CUMBERLAND
RESOURCES LTD.

MEADOWBANK GOLD PROJECT

NOISE IMPACT ASSESSMENT

JANUARY 2005

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DESCRIPTION OF SUPPORTING DOCUMENTATION

Cumberland Resources Ltd. (Cumberland) is proposing to develop a mine on the Meadowbank property. The property is located in the Kivalliq region approximately 70 km north of the Hamlet of Baker Lake on Inuit-owned surface lands. Cumberland has been actively exploring the Meadowbank area since 1995. Engineering, environmental baseline studies, and community consultations have paralleled these exploration programs and have been integrated to form the basis of current project design.

The Meadowbank project is subject to the environmental review and related licensing and permitting processes established by Part 5 of the Nunavut Land Claims Agreement. To complete an environmental impact assessment (EIA) for the Meadowbank Gold project, Cumberland followed the steps listed below:

1. Determined the VECs (air quality, noise, water quality, surface water quantity and distribution, permafrost, fish populations, fish habitat, ungulates, predatory mammals, small mammals, raptors, waterbirds, and other breeding birds) and VSECs (employment, training and business opportunities; traditional ways of life; individual and community wellness; infrastructure and social services; and sites of heritage significance) based on discussions with stakeholders, public meetings, traditional knowledge, and the experience of other mines in the north.

2. Conducted baseline studies for each VEC and compared / contrasted the results with the information gained through traditional knowledge studies (see Column 1 on the following page for a list of baseline reports).

3. Used the baseline and traditional knowledge studies to determine the key potential project interactions and impacts for each VEC (see Column 2 for a list of EIA reports).

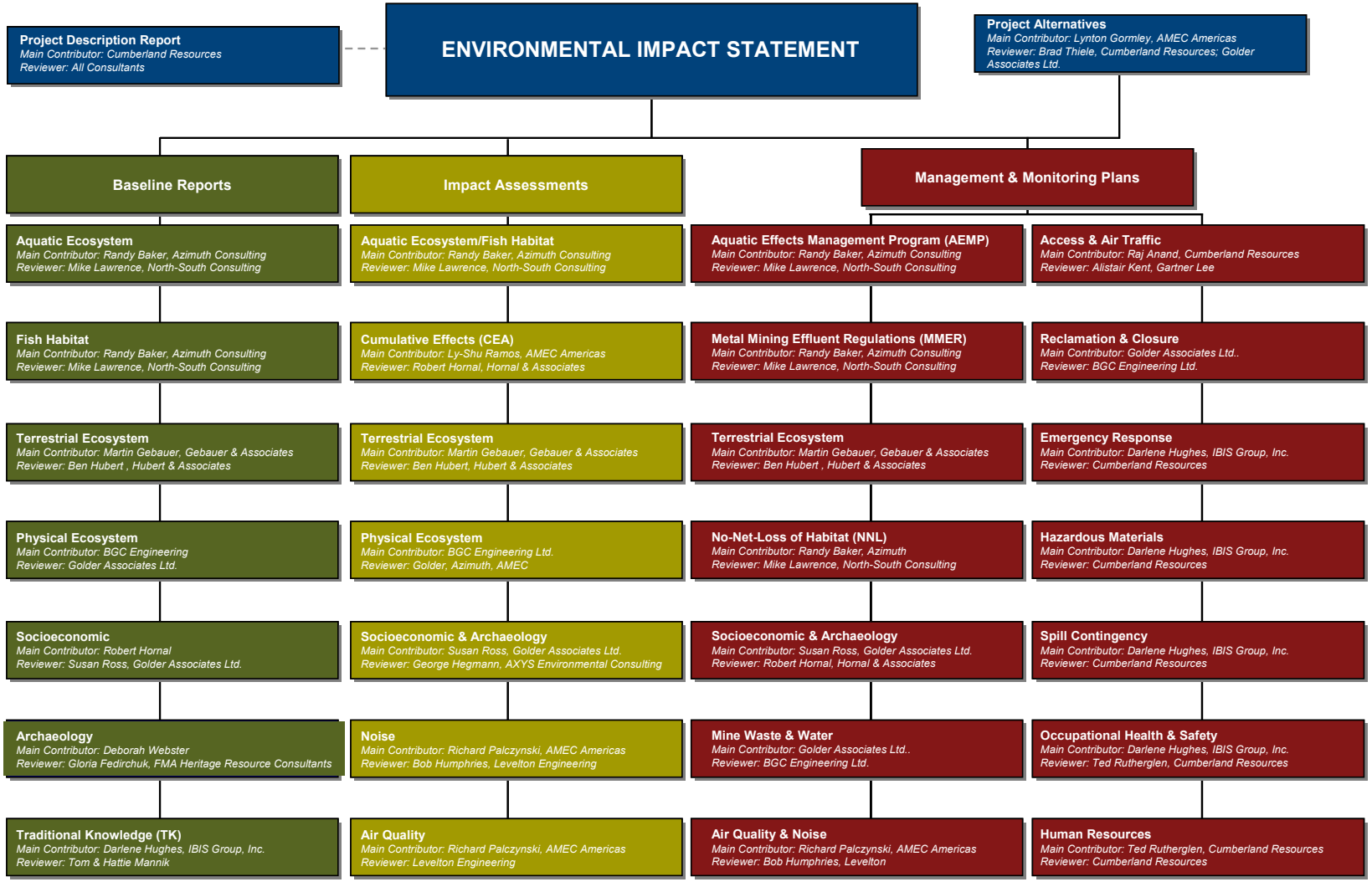
4. Developed preliminary mitigation strategies for key potential interactions and proposed contingency plans to mitigate unforeseen impacts by applying the precautionary principle (see Column 3 for a list of management plans).

5. Developed long-term monitoring programs to identify residual effects and areas in which mitigation measures are non-compliant and require further refinement. These mitigation and monitoring procedures will be integrated into all stages of project development and will assist in identifying how natural changes in the environment can be distinguished from project-related impacts (monitoring plans are also included in Column 3).

