/s

V_R = 100 x (735 m / ($W^{0.5}$))$^{-1.6}$ = 76.6 mm/s   W = 3.87 x 10^5 kg (charge weight to meet the 100 kPa Water pressure)

V_R = 13 mm/s (target criterion)

13 mm/s = 100 x (735 m x / ($W^{0.5}$))$^{-1.6}$ W = 2.3 x 10^3 kg (charge weight to meet the 13 mm/s substrate vibration)

As such, a maximum weight per charge of 2300 kg will be used. A charge delay of 25ms is recommended to avoid constructive wave / compounded effect.

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