EARLY REVENUE PHASE

ADDENDUM TO
FINAL ENVIRONMENTAL IMPACT STATEMENT

VOLUME 5
ATMOSPHERIC ENVIRONMENT

Preamble

The Approved Project is for an iron ore mine and associated facilities located on North Baffin Island, in the Qikiqtaaluk Region of Nunavut (Figure 1-1.1 in the FEIS). The Project involves the Construction, Operation, Closure, and Reclamation of an 18 million tonne-per-annum (Mt/a) open-pit mine that will operate for 21 years. The high-grade iron ore to be mined is suitable for international shipment after only crushing and screening with no chemical processing facilities. A railway system will transport 18 Mt/a of the ore from the mine area to an all-season deep-water port and ship loading facility at Steensby Port where the ore will be loaded into ore carriers for overseas shipment through Foxe Basin. A dedicated fleet of cape-sized ice-breaking ore carriers and some non-icebreaking ore carriers and conventional ships will be used during the open water season to ship the iron ore to markets. The Approved Project was issued Project Certificate No. 005 by the Nunavut Impact Review Board on December 28, 2012.

An Early Revenue Phase (ERP) has been proposed as an amendment to the Approved Project. The ERP comprises the production of 3.5 Mt/a of iron ore that is to be transported via the upgraded existing road to Milne Port where it will be stockpiled for shipment during the open water season.

Once the ERP is approved, the total production level of the Mary River Project will be 21.5 Mt/a.

The ERP introduces the following additional activities that were not assessed in the FEIS of the Approved Project:

1. Mine Site
    a. Loading of ore into trucks; and
    b. Ore haulage truck fleet and maintenance facilities.

2. Tote Road
    a. Haulage of ore along the Tote Road.

3. Milne Port
    a. Ore stockpiling and loading onto ships.

4. Marine Shipping
    a. Ore carrier loading at Milne Port; and
    b. Ore carrier shipping volume and timing.

The Project Description and related assessments for approval of the ERP are addressed in this Addendum to Final Environmental Impact Statement.

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1.3 GREENHOUSE GAS EMISSIONS ESTIMATED FOR THE PROJECT (CHANGE)

An evaluation of the Project's GHG emissions is provided in Appendix 5B. The Mining Association of Canada's (2009) categorization of GHG emissions has been adopted:

- Scope 1 emissions - direct emissions by equipment owned or controlled by the company;
- Scope 2 emissions - emissions from purchased electricity; not applicable to the Project; and
- Scope 3 emissions - emissions from related upstream and downstream activities, such as air travel and shipping.

Key facts related to the Project's GHG emissions are summarized below:

- About 11.4 Mt CO_2 eq of Scope 1 emissions will be generated over the life of the Project, an annual average of 0.426 Mt CO_2 eq. An additional 8.6 Mt CO_2 eq of Scope 3 emissions will be generated.
- The Project's emission intensity from Scope 1 emission sources (Baffinland, personal communication) is approximately 0.0311 Mt CO_2eq / Mt ore, similar to the estimated emission intensity of the Mary River project (0.0211Mt CO_2eq / Mt ore). The higher emission intensity at the Carol project can be attributed to the additional concentrator/pellet plant.
- The Project will contribute substantially to Nunavut's total GHG emissions. Depending on the number used for Nunavut's total emissions (several different totals were identified; see below), the Project will increase the total by 105 % to 203 %.
- The Project's annual GHG emissions represent 2.98 % of the current total GHG emissions from mining in Canada; 0.100 % of Canada's total emissions, and 0.002 % of Global emissions (RWDI, 2010; Appendix 5B).

Several different totals have been reported for Nunavut's annual GHG emissions. Environment Canada (2010a) reports a 2008 total of 0.36 Mt CO_2 eq. The Government of Nunavut (2003) reported 0.696 Mt CO_2 eq for 1995, and separately reported annual totals for the years 2000, 2005, 2006 and 2007 ranging from 0.412 Mt CO_2 eq to 0.472 Mt CO_2 eq (Government of Nunavut, undated). The Government of Nunavut (2003) source is thought to be most representative since the resultant per capita emissions for Nunavut align quite well with the per capita estimates for the Northwest Territories and Yukon.

Because of Nunavut's small population and manufacturing base, total GHG emissions are very low. Because the proposed project would be one of the large developments in Nunavut, annual GHG emissions of the proposed mine would be more than double of total territorial emissions in 2008.

On a national level, the emissions from the project are very small, and compared with global emissions they are insignificant.

1.4 AUTHORS (NO CHANGE)

The climate change forecast was prepared by Nicole Vadori, P.Eng., Senior Air Quality Scientist with RWDI Air Inc. The GHG assessment was prepared by Christian Reuten, Ph.D. of RWDI. Senior review was provided by Alain Carrière, B.A., Dipl. Ecotox (Senior Project Manager) and Mike Lepage, M.Sc., ACM, CCM (Project Director) of RWDI, and Richard Cook, B.Sc. (Senior Scientist) of Knight Piésold Ltd.