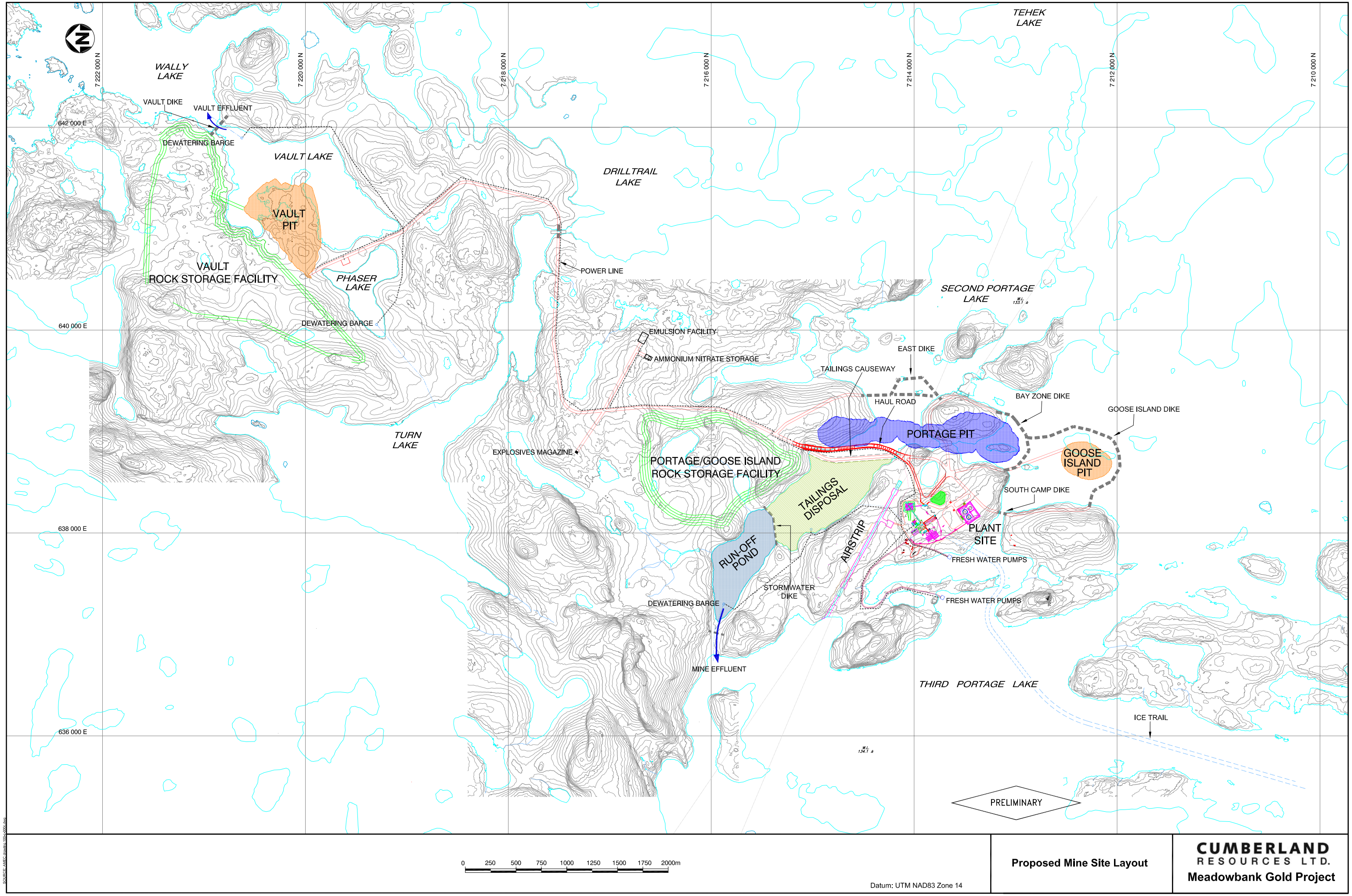
6. Produce and submit an EIS report to NIRB.

As shown on the following page, this report is part of the documentation series that has been produced during this six-stage EIA process.

EIA DOCUMENTATION ORGANIZATION CHART



PROJECT LOCATION MAP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7 214 000 N
7 212 000 N
7 210 000 N
642 000 E
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638 000 E
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WALLY LAKE
TEHEK LAKE
VAULT DIKE
VAULT EFFLUENT
DEWATERING BARGE
VAULT LAKE
DRILLTRAIL LAKE
VAULT PIT
VAULT ROCK STORAGE FACILITY
PHASER LAKE
POWER LINE
SECOND PORTAGE LAKE
DEWATERING BARGE
EMULSION FACILITY
AMMONIUM NITRATE STORAGE
EAST DIKE
TAILINGS CAUSEWAY
HAUL ROAD
BAY ZONE DIKE
GOOSE ISLAND DIKE
PORTAGE PIT
GOOSE ISLAND PIT
TURN LAKE
EXPLOSIVES MAGAZINE
PORTAGE/GOOSE ISLAND ROCK STORAGE FACILITY
TAILINGS DISPOSAL
SOUTH CAMP DIKE
PLANT SITE
AIRSTRIP
FRESH WATER PUMPS
RUN-OFF POND
STORMWATER DIKE
FRESH WATER PUMPS
DEWATERING BARGE
MINE EFFLUENT
THIRD PORTAGE LAKE
ICE TRAIL
PRELIMINARY
0 250 500 750 1000 1250 1500 1750 2000m
Datum: UTM NAD83 Zone 14
Proposed Mine Site Layout
CUMBERLAND RESOURCES LTD.
Meadowbank Gold Project

SECTION 1 • INTRODUCTION

Cumberland Resources Ltd. (Cumberland) has prepared this report to assess the noise levels and impacts of project related activities at the Meadowbank project site. For information on noise mitigation and monitoring, see the "Air Quality and Noise Management Plan" (Cumberland, 2005) which is included in this documentation series under separate cover.

The following project activities will generate noise:

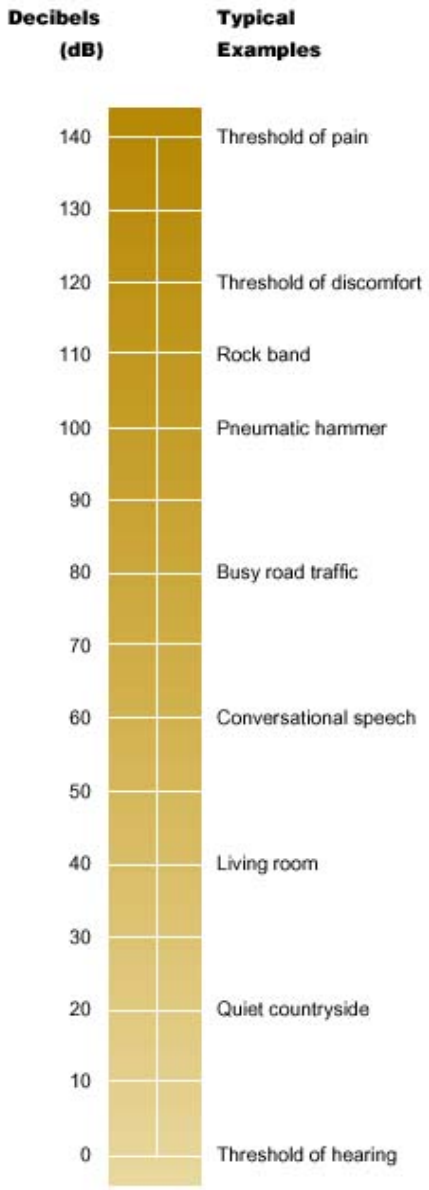
- construction
- pre-stripping
- open pit mining
- ore hauling from the Vault pit and the Portage pits to the processing plant
- tailings and waste rock disposal
- ore processing and gold recovery at the plant.

Noise generation will fall into three categories: instant, intermittent, or continuous periods, with levels that vary from low to high. Mining operations, including blasting and operating the primary crusher and mills, will be the main sources of noise. Ore processing and gold recovery plant operation will generate continuous noise associated with ore crushing, grinding, and power generation. Noise due to vehicular movement will be intermittent, but will add to background levels. Air traffic noise related to fixed- and rotary-wing aircrafts will be present on an irregular basis and will be of short duration. Therefore, no consideration is given to air traffic in this assessment.

SECTION 2 • NOISE BASICS, STANDARDS & CRITERIA

2.1 NOISE BASICS

Noise may be defined as unwanted sound because it can be disturbing or annoying. There are several noise measurement scales used to describe noise in a particular location. The most common is the A-weighted sound level or decibel (dBA). This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. A graphic showing the decibel scale and typical examples of equivalent noise sources is presented to the right of this page.



Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behaviour of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy equivalent sound/noise descriptor is called equivalent level (L_{eq}). The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The two significant environmental factors resulting from blasting activities are the groundborne vibration and the airborne pressure wave. Groundborne vibration can cause annoyance above levels of about 5 mm/s due to perception of movement. Structural damage can also occur but at significantly higher levels (around 50 mm/s). Airborne pressure waves can cause annoyance due to hearing and feeling (particularly the low frequency component) the noise at levels above peak linear values of around 115 dBA. However, blasting can be managed to comply with the comfort criteria and be well below any criteria relative to damage risk.

The scale of sound levels shows that calm environments correspond to a level of 30 to 50 dBA (see chart). The 24-hour noise surveys conducted in remote areas of the northern Alberta have revealed sound levels around 35 dBA at night time and 45 dBA at daytime. As a rule,

noise beyond 70 dBA becomes very disruptive. It has been observed at mine sites where heavy earth moving machinery is in operation that noise level can be more than 90 dBA. Instant blasting noise levels would be 10 to 15 dBA higher. To keep noise generation under control, appropriate technology and equipment would be considered. Initially, the mining equipment will operate on the surface. As the pit deepens, equipment will be relocated to the bottom of the pit to minimize noise. Blasting will be controlled by using delays, both surface and downhole; by selecting times when the environment is least sensitive (e.g., daytime hours); and by locating charges at depths as required (normal production practice). Natural terrain, the pit walls, earth banks, and stockpiles may form significant noise barriers for most operations. A desired sound level 1.5 km from the source is 45 dBA at night time and 55 dBA during the daytime.

Noise levels throughout the project area during various stages of operation can be predicted computer modelling programs. The SPM9613 program, based on ISO standards, has been used in this assessment to determine the various attenuation effects observed during outdoor sound propagation.

2.2 NOISE STANDARDS & CRITERIA

As no noise standards exist for the area of the proposed Meadowbank project, two relevant noise guidelines were used in this assessment: U.S. Environmental Protection Agency's (EPA) "Guideline Note for Noise in Relation to Scheduled Activities" (1996), and the Alberta Energy and Utilities Board's "Noise Control Directive User Guide" (1999). These guidelines were used to assist in interpreting and applying Interim Directive (ID) 99-8 and are discussed in more detail below.

The EPA guideline provides a general approach to measuring and controlling noise, and distributes advice in relation to the setting of noise emission limit values and compliance monitoring. With regard to mine development and ancillary activities, the EPA recommends that on-site noise should not exceed the following noise emission limit values at the nearest noise sensitive receptor:

- daytime: 08:00 to 20:00 hrs L_{eq} (1 hour) = 55 dBA
- night time: 20:00 to 08:00 hrs L_{eq} (15 minutes) = 45 dBA

The EPA also recommends that no noise level should exceed the limit value by more than 2 dBA. On-site activities should be permitted during night time hours only when they comply with the noise emission limit values (e.g., loading and moving of materials). Where existing background noise levels are very low, lower noise emission limit values may be appropriate. Audible tones or impulsive noise should be avoided at night. It is also appropriate to permit higher noise emission limit values for short-term temporary activities such as constructing screening berms or noise prevention walls, where these activities will result in a considerable environmental benefit.

With regard to blasting activities within Vault and Portage quarry developments, the EPA recommends that the following vibration and air overpressure emission limit values be adopted and applied at the nearest vibration sensitive location (e.g., a residential property):

- *Groundborne Vibration*: Peak particle velocity = 12 mm per second (mm/s), measured in any of the three mutually orthogonal directions at the receiving location (for vibration with a frequency of less than 40 Hz)
- *Air Overpressure*: 125 dBA (linear maximum peak value), with a 95% confidence limit.

Normal hours of blasting should be defined (e.g., 08:00 to 19:00 hrs), and provision should be included to permit blasting outside these hours for emergency or safety reasons beyond the control of the pit operator. Pit operators should provide advance notification of blasting to nearby residents (if any) through use of written notes, signage at site entrance, or warning sirens (or a combination of these methods).

The Alberta Energy and Utilities Board (EUB) has clear guidelines outlined in their Noise Control Directive (ID 99-8) on regulating noise at remote areas such as in northern Alberta, the Northwest Territories, or Nunavut. The Noise Control Directive User Guide (Guide 38) defines the permissible sound level (PSL) as the maximum sound level which a noise source should not exceed at a point 15 m from the nearest or most impacted dwelling unit, if applicable.

The PSL is calculated as follows:

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

The EUB recommends that new facilities planned for remote areas should be designed to meet a target sound level of 40 dBA at a distance of 1.5 km, although this is not a mandatory requirement. In most noise-related complaint situations, the comprehensive sound level (CSL) must be measured and compared to the PSL. The CSL for the facility must not exceed the PSL.

For any recreational or trapper cabin which could be constructed in the future in the area, which are in the Category 1 group defined by the Guide 38, the basic sound level (BSL) is 40 dBA at night time. The daytime adjustment is +10 dBA. The Class A adjustment includes a seasonal adjustment (A1), a tonal and impulse/impact component (A2), and an ambient monitoring adjustment (A3). For seasonally occupied dwellings, the adjustments are: A1 = + 5dBA; A2 = 0 dBA and A3 = 0 dBA. The Class B adjustment, which is based upon people's responses to temporary activities, is 0 dBA as the duration of noise generating activity will be more than two months. Therefore, the calculated PSL for any recreational, not permanently occupied cabin would be:

(a) Daytime PSL = 40 + 10 + (5 + 0 + 0) + 0 = 55 dBA
(b) Night time PSL = 40 + 0 + (5 + 0 + 0) + 0 = 45 dBA

The calculated PSL should be reviewed when the project quarries are in operation. This would involve an ambient 24-hour sound monitoring survey to ensure the actual ambient sound level for the daytime and night time periods, conducted 1,500 m from the noise sources. The survey should include the sound pressure level of the slow-response, A-weighted, 1/3 octave bands between 31.5 Hz and 16 kHz required for the A2 tonal and impulse/impact adjustment.

SECTION 3 • NOISE LEVELS AT MEADOWBANK

3.1 BASELINE NOISE

No previous noise surveys have been conducted within the proposed Meadowbank Gold project. A 24-hour background sound survey has been completed for the Fort McKay area in Northern Alberta. The results of this survey can be considered to represent the baseline noise conditions for the Meadowbank Gold mining project as the Fort McKay area also has no anthropogenic noise sources present. It can be assumed that the baseline noise characteristics for the project area are as given in Table 3.1.

Table 3.1: Assumed Background Noise (in dBA) in the Project Area

Period	L_{eq}	L_{90}	L_{50}	L_{10}	L_{max}	L_{min}
Daytime	42.7	33.3	35.0	49.8	67.5	31.5
Night time	35.4	34.2	35.2	37.2	62.0	30.0

The L_{10}, L_{50}, and L_{90} are the percent noise levels (PNL), which are the noise levels exceeded over different percentages of the time. L_{max} and L_{min} are the maximum and minimum sound levels recorded, and L_{eq} is the equivalent sound level defined. The L_{90} noise index is a good representation of the background noise level. It represents the level that is exceeded 90% of the time during the sampling period. Therefore, it is commonly referred to as residual or background noise when other sources of noise are not present. This level is the benchmark above which other noise events occur, such as pit mining.