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Details of the construction activities at all three sites are provided in the Project Description (Volume 3).

A detailed emissions inventory and dispersion modelling assessment was not conducted for the Construction Phase because of the intermittent and temporary nature of construction activities. Potential air quality effects were therefore assessed qualitatively based on previous air quality experience and some ambient monitoring that was conducted over a three-week period (August 31 to September 23, 2007) at Milne Port during the preparation for bulk sampling (Appendix 5C-2). Activities at that time included a sealift and ancillary equipment operations including, cranes, barges, a tugboat, and front-end loaders. Other activities during the monitoring period included five to seven aircraft flights a day, light-duty vehicle trips, and road construction.

A brief overview of the ambient air quality monitoring program and a discussion of potential air quality effects from future construction activities are discussed below.

Milne Port

The construction activities at Milne Port that have the potential to affect local air quality include:

- Sealift activities;
- Construction of Infrastructure such as camps and laydown areas;
- Drilling, blasting, excavation and crushing of aggregate from rock quarries, and extraction of sand and gravel from borrow areas; and
- Construction of docks.

Milne Inlet Tote Road

Approved road upgrade activities to be undertaken mainly in the first two years of construction will include drilling, blasting and crushing of rock to produce aggregate; earthmoving; road haulage and placement of aggregate; culvert replacement and bridge construction.

Mine Site (assessed with Approved Project)

2.4 AIR EMISSION SOURCES DURING OPERATIONS PHASE (CHANGE)

The sources of air emissions for the Operations Phase are summarized in the following section. The base quantities, such as equipment ratings and production rates applied to determine air emissions, are provided in Appendix 5C-4.

Milne Port

The following activities have the potential to affect local air quality and were considered in the assessment of the Operations Phase:

- Ore stockpiles (lump and fines) including stacker/reclaimer and conveyance systems;
- Unloading of ore from the haul trucks;
- Power generating station, including a series of generators operating on Arctic diesel, with boilers providing emergency backup heat;
- Shipping activities, specifically the loading and operation of “hotel” engines while at the dock; and
- Waste incineration at the camp.

Milne Inlet Tote Road

The following activities have the potential to affect local air quality and were considered in the assessment of the Operations Phase:

- Haul road activities for the shipment of 3.5 Mt/a of iron ore from the Mine Site to Milne Port; and
- Resupply operations, including the haulage of materials and fuel from Milne Port to the Mine Site.

Mine Site (increase production from 18 Mt/a to 21.5 Mt/a)

The following activities have the potential to affect local air quality and were considered in the assessment of the Operations Phase:

- Open pit mine operations including drilling, blasting grading and dozing;
- Mobile engine operations in the pit, including drills, shovels, loaders, trucks etc.;
- Mine haul roads and Tote Road;
- Ore stockpiles (lump and fines) including stacker/reclaimer and conveyance systems;
- Rail car loading, truck loading, and idling locomotives;
- Power generating station, including a series of generators operating on Arctic diesel, with boilers providing emergency backup heat; and
- Waste incineration.

Railway (No Change)

Steensby Port (No Change)

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2.6 AIR QUALITY (CHANGE)

2.6.1 Assessment Methodology (Change)

Overview

A standard assessment approach was used to determine air quality effects associated with Project-related activities. This approach is outlined in Table 5-2.9 and includes the following tasks:

- Use baseline ambient air quality monitoring to establish existing background levels;
- Identify and quantify atmospheric emission sources associated with each of the Project sites (Milne Port, Tote Road, Mine Site, Railway, Steensby Port);
- Establish local meteorological conditions to determine transport and dispersion patterns in the region;
- Use dispersion models to predict ambient concentrations and deposition patterns for the Operations Phase;
- Compare the ambient monitoring measurements (i.e., baseline conditions) and air quality predictions to the ambient air quality and deposition criteria; and
- Identify the incremental air quality changes and assess the significance of these effects.

Table 5-2.9 Air Quality Effects Assessment Approach (Change)

Component	Description
Quantify Emission Sources	The objective of this task is to identify stack (point source) parameters such as location, physical dimensions, gross flow conditions, and pollutant flow rates. Fugitive sources (area and volume sources) were also characterized. This task was completed using manufacturer specifications, published emission factors, and project design information. Emissions were estimated for Milne Port, Mine Site, and Steensby Port (see Appendix 5C-4).
Terrestrial characterization	Digital terrain data were obtained to account for elevation changes in the study areas. The nature of the surface will affect the deposition of pollutants. Land surface features were obtained from satellite data. The nature of the surface was grouped according to land use classes: water, tundra, and barren land.
Review of ambient air quality measurements	A number of ambient monitoring programs were undertaken to establish air quality conditions in the absence of the Project and to establish potential effects from activities that were not explicitly modelled as part of this assessment.
Meteorological characteristics	The CALMET preprocessor was used to generate three-dimensional meteorological fields for one year (2006) at all three sites, which is consistent with other EIA applications undertaken using the CALMET/CALPUFF model system.
Model approach	The CALPUFF model was used to predict the transport, dispersion, chemical transformation, and deposition from all sources associated with the Project. The model was used to predict 1-h, 24-h and annual average concentration patterns (i.e., SO_2, NO_2, CO and $PM_{2.5}$) and annual nitrogen, sulphur, PAI and dust deposition patterns.