3.2 CONSTRUCTION NOISE

During early site preparation and construction, different types of equipment will be utilized. This equipment could include a number of machines and devices varying in physical size, horsepower rating, and mode of operation. Consequently, the noise produced is expected to vary widely. Even for equipment of a single model, variations in sound level at a fixed distance can be expected (Harris, 1979).

Construction activities will proceed through a number of phases, to which both generic and phase-specific noise will be associated. Construction noise emissions are expected to occur during the following activities:

- levelling and grading
- vehicle/heavy equipment traffic
- excavation
- pile driving
- concrete pouring
- steel erection
- mechanical installation
- commissioning and startup.

A list of construction equipment noise sources typically found at large industrial construction sites is provided in Table 3.2 (Holland and Attenborough, 1981). The predominant sources of construction equipment noise are associated with internal combustion engines and impact construction equipment. The table also provides the typical maximum A-weighted sound levels for each type of construction noise source.

Table 3.2: Typical Maximum Construction Equipment Sound Levels at 15 m

Noise Source	A-Weighted Sound Level (dBA)
Earth-moving	
Crawler tractors, dozers	81-85
Front-end Loaders	81-86
Graders	79-83
Earth haulers	88-90
Dump trucks	88
Materials Handling	
Mobile Cranes	83
Concrete mixers (truck)	85
Concrete pumps	82
Impact Equipment	
Jackhammers	88
Pneumatic tools	86
Auxiliary Equipment	
Pumps	76
Generators	78
Compressors	87
Paging systems	80-92
Warning horns	98-102
Other Equipment	
Saws	78
Vibrators	76

The internal combustion engine is used to provide propulsion for the wheels of trucks and/or operating power for the working mechanisms such as buckets, dozers, etc. Exhaust noise is usually the most important component of engine noise in the engine. However, noise associated with the air intake, cooling fans, and the mechanical and hydraulic transmission and control systems also can be significant.

Impact construction equipment typically includes pile drivers, rock drills, and small hand-held pneumatically, hydraulically, or electrically powered tools. The primary noise source for conventional pile drivers is the impact of the hammer striking the pile. Engine-related noise sources, such as combustion explosion or release of steam at the head of some equipment, are usually secondary. The predominant sources of noise in pneumatic tools are the high-pressure exhaust and the impact of the tool bit against the material on which it acts.

During construction of the proposed project, a large number of machines and trucks would work in a small area. Thus, the site may be disturbed for several months by vibration as well as noise. For the conservatively assumed cumulative noise of 90 dBA at 15 m from source (based on sound levels provided in Table 3.2), there will be a 55 dBA noise level (recommended daytime objective) at a distance of approximately 1,000 m, assuming typical loss of 6 dBA with the doubling of distance.

3.3 PIT NOISE

Typical noise levels at a pit measured at various distances from noise sources are given in Table 3.3 (Environment Australia, 1998).

Table 3.3: Typical Mining Noise Levels

Noise Source	Operating Condition	Typical Measured Noise Level
Haul tuck	Laden pass by	91 dBA L_{max} @ 7 m
Haul truck	Empty pass by	87 dBA L_{max} @ 7 m
Product truck	Laden pass by	88 dBA L_{max} @ 7 m
Front-end loader	Loading	85 dBA L_{max} @ 7 m
Primary jaw crusher	Crushing	104 dBA L_{max} @ 4 m
Haul truck	Laden/uphill	98 dBA L_{max} @ 7 m
Rock breaker	Breaking	100 dBA L_{max} @ 7 m
Hydraulic drill	Maximum	100 dBA L_{max} @ 7 m
Excavator	Scraping	90 dBA L_{max} @ 7 m
Reversing alarm		92 dBA L_{max} @ 4 m
Production blast		110 dBA L_{max} @ 100 m

Common tonal components in the noise spectrum measured 1 m from the source generated by typical equipment operated at a pit are presented in Table 3.4 (Herring Storer Acoustics, 2002).

Table 3.4: Pit Mining Equipment Tonal Components

	Octave Band Frequency (Hz)									
Source	**31.5**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Haul truck	-	109	114	117	112	110	107	91	95	115
Front-end loader	-	109	114	117	112	110	107	101	95	115
Primary crusher	111	120	121	121	120	117	115	111	105	123
Screen	112	109	106	103	102	102	100	97	95	107
Excavator	-	104	109	112	107	105	102	86	90	110
Hydraulic drill	98	107	114	114	115	119	119	121	118	126
Scraper	-	118	123	126	121	119	116	110	104	124

3.4 PLANT NOISE

The major noise sources at the Meadowbank plant will be located in the following three main process areas:

- crushing
- powerhouse
- processing facility (including the SAG and ball mills).

The highest noise levels will be generated by the primary crusher, SAG mill, and ball mill in addition to auxiliary facilities, such as the conveyor and haul truck unloading bay. Other noise sources will include front-end loaders, diesel powered generators, recirculation valves, compressors, emergency equipment, relief valves, fin-fan air coolers, small pumps, and service vehicles. Plant operations, such as flotation, leaching, refining, cyanide destruction and electrowinning, will be relatively quiet in comparison.

SECTION 4 • NOISE MODELLING

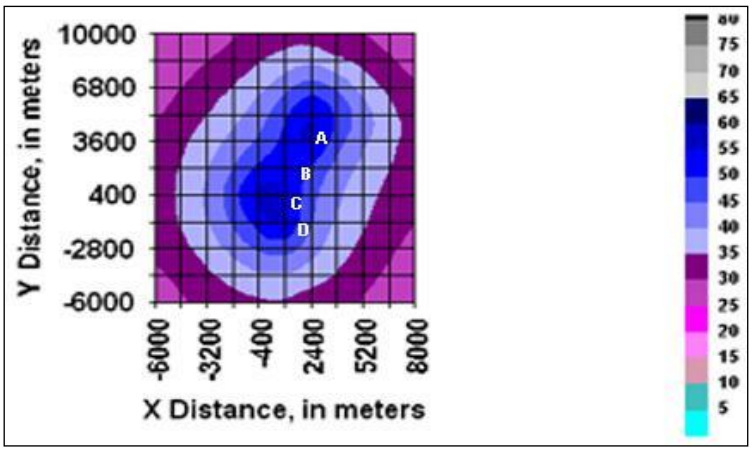
Anticipated noise levels for the Meadowbank project have been predicted using industry standards and the best available noise prediction models. The predicted sound level contributions (i.e., dBA) of the project during operation were determined using the SPM9613 noise prediction model developed by Power Acoustics. The model includes two subroutines: ISO 9613-1, which specifically addresses atmospheric attenuation, and ISO 9613-2, which specifies an engineering method for calculating environmental noise from a variety of noise sources by prescribing methods to determine the various attenuation effects observed during outdoor sound propagation. The noise level modelling for this project is based on the following assumptions:

- the only major noise sources will be the primary crusher, screens, excavators, hydraulic drills, mills, and haul trucks
- noise generated during pit mining at each of the deposit sites will be the same, with sources located at the bottom of the pit
- the facility will operate continuously at the same level, day and night
- the processing building noise is presented as a computed combined source
- five 90-tonne rock trucks will travel on the Vault haul road (two trucks at the tailings and waste rock sites and one truck at each of two modelled pit mining sites)
- octave bands spectrum provided for similar equipment were used for each type of noise source
- all model input noise levels are in dBA units at 1 m distance from sources
- the terrain is conservatively assumed to be flat with no major barriers
- atmospheric conditions that would minimize sound attenuations are not taken into account (conservative approach)
- the grid size was selected to include both the local study and neighbouring areas to include nearby and distant noise levels.