The assessment identifies potential changes or effects to existing air quality conditions and dust, metal, nitrogen, sulphur and PAI deposition levels that may result from Project activities. Air quality effects will depend on the magnitude of the emissions, which vary with the activities over the lifetime of the Project, i.e., Construction (four years); Operations (21 years): early revenue phase and full production phase; Closure and Reclamation (three years). This assessment approach, described in the preceding paragraphs, was applied to the Operations Phase. It was not applied to the Construction and Closure Phases because of their temporary nature. However, the Construction and Closure Phases were assessed qualitatively.

Effects during the Construction and Project Closure and Reclamation Phases were assessed qualitatively for Milne Port, the Mine Site, and Steensby Port.

All major Project components will operate year round with the exception of shipping to and from Milne Port.

Mitigation measures that may prevent or minimize the identified air quality effects fall under one of two categories:

- Mitigation by design describes mitigations that have been built into the Project design; and
- Air Quality Specific Mitigations are those identified by the air quality effects assessment team to reduce predicted project effects.

Residual effects are those effects remaining after all appropriate mitigations have been implemented. Residual effects are evaluated based on the criteria in Table 5-2.14.

Estimation of Project Emissions

A systematic approach to identify and quantify emissions was used to determine the emissions that could occur due to the operation of the Project. The key components of the approach are as follows:

- Determine the types of activities and relevant activity levels;
- Determine temporal and spatial boundaries associated with these activities; and
- Apply manufacturer's data, where available, or industry specific emission factors to the defined activities to determine the emission type and calculate emission rates.

The activities, corresponding temporal and spatial boundaries, and manufacturer's data were collected from the Development Proposal and Project engineering staff. Manufacturer's data were available for the power generators and waste incinerators.

An emission factor is a representative value that relates the quantity of a contaminant released into the atmosphere to an activity associated with the release of that contaminant. The United States Environmental Protection Agency (USEPA) "AP-42" document (USEPA, 2008) provided emission factors for the wide range of mining-related activities.

The following sections of AP-42 were adopted:

- Section 11.9 (Western Surface Coal Mining) was used to estimate emissions from various mining activities;
- Section 11.19.2 (Crushed Stone Processing and Pulverized Mineral Processing) was used to estimate emissions from drilling activities;
- Section 11.24 (Metallic Mineral Processing) was used to estimate emissions from processing operations (i.e., crushing, concentrate handling, etc.);
- Section 13.2.2 (Unpaved Roads) was used to estimate emissions from the haul roads; and
- Section 13.2.4 (Aggregate Handling and Storage Piles) was used to estimate emissions for drop operations such as stacking ore onto storage piles.

US EPA Tier II/III non-road emission standards were used to estimate the exhaust emissions from the mine fleet and truck fleet activities at the site. Emissions from shipping activities were determined from emissions factors published as part of an emissions inventory conducted in BC that included marine emissions

(Chamber of Shipping, 2007). The use of dust suppressant during summer months, together with natural dust suppression during the winter months, was assumed to provide a 66 % overall reduction in potential dust emissions.

A portion of the TSP concentrations predicted by the model will comprise heavy metals such as iron, arsenic, and calcium associated with general mining activities (waste and ore handling) as well as dust from ancillary operations (haul roads). As an approximate approach, and in the absence of detailed metals analyses from all dust deposition sources, the metals concentrations were predicted for the top five metals (those with the highest ratio of metal content to air quality thresholds) are shown in Table 5-2.10.

Table 5-2.10 Summary of Metal Analysis of Ore (No Change)

Air Dispersion Modelling

A dispersion model provides a scientific link between emissions and the associated ambient air quality downwind of their source. The models account for the transport, dispersion, and deposition processes in relation to local terrain and meteorology. Given the importance of dispersion models for air quality effects assessments, regulatory agencies identify accepted models and provide guidance on their application (e.g., US EPA, 2005; BC Ministry of Environment, 2008; Alberta Environment, 2003; Ontario Ministry of the Environment, 2009).

The CALPUFF dispersion model, recommended by a number of regulatory agencies, was adopted to assess emissions from the Mary River Project activities. This model has been the *de facto* standard for environment assessments in Canada's North including the Miramar Doris North Project and High Lake Mine Project assessments.

2.6.2 Potential Effects and Proposed Mitigation - Construction Phase (Change)

2.6.2.1 Milne Port (Change)

- There is a potential for the maximum 24-hour dust concentrations to exceed indicator thresholds for TSP, PM_{10} and $PM_{2.5}$ within the immediate vicinity of construction activities (i.e., within several hundred metres, depending on activity levels). Beyond this distance, TSP levels should fall below the indicator threshold.

- Metal concentrations in the vicinity of construction activities are expected to be much less than their respective indicator thresholds. There may be a potential for silica levels to approach or exceed its indicator threshold depending on natural levels of the silica in the soil within the disturbed areas.

- SO_2 and NO_2 levels from mobile equipment are expected to be lower than the indicator thresholds during Construction.

- Elevated dust deposition levels are expected in the immediate vicinity of construction. These levels could exceed the indicator thresholds.

Best management practices for dust control will be followed during Construction. An Air Quality and Noise Abatement Management Plan is included in FEIS Addendum Appendix 10A.

2.6.2.2 Tote Road Upgrades (Change)

- There is a potential for the maximum 24-hour dust concentrations to exceed indicator thresholds for TSP, PM_{10} and $PM_{2.5}$ within the immediate vicinity of Construction activities (i.e., within several hundred metres, depending on activity levels). Beyond this distance, TSP levels should fall below the indicator threshold.
- Metal concentrations in the vicinity of construction activities are expected to be much less than their respective indicator thresholds. There may be a potential for silica levels to approach or exceed its indicator threshold depending on natural levels of the silica in the soil within the disturbed areas.
- SO_2 and NO_2 levels from mobile equipment are expected to be lower than the indicator thresholds during the construction activities.
- Elevated dust deposition levels are expected in the immediate vicinity of construction and blasting activities. These levels could exceed the indicator thresholds.

Best management practices for dust control will be followed during road and rail construction and quarry activities, where possible (FEIS Addendum Appendix 10A).

2.6.2.3 Mine Site (Change)

The following air quality effects are expected at Mine Site during construction as a result of the aforementioned activities:

- There is a potential for the maximum 24-hour dust concentrations to exceed indicator thresholds for TSP, PM_{10} and $PM_{2.5}$ within the immediate vicinity of Construction activities (i.e., within several hundred metres, depending on activity levels). Beyond this distance, TSP levels should fall below the indicator threshold;
- Metal concentrations in the vicinity of construction activities are expected to be much less than their respective indicator thresholds. There may be a potential for silica levels to approach or exceed its indicator threshold depending on natural levels of the silica in the soil within the disturbed areas;
- SO_2 and NO_2 levels from mobile equipment are expected to be lower than the indicator thresholds during the construction activities; and
- Elevated dust deposition levels are expected in the immediate vicinity of construction. These levels could exceed the indicator thresholds.

Best management practices outlined in the previous section will be implemented during Construction, where possible. For the Approved Project, permanent crushing and sizing facilities will be enclosed and ventilated, and dust collection equipment will be installed to capture dust emissions.

2.6.3 Potential Effects and Proposed Mitigation – Operations (Change)

2.6.3.1 Milne Port (Change)

The emissions inventory for Milne Port during the Operations Phase is provided in Table 5-2.16.

Table 5-2.16 Emission Sources and Estimated Annual Emissions due to Milne Port Operations (Mt/a) (New)

Source Description	TSP	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO
Stockpile emissions						
Fines/lump stockpile	37.0	18.5	2.80	0	0	0
Sub-total	**37.0**	**18.5**	**2.80**	**0**	**0**	**0**
Bulk Handling						
Stackers, Reclaimers, Conveyors	284.0	134.3	20.3	0	0	0
Sub-total	**284.0**	**134.3**	**20.3**	**0**	**0**	**0**
Point Sources						
Power Generators (5 units)	3.5	3.5	3.5	7.3	458	58.7
Incinerator (2 units)	5.1	5.1	5.1	0.0	7.6	0.5
Ship Generator at Port	19.0	19.0	9.0	121.1	129.7	9.9
Sub-total	**27.5**	**27.5**	**17.5**	**129**	**595**	**69.2**
Tote Road						
Milne Inlet Modelled Section	295	80.2	30.5	0.002	76.8	76.8
Sub-total	**295**	**80.2**	**30.5**	**0.002**	**76.8**	**76.8**
TOTAL	**644**	**261**	**71.1**	**129**	**672**	**146**

- The main sources of TSP, PM_{10} and $PM_{2.5}$ emissions are fugitive sources, specifically bulk handling operations (stackers and reclaimers) and dust emissions from Tote Road. These sources account for 90 %, 82 %, and 83 % of the TSP, $PM_{10,}$ and $PM_{2.5}$ emissions, respectively. These emissions were assumed to occur continuously even though daytime operations are discontinuous and precipitation events can suppress these emissions.
- Power generation (including on-board power for a ship at the dock) accounts for nearly 100 % of the SO_2, 89 % of NO_x and 47 % of CO emissions, respectively.

Maximum predicted concentrations for the operation are superimposed on a base map centred on the Milne Port site. For the purpose of presentation, a limited number of concentration plots are shown.