The modelling results are shown as noise level contour plots for the project area, including Goose Inland pit to the south and the Vault pit to the north. The colour scale corresponds to sound levels in 5 dBA intervals. The 0-0 coordinates represent the location of the primary crusher at the processing plant.

The modelling results show that the major noise sources at the proposed operation will be the quarry area, where equipment extracting the ore (e.g., shovels, loaders, trucks, drills, etc.) will operate. Due to the close proximity of the major items of equipment, the combined noise levels will be higher than the individual equipment noise levels shown in Tables 3.3 and 3.4. Activities at the tailings and waste rock disposal sites will also contribute to the environmental noise. Noise level contours for the complete project area (Vault site to the north and Goose Island site to the south), as generated by the ISO9613 computer model, are shown in Figure 4.1. Active sites include Vault pit, Vault haul road traveled by five haul trucks, Goose Island pit, tailings and waste rock site north of the plant, and the plant itself.

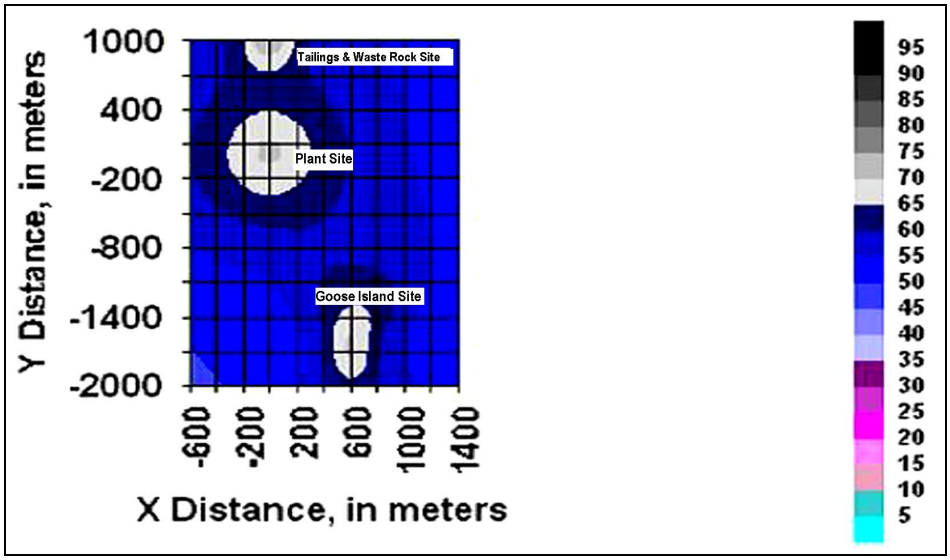
Figure 4.1: Local A-Weighted (dBA Scale) Sound Level Contours within the Plant Area



The model output shows elevated (over 70 dBA, previously identified as the level over which noise becomes annoying) sound levels approximately 600 m from noise sources. Actual sound values for contours in purple should be taken as 35 dBA to 45 dBA, which are likely noise background levels. More accurate sound level predictions are presented in Figure 4.2, which shows sound level contours around the plant, tailings/waste disposal site, and the Goose Island site. It can be seen that noise levels close to sources are between 70 dBA and 80 dBA. Ambient noise at North Camp will be around 75 dBA. Indoor sound level will be significantly lower due to attenuation in walls.

The predicted noise levels, while based on the best available initial design information, should be regarded as preliminary. A detailed modelling study could be performed after finalization of the detailed engineering design to refine the preliminary estimates. Even so, the most accurate assessment of noise level can be achieved by direct field monitoring when the quarry is fully operational.

Figure 4.2: Regional A-Weighted (dBA Scale) Sound Level Contour



Note: **A** = Vault site; **B** = Vault haul road; **C** = plant site and tailings/waste site; and **D** = Goose Island site.

SECTION 5 • NOISE IMPACT ASSESSMENT

The literature confirms that there are a number of potential effects of noise on health, although the evidence in support of actual health effects other than those based on reported bother or annoyance and on some indicators of sleep disturbance is quite weak. It has been shown that animals are also impacted by noise. Existing standards and regulations usually take the results of health impact research into account, but social, political, and historic factors are at least as important.

5.1 IMPACT ON HUMANS

Quantitative information on the effects of airborne noise on people is well documented. If sufficiently loud, noise may adversely affect people in several ways. For example, noise may interfere with human activities, such as sleep, speech, communication, and tasks requiring concentration or coordination. It may also cause annoyance, hearing damage, and other physiological problems. These factors lead to irritability, which is the first sign of the psychological impact of noise.

The effects of noise are seldom catastrophic and are often only transitory, but adverse effects can be cumulative with prolonged or repeated exposure. In addition, noise can interfere with the teaching and learning process, disrupt the performance of certain tasks, and increase the incidence of antisocial behaviour. There is also some evidence that noise can adversely affect general health and wellbeing in the same manner as chronic stress (WHO, 1999; Passchier-Vermeer and Passchier, 2000).

Several noise scales and rating methods are used to quantify the effects of noise on people. These scales and methods consider such factors as loudness, duration, time of occurrence, and changes in noise level with time. However, it must be remembered that all the stated effects of noise on people vary greatly with the individual.

Generally, changes in noise levels less than 3 dBA are barely perceptible to most listeners, whereas 10 dBA changes are normally perceived as doublings (or halvings) of noise levels. These guidelines permit direct estimation of an individual's probable perception of changes in noise levels. It is also possible to characterize the effects of noise by studying the aggregate response of people in communities. The rating method used for this purpose is based on a statistical analysis of the fluctuations in noise levels in a community, and integrating the fluctuating sound energy during a known period of time, most typically during 1 hour or 24 hours. Various government and research institutions have proposed criteria that attempt to relate changes in noise levels to community response. One commonly applied criterion for estimating response is incorporated into the community response scale proposed by the International Standards Organization (ISO) of the United Nations as shown in Table 5.1. This scale relates changes in noise level to the degree of community response and permits direct estimation of the probable response of a community to a predicted change in noise level.

There are no human receptors residing near the mine and hence currently off-site human impacts are not an issue.

Table 5.1: Community Response to Increases in Noise Levels

Change (dBA)	Category	Description
0	None	No observed reaction
5	Little	Sporadic complaints
10	Medium	Widespread complaints
15	Strong	Threats of community action
20	Very Strong	Vigorous community action

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

5.2 IMPACT ON ANIMALS

Research into the effects of noise on animals is relatively scarce. The results obtained from the studies conducted are frequently contradictory or inconclusive. It does appear reasonably conclusive however, that the effect of noise on animals can be similar to the effects observed in humans. It does appear reasonably conclusive, however, that as with humans, animal reactions to noise vary from one individual to the next.

Noise can adversely affect wildlife by interfering with communication, masking the sounds of predators and prey, cause "stress" or avoidance reactions and, in the extreme, result in temporary or permanent hearing damage. Experiments have also shown that exposure to noise impulses throughout the night time sleep period resulted in poorer daytime task performance by animals (Fletcher and Busnel, 1978).