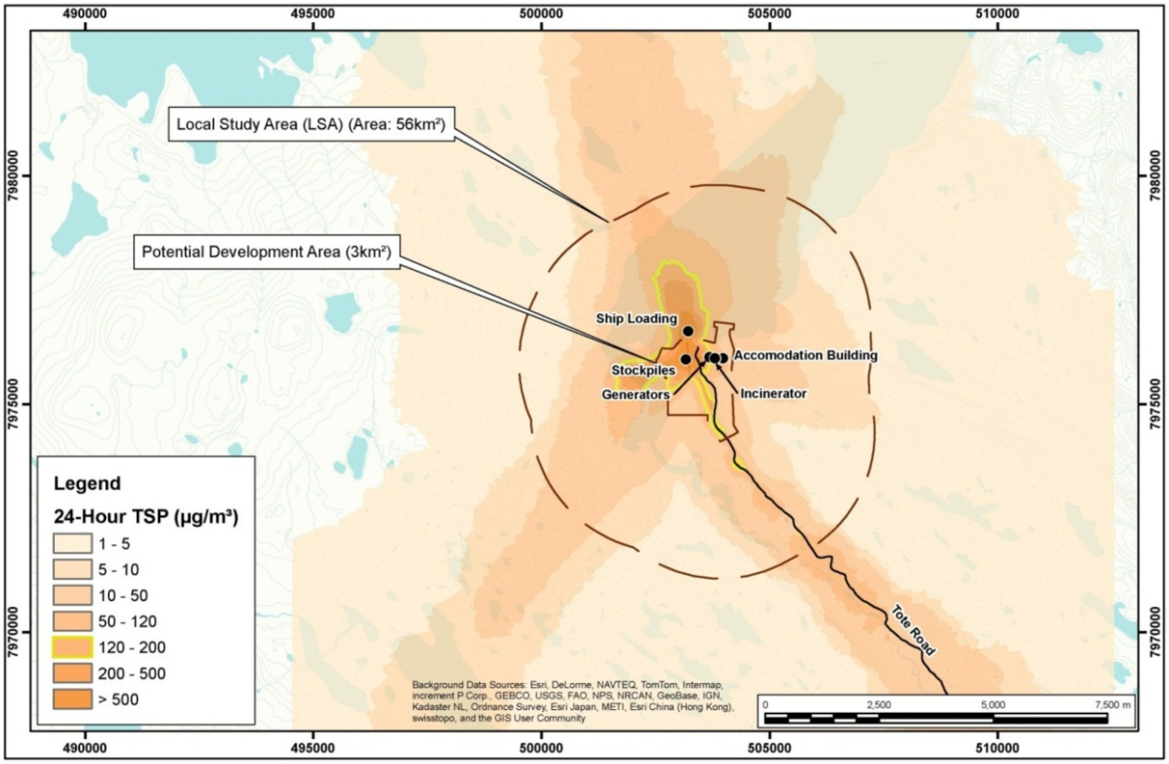

Figure 5-2.11 Maximum 24-hour TSP Concentrations at Milne Port (New)