It is known that a large number of animals have adapted to the presence of humans and the noise generated by humans. In fact, many animals have demonstrated an ability to live in extremely noisy environments (e.g., rodents in factories, on ships, and in subways; fish in waters with constant shipping activity; birds and mammals on and around airfields). Although there have been reports of panic and similar "startle" reactions in animals to both fixed and rotating wing aircraft activity, the difference between these reports and field observations around military and commercial airfields may be explained by the learning process and habituation of many animal populations.

Studies conducted on arctic wildlife suggest that the same animal population should be observed over an extended time period at the same location. Busnel (1978) believes that unusual noise, in combination with close proximity visual stimulation, is enough to disturb any animal, including humans, and cause panic. He also points out that any sudden and unexpected intrusion, whether acoustic or other in nature, can produce a startle or panic reaction. What response is due specifically to noise itself is not always known.

Experimentation with the repeated sonic booms (equivalent to quarry blasting), which is a purely acoustic stimulus (with no associated visual or odour stimuli), shows that the behaviour of domestic and also some traditionally shy wild species can be unaffected (Casaday and Lehmann, 1967; Welch, 1970). Bird scare guns are also an acoustic source that produces similar results. Farmers have reported birds actually perching on the guns after several days of operation.

The learning ability of many animal species is discussed by Busnel (1971). The animal's initial reaction to a new noise source is fright and avoidance, but if other sensory systems are not stimulated (for instance optical or smell), the animal learns quite quickly to ignore the noise source, particularly when it exists in the presence of human beings.

SECTION 6 • CUMULATIVE EFFECT

No notable noise cumulative effect is expected due to the absence of communal or industrial noise sources within the local and regional study areas. A contribution of existing background noise of 43 dBA to the pit, or a plant noise level of 55 dBA at the study area, will be as low as 0.3 dBA, resulting in a cumulative noise level of 55.3 dBA. At sound levels above 60 dBA, contribution of the baseline noise will be negligible.

SECTION 7 • REFERENCES

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APPENDIX A

Noise Impact Matrices

Table A.1: Noise Impact Matrix – Construction

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
MAIN FACILITIES												
Dykes												
East Dyke	Moderate noise levels from construction	Medium	Local	Infrequent	Medium	Summer	No	Use pumps and generators equipped with mufflers; place equipment inside dyke below the ground level; minimize number of trips required to transport equipment	Lower noise levels	No	Certain	Maintain equipment in good repair
West Dyke	Moderate noise levels from construction	Medium	Local	Infrequent	Medium	Summer	No	Use pumps and generators equipped with mufflers; place equipment inside dyke below the ground level; minimize number of trips required to transport equipment	Lower noise levels	No	Certain	Maintain equipment in good repair
Portage South Dyke	Moderate noise levels from construction	Medium	Local	Infrequent	Medium	Summer	No	Use pumps and generators equipped with mufflers; place equipment inside dyke below the ground level; minimize number of trips required to transport equipment	Lower noise levels	No	Certain	Maintain equipment in good repair
Goose Island and 3rd Portage Arm Dykes	Moderate noise levels from construction	Medium	Local	Infrequent	Medium	Summer	No	Use pumps and generators equipped with mufflers; place equipment inside dyke below the ground level; minimize number of trips required to transport equipment	Lower noise levels	No	Certain	Maintain equipment in good repair

Table A.1 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Dewatering												
2nd Portage Lake	Low noise levels associated with assembling pumping facilities and pump operation; some noise associated with helicopter transport of materials	Medium	Local	Infrequent	Medium	Summer	No	Use pumps and generators equipped with mufflers; place equipment inside dyke below the ground level; minimize number of trips required to transport equipment	Lower noise levels	No	Certain	Maintain equipment in good repair
Portage Pit (3rd Portage Lake)	Low noise levels associated with assembling pumping facilities and pump operation; some noise associated with helicopter transport of materials	Medium	Local	Infrequent	Medium	Summer	No	Use pumps and generators equipped with mufflers; place equipment inside dyke below the ground level; minimize number of trips required to transport equipment	Lower noise levels	No	Certain	Maintain equipment in good repair
Goose Island (3rd Portage Lake)	Low noise levels associated with assembling pumping facilities and pump operation; some noise associated with helicopter transport of materials	Medium	Local	Infrequent	Medium	Summer	No	Use pumps and generators equipped with mufflers; place equipment inside dyke below the ground level; minimize number of trips required to transport equipment	Lower noise levels	No	Certain	Maintain equipment in good repair
Pits												
Portage Pit	High noise levels from blasting, drilling and material handling will disturb wildlife and result in reduced habitat effectiveness	High	Local	Continuous	Long	All Year	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available; limit noisy operation to day time use; use specialized blasting techniques	Lower noise levels	Yes	Certain	Maintain vehicle mufflers and noisy components; monitor noise levels and behavioural responses of wildlife

Table A.1 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Goose Island Pit	High noise levels from blasting, drilling and material handling will disturb wildlife and result in reduced habitat effectiveness	High	Local	Continuous	Long	All Year	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available; limit noisy operation to day time use; use specialized blasting techniques	Lower noise levels	Yes	Certain	Maintain vehicle mufflers and noisy components; monitor noise levels and behavioural responses of wildlife
Waste Dump (Portage/Goose)	Moderate noise levels from berm construction and material handling	Medium	Local	Continuous	Long	All Year	No	Limit noisy operation to day time use; use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair
Borrow Pit/ Quarry (UNKNOWN)	High noise levels from blasting, excavation, and material handling will disturb wildlife and result in reduced habitat effectiveness	High	Local	Continuous	Long	All Year	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available; limit noisy operation to day time use; use specialized blasting techniques	Lower noise levels	Yes	Certain	Maintain vehicle mufflers and noisy components; monitor noise levels and behavioural responses of wildlife
Tailings Facilities (2nd Portage Lake)	Not until operation	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA
Roads and Traffic	Moderate noise levels associated with construction	Medium	Local	Frequent	Medium	All Year	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; Use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair
	Moderate noise associated with traffic and road maintenance activities	Medium	Local	Continuous	Long	All Year	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; minimize vehicular traffic and speeds; convoy shipments whenever possible; limit random traffic; schedule transportation for daytime hours whenever possible	Lower noise levels	No	Certain	Enforcement of traffic speeds; maintain equipment in good repair; maintain road in order to reduce tire noise

Table A.1 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Airstrip and Air Traffic	Intermittent noise from air traffic reduces habitat effectiveness adjacent to airstrip and results in behavioural changes in wildlife	Medium	Regional	Continuous	Long	All Year	Yes	Minimize number of take-offs and landings; avoid excessive engine operation on high rotation follow clearly defined flight corridors; maintain minimum altitude; maintain a no wildlife harassment policy	Lower noise levels	No	Certain	Control flight paths and altitudes of flights
Mine Plant and Associated Facilities	High noise levels from blasting, material handling and construction will disturb wildlife and result in reduced habitat effectiveness	High	Local	Infrequent	Medium	All Year	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available; limit noisy operation to day time use; minimize amount of blasting necessary	Lower noise levels	Yes	Certain	Maintain vehicle mufflers and noisy components; monitor noise levels (decibels) and behavioural responses of wildlife
Freshwater Intake and Pipeline	Low noise levels associated with construction and assemblage	Low	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair
Discharge Facilities and Pipeline(s)	Low noise levels associated with construction and assemblage	Low	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair
Non-contact Diversion Facilities												
Fuel Storage (at Plant site)	Low noise levels associated with construction and assemblage	Low	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair

Table A.1 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Emulsion/AN Storage/ Explosives Magazines	Low noise levels associated with construction and assemblage	Low	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair
Camps (North and South)	Low noise levels associated with human activity and generators around camps	Low	Local	Continuous	Long	Summer	No	None necessary	Lower noise levels	No	High	NA
Sewage and Solid Waste Disposal	Low noise levels associated with construction and assemblage	Low	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair
VAULT FACILITIES												
Dyke(s)	Low noise levels associated with construction and assemblage	Low	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; Use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair
Dewatering	Low noise levels associated with assembling pumping facilities and pump operation; some noise associated with helicopter transport of materials	Low	Local	Infrequent	Medium	Summer	No	Use pumps and generators equipped with mufflers; place equipment inside dyke below the ground level; minimize number of trips required to transport equipment	Lower noise levels	No	Certain	Maintain equipment in good repair

Table A.1 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Waste Dump	Moderate noise levels from berm construction and material handling	Medium	Local	Continuous	Long	All Year	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; Use quietest machinery available; minimize amount of blasting required	Lower noise levels	No	Certain	Maintain equipment in good repair
Roads and Traffic	Moderate noise levels associated with construction	Medium	Local	Frequent	Medium	All Year	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; Use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair
	Moderate noise associated with traffic and road maintenance activities	Medium	Local	Continuous	Long	All Year	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; minimize vehicular traffic and speeds; convoy shipments whenever possible; limit random traffic; schedule transportation for daytime hours whenever possible	Lower noise levels	No	Certain	Enforcement of traffic speeds; maintain equipment in good repair; maintain road in order to reduce tire noise
Mine Shop/ Office	Low noise levels associated with construction and assemblage	Medium	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; Use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair

Table A.1 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
OTHER FACILITIES												
Winter Road and Traffic	Noise associated with grading and snowplowing	Medium	Regional	Continuous	Long	Winter	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; Use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair
	Moderate noise associated with traffic and road maintenance activities	Medium	Regional	Continuous	Long	Winter	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; minimize vehicular traffic and speeds; convoy shipments whenever possible; limit random traffic; schedule transportation for daytime hours whenever possible	Lower noise levels	No	Certain	Enforcement of traffic speeds; maintain equipment in good repair; maintain road in order to reduce tire noise
Baker Lake Access Road and Traffic	Moderate noise levels associated with construction	Medium	Local	Frequent	Medium	All Year	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; Use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair
	Moderate noise associated with traffic and road maintenance activities	Medium	Local	Continuous	Long	All Year	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; minimize vehicular traffic and speeds; convoy shipments whenever possible; limit random traffic; schedule transportation for daytime hours whenever possible	Lower noise levels	No	Certain	Enforcement of traffic speeds; maintain equipment in good repair in order to reduce tire noise
Barge Landing Facility	No measurable effects anticipated	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barge Traffic	Minor noise levels associated with barge engines and beach landings	Low	Regional	Continuous	Long	Summer	No	Minimize number of barges required per year	Lower frequency of noise appearances	No		None recommended

Table A.1 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
In-town Staging Facility	Moderate noise levels from blasting, material handling and construction will disturb wildlife and result in reduced habitat effectiveness	High	Local	Infrequent	Long	All Year	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available; limit noisy operation to day time use; minimize amount of blasting necessary	Lower noise levels	No	Certain	Maintain vehicle mufflers and noisy components; monitor noise levels and behavioural responses of wildlife
Explosives Magazine	Low noise levels associated with construction and assemblage	Low	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair
Tank Farm	Low noise levels associated with construction and assemblage	Low	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair

Table A.2: Noise Impact Matrix – Operation

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
MAIN FACILITIES												
Dykes												
East Dyke	Moderate noise levels from construction of Goose Island Dyke	Medium	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower level noise	No	Certain	Maintain equipment in good repair
West Dyke	Moderate noise levels from construction of Goose Island Dyke	Medium	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower level noise	No	Certain	Maintain equipment in good repair
Portage South Dyke	Moderate noise levels from construction of Goose Island Dyke	Medium	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower level noise	No	Certain	Maintain equipment in good repair
Goose Island and 3rd Portage Arm Dykes	Moderate noise levels from construction of Goose Island Dyke	Medium	Local	Infrequent	Medium	Summer	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower level noise	No	Certain	Maintain equipment in good repair
Dewatering												
2nd Portage Lake	No further dewatering activities anticipated during operations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Portage Pit (3rd Portage Lake)	No further dewatering activities anticipated during operations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Goose Island (3rd Portage Lake)	No further dewatering activities anticipated during operations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table A.2 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Pits												
Portage Pit	High noise levels from blasting, drilling and material handling will disturb wildlife and result in reduced habitat effectiveness	High	Local	Continuous	Long	All Year	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available; use specialized blasting techniques	Lower level noise	Yes	Certain	Maintain vehicle mufflers and other noisy components; monitor noise levels and behavioural responses of wildlife
Goose Island Pit	High noise levels from blasting, drilling and material handling will disturb wildlife and result in reduced habitat effectiveness	High	Local	Continuous	Long	All Year	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available; use specialized blasting techniques	Lower level noise	Yes	Certain	Maintain vehicle mufflers and other noisy components; monitor noise levels and behavioural responses of wildlife
Waste Dump (Portage/Goose)	Moderate noise levels from ongoing berm construction, and material handling and deposition	Medium	Local	Continuous	Long	All Year	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower level noise	No	Certain	Maintain equipment in good repair
Borrow Pit (MAY NOT APPLY)	High noise levels from blasting, excavation, and material handling will disturb wildlife and result in reduced habitat effectiveness	High	Local	Continuous	Long	All Year	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available; limit noisy operation to day time use; use specialized blasting techniques	Lower level noise	Yes	Certain	Maintain vehicle mufflers and other noisy components; monitor noise levels and behavioural responses of wildlife
Tailings Facilities (2nd Portage Lake)	Moderate noise levels from ongoing berm construction, and material handling and deposition	Medium	Local	Continuous	Long	All Year	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; Use quietest machinery available	Lower level noise	No	Certain	Maintain vehicle mufflers and other noisy components; monitor noise levels and behavioural responses of wildlife

Table A.2 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Roads and Traffic	Negligible noise levels associated with maintenance of road	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Moderate noise associated with traffic and road maintenance activities	Medium	Local	Continuous	Long	All Year	No	Use newer vehicles equipped in efficient mufflers; minimize vehicular traffic and speeds; convoy shipments whenever possible; limit random traffic; schedule transportation for daytime hours whenever possible	Lower level noise	No	Certain	Enforcement of traffic speeds; maintain equipment in good repair; maintain roads in order to reduce tire noise
Airstrip and Air Traffic	Negligible noise levels associated with maintenance of airstrip	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Intermittent noise from air traffic reduces habitat effectiveness adjacent to airstrip and results in behavioural changes in wildlife	Medium	Regional	Continuous	Long	All Year	Yes	Minimize number of take-offs and landings; avoid excessive engine operation on high rotation follow clearly defined flight corridors; maintain minimum altitude; maintain a no wildlife harassment policy	Lower level noise	No	Certain	Control flight paths and altitudes of flights
Mine Plant and Associated Facilities	Negligible noise levels associated with maintenance	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Moderate noise levels may result in displacement of wildlife and reduced habitat effectiveness	Medium	Local	Continuous	Long	All Year	No	Locate noisy equipment indoor. Provide noise barrier around crushers. Provide mufflers for power generators.	Lower level noise	No	Certain	Monitor sound levels of various activities
Freshwater Intake and Pipeline	Negligible noise levels associated with maintenance	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Discharge Facilities and Pipeline(s)	Negligible noise levels associated with maintenance	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Non-contact Diversion Facilities												