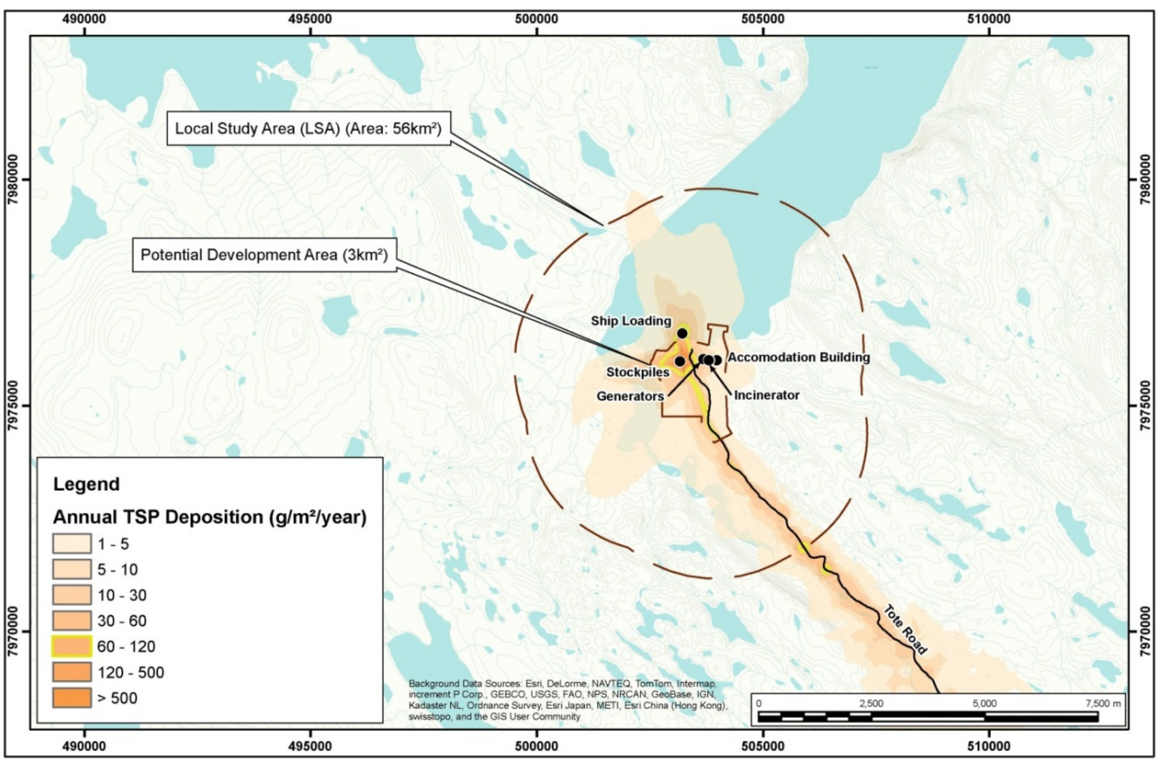

Figure 5-2.12 Annual TSP Deposition at Milne Port (New)

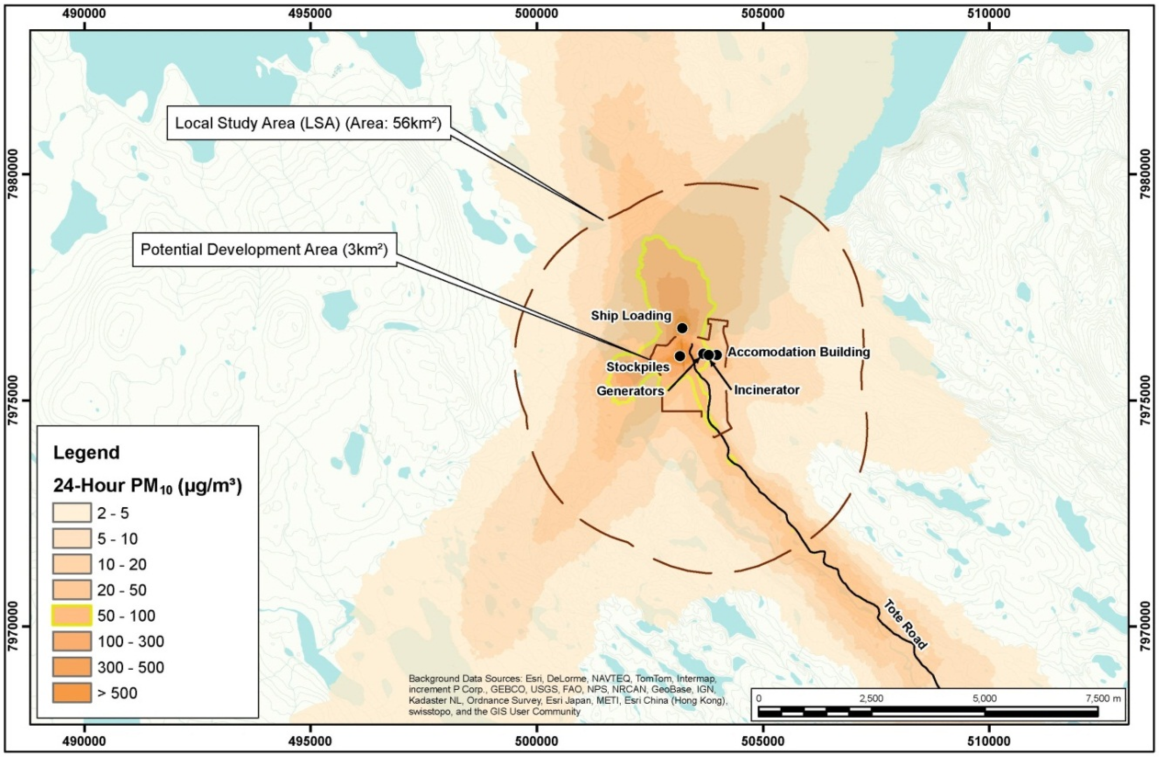

Figure 5-2.13 Maximum 24-hour PM_{10} Concentrations at Milne Port (New)