Table A.2 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Fuel Storage (at Plant site)	Negligible noise levels associated with maintenance	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Emulsion/AN Storage/ Explosives Magazines	Negligible noise levels associated with maintenance	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Camps (North and South)	Low noise levels associated with dismantling of camps and habitat reclamation activities; once camps dismantled, no further noise impacts anticipated	Low	Local	Infrequent	Medium	Summer	No	None necessary	Noise at daytime only	No	High	NA
Sewage and Solid Waste Disposal	Occasional noise of waste hauling trucks	Medium	Local	Infrequent	Short	All year	No	Limit operation at disposal site to daytime hours	NA	No	Certain	Maintain equipment in good repair
VAULT FACILITIES												
Dyke(s)	Negligible noise levels associated with maintenance	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dewatering	No further dewatering activities anticipated	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pit	High noise levels from blasting, drilling and material handling will disturb wildlife and result in reduced habitat effectiveness	High	Local	Continuous	Long	All Year	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available; use specialized blasting techniques	Lower level noise	Yes	Certain	Maintain vehicle mufflers and moving parts; monitor noise levels; observe behavioural responses of wildlife
Waste Dump	Moderate noise levels from ongoing berm construction, and material handling and deposition	Medium	Local	Continuous	Long	All Year	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available	Lower level noise	No	Certain	Maintain equipment in good repair

Table A.2 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Roads and Traffic	Negligible noise levels associated with maintenance of road	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Moderate noise associated with traffic and road maintenance activities	Medium	Local	Continuous	Long	All Year	No	Use newer vehicles equipped in efficient mufflers; minimize vehicular traffic and speeds; convoy shipments whenever possible; limit random traffic; schedule transportation for daytime hours whenever possible	Lower level noise	No	Certain	Enforcement of traffic speeds; maintain equipment in good repair; maintain roads in order to reduce tire noise
Non-contact Diversion Facilities												
Mine Shop/ Office	Negligible noise levels associated with maintenance	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OTHER FACILITIES												
Winter Road and Traffic	Noise associated with grading and snowplowing; traffic noise	Medium	Regional	Continuous	Long	Winter	Yes	Use newer vehicles equipped in efficient mufflers; Use quietest machinery available	Lower level noise	No	Certain	Maintain equipment in good repair
Baker Lake Access Road and Traffic	Negligible noise levels associated with maintenance of road	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA
	Moderate noise associated with traffic and road maintenance activities	Medium	Local	Continuous	Long	All Year	No	Use newer vehicles equipped in efficient mufflers; minimize vehicular traffic and speeds; convoy shipments whenever possible; limit random traffic; schedule transportation for daytime hours whenever possible	Lower level noise	No	Certain	Enforcement of traffic speeds; maintain equipment in good repair; maintain roads in order to reduce tire noise
Barge Landing Facility	No measurable effects anticipated	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table A.2 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Barge Traffic	Minor noise levels associated with barge engines and beach landings	Medium	Regional	Continuous	Long	Summer	No	Minimize number of barges required per year	Lower level noise	No	Certain	None recommended
In-town Staging Facility	Moderate noise levels from on-site activity	Medium	Local	Continuous	Long	All Year	No	Use newer vehicles equipped in efficient mufflers; use quietest machinery available; limit noisy operation to day time use	Lower level noise	No	Certain	Maintain vehicle mufflers and noise generating components
Explosives Magazine	Negligible noise levels associated with maintenance	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tank Farm	Negligible noise levels associated with maintenance	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table A.3: Noise Impact Matrix – Closure & Post-Closure

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
MAIN FACILITIES												
Dykes												
East Dyke	Moderate noise level from site preparation for closure	Medium	Local	Continuous at closure	Medium	Summer	No	Use equipment which meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
West Dyke	Moderate noise level from site preparation for closure	Medium	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Portage South Dyke	Moderate noise level from site preparation for closure	Medium	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Goose Island and 3rd Portage Arm Dykes	Moderate noise level from site preparation for closure	Medium	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Dewatering								Use equipment that meets noise emission specification standards.				
2nd Portage Lake	Low noise levels from equipment removal	Low	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Portage Pit (3rd Portage Lake)	Low noise levels from equipment removal	Low	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.

Table A.3 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Goose Island (3rd Portage Lake)	Low noise levels from equipment removal	Low	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Pits												
Portage Pit	Moderate noise from pit closure activities	Medium	Local	Continuous at closure	Medium	Summer	No	Use equipment which meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Goose Island Pit	Moderate noise from pit closure activities	Medium	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Waste Dump (Portage/Goose)	Moderate noise from dump cupping equipment	Medium	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Tailings Facilities (2nd Portage Lake)	Moderate noise from tailings cupping equipment	Medium	Local	Continuous at closure	Short	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Roads and Traffic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Airstrip and Air Traffic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mine Plant and Associated Facilities	Moderate noise level from plant disassemble	Medium	Local	Continuous at closure	Long	All year	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Freshwater Intake and Pipeline	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Discharge Facilities and Pipeline(s)	Low level noise from facilities abandon activities	Low	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.

Table A.3 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Non-contact Diversion Facilities												
Fuel Storage (at Plant site)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Emulsion/AN Storage/ Explosives Magazines	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Camps (North and South)	Low level noise from facilities abandon activities	Low	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Sewage and Solid Waste Disposal	Moderate noise levels associated with disposal site capping	Medium	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
VAULT FACILITIES												
Dyke(s)	Moderate noise from cupping equipment	Medium	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Dewatering	Low noise levels from equipment removal	Low	Local	Continuous at closure	Short	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Pit	Moderate noise from pit closure activities	Medium	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Waste Dump	Moderate noise from cupping equipment	Medium	Local	Continuous at closure	Short	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Roads and Traffic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table A.3 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Non-contact Diversion Facilities												
Mine Shop/ Office	Low level noise from facilities abandon activities	Low	Local	Continuous at closure	Long	All Year	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
OTHER FACILITIES												
Winter Road and Traffic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Baker Lake Access Road and Traffic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barge Landing Facility	Low level noise from facility closing	Low	Local	Continuous at closure	Medium	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Barge Traffic	Minor noise level associated with barge engines and beach landing during closure	Low	Regional	Continuous	Long	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
In-town Staging Facility											**Certain**	
Explosives Magazine	Low level noise from facilities abandon activities	Low	Local	Continuous at closure	Short	Summer	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.
Tank Farm	Moderate noise level from tanks disassemble	Medium	Local	Continuous at closure	Long	All Year	No	Use equipment that meets noise emission specification standards.	Lower noise level	No	Certain	Conduct work according to code of practice for minimizing noise. Schedule work to avoid simultaneous noisy operations.