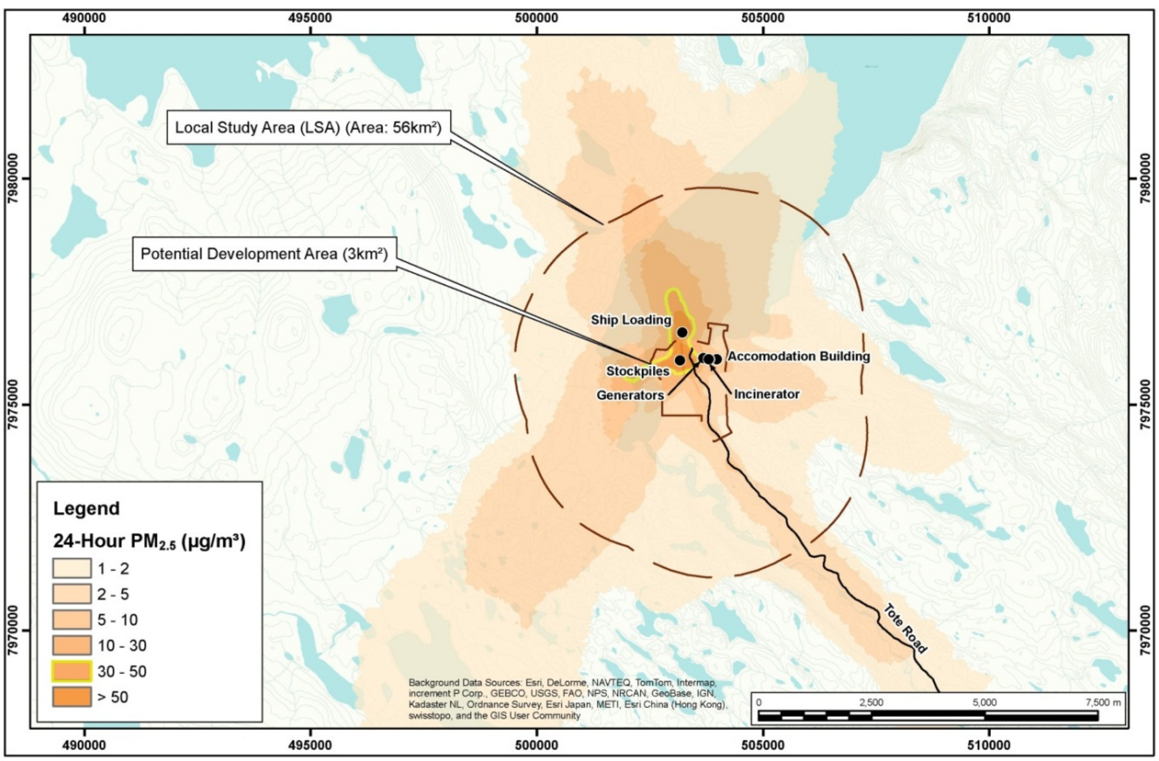

Figure 5-2.14 Maximum 24-hour $PM_{2.5}$ Concentrations at Milne Port (New)

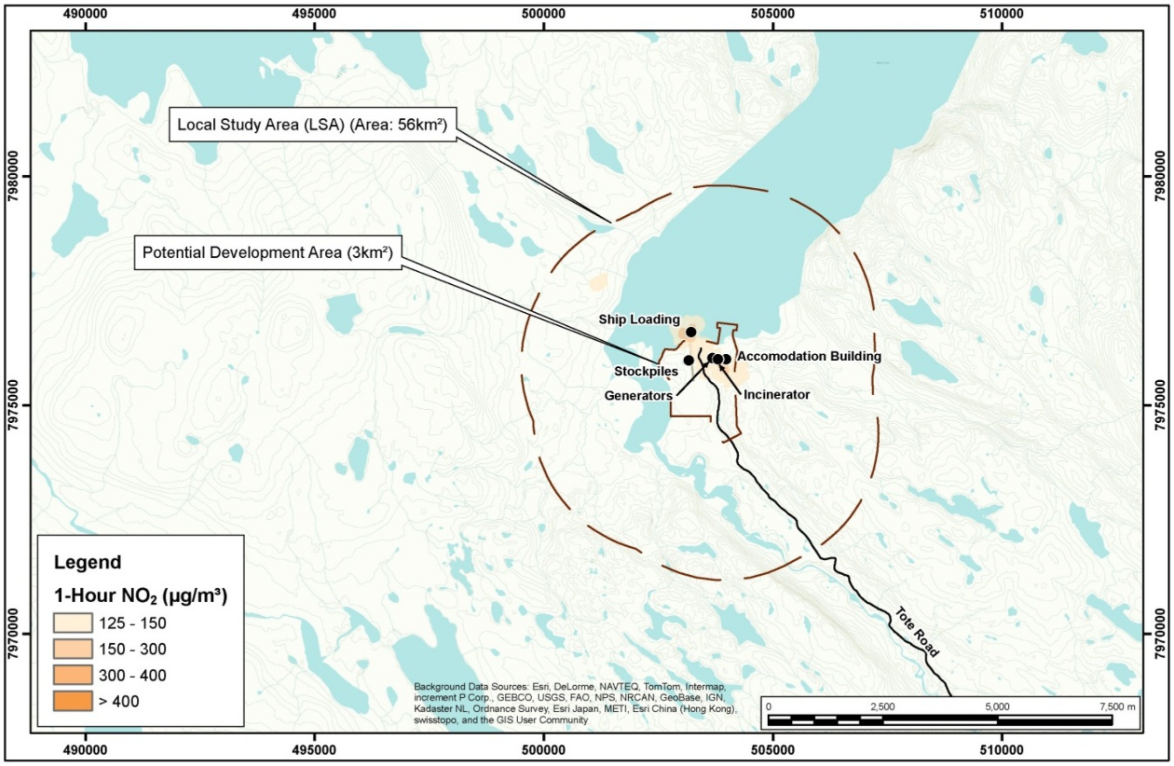

Figure 5-2.15 Maximum 1-hour NO_2 Concentrations at Milne Port (New)

These figures are described by contaminant in the following sections. Concentration plots for the remaining averaging times and contaminants are provided in Appendix 5C-5. For plots not shown, the maximum predicted levels are less than their respective thresholds beyond the LSA.

TSP Concentrations

High 24-hour TSP concentrations in excess of the indicator threshold of 120 µg/m^3 are limited to the LSA. Concentrations above the indicator threshold also occur along Tote Road, because of dust generated by trucks. These exceedances are limited to the close proximity of the Tote Road. Concentrations beyond the LSA generally fall below 10-50 µg/m^3 with the exception of areas adjacent to the Tote Road. Values shown in concentration contour plots represent the maximum 24-hour concentrations under worst-case meteorological and maximum operating conditions, which will occur during the summer shipping season.

Metals Concentrations

Concentrations of the metals are not shown in the concentration contour plots, but are interpreted from the plot of 24-hour TSP concentrations. Iron, based on the metals analysis of the iron ore, could account for up to 72 % of the TSP. Iron concentrations in excess of the indicator threshold of 4 µg/m^3 will occur beyond the LSA.

Manganese, based on the metals analysis of the iron ore, could account for up to 2.9 % of the TSP. Concentrations in excess of the indicator threshold of 2.5 µg/m^3 are limited to the LSA, beyond which they fall below about 1.45 µg/m^3.

Arsenic, based on the metals analysis of the iron ore, could account for up to 0.08 % of the TSP. Concentrations in excess of the indicator threshold of 0.3 µg/m^3 are limited to a very small area of the LSA, and beyond which they fall below about 0.04 µg/m^3.

Calcium, based on the metals analysis of the iron ore, could account for up to 2 % of the TSP. Concentrations in excess of the indicator threshold of 10 µg/m^3 (expressed as calcium oxide) are limited to a very small area of the LSA, and beyond which they fall below about 1.0 µg/m^3.

Cobalt, based on the metals analysis of the iron ore, could account for up to 0.01 % of the TSP. Concentrations in excess of the indicator threshold of 0.1 µg/m^3 are limited to a very small area of the LSA, and beyond which they fall below about 0.005 µg/m^3.

TSP Deposition

High TSP deposition is predicted to occur within the LSA. Values are predicted to exceed the annual indicator threshold of 60 g/m^2/year within a small part of the LSA, and immediately adjacent to the Tote Road.

PM_{10} Concentrations

High 24-hour PM_{10} concentrations in excess of the indicator threshold of 50 µg/m^3 are contained within the LSA, except for areas immediately adjacent to the Tote Road. The values shown in the concentration contour plots represent the maximum 24-hour concentrations under worst-case meteorological and maximum operating conditions.

$PM_{2.5}$ Concentrations

High 24-hour $PM_{2.5}$ concentrations in excess of the indicator threshold of 30 µg/m^3 are limited to the several small zones within the LSA. Concentrations beyond the LSA generally fall below 2 to 5 µg/m^3. The values shown in the concentration contour plots represent the maximum 24-hour concentrations under worst-case meteorological and maximum operating conditions.

NO_2 Concentrations

High 1-hour NO_2 concentrations are below the indicator threshold of 400 µg/m^3 within the entire model domain. Concentrations beyond the LSA generally fall below 125 µg/m^3.

Mitigation Measures

The following mitigation measures are incorporated into the design and have also been included in the air quality assessment:

- Follow good engineering practice in design of exhaust stacks for the power generators to reduce ground level concentrations; and
- Ore carrier and sealift vessels will not be permitted to operate on-ship incinerators while docked.

Two adaptive management strategies will be available for implementation, if required by monitoring:

- Control of transfer points; and
- Adjust speed limits according to conditions.

These potential options have been identified for consideration in the Air Quality and Noise Abatement Management Plan (FEIS Addendum Appendix 10A).

Emissions of Dioxins/Furans and Mercury from Waste Incineration

Although the emission of typical products of combustion from waste incineration has been addressed in the emissions inventory and dispersion modelling for this site, emissions of dioxins/furans and mercury warrants additional comment because waste incineration has the potential to emit these specific air contaminants, for which Canada-wide Standards (CWS) exist. Minimizing these emissions is largely related to best waste management practices and the proper operation of appropriately sized incineration units. Baffinland is committed to the development of appropriate Waste Management Plans and Standard Operating Procedures for waste incineration to minimize the emissions of dioxin/furans and mercury.

2.6.3.2 Tote Road (Change)

Air quality effects from truck traffic on the Milne Inlet Tote Road, between the Mine Site and Milne Port, were determined for a segment of the road. Similar results are expected down the entire length of the road. Predicted air quality effects, shown in Figure 5-2.16, indicate that deposition levels in excess of the threshold value of 50 g/m^2/year are expected to occur at distances up to 50-100 m from the centre of the road.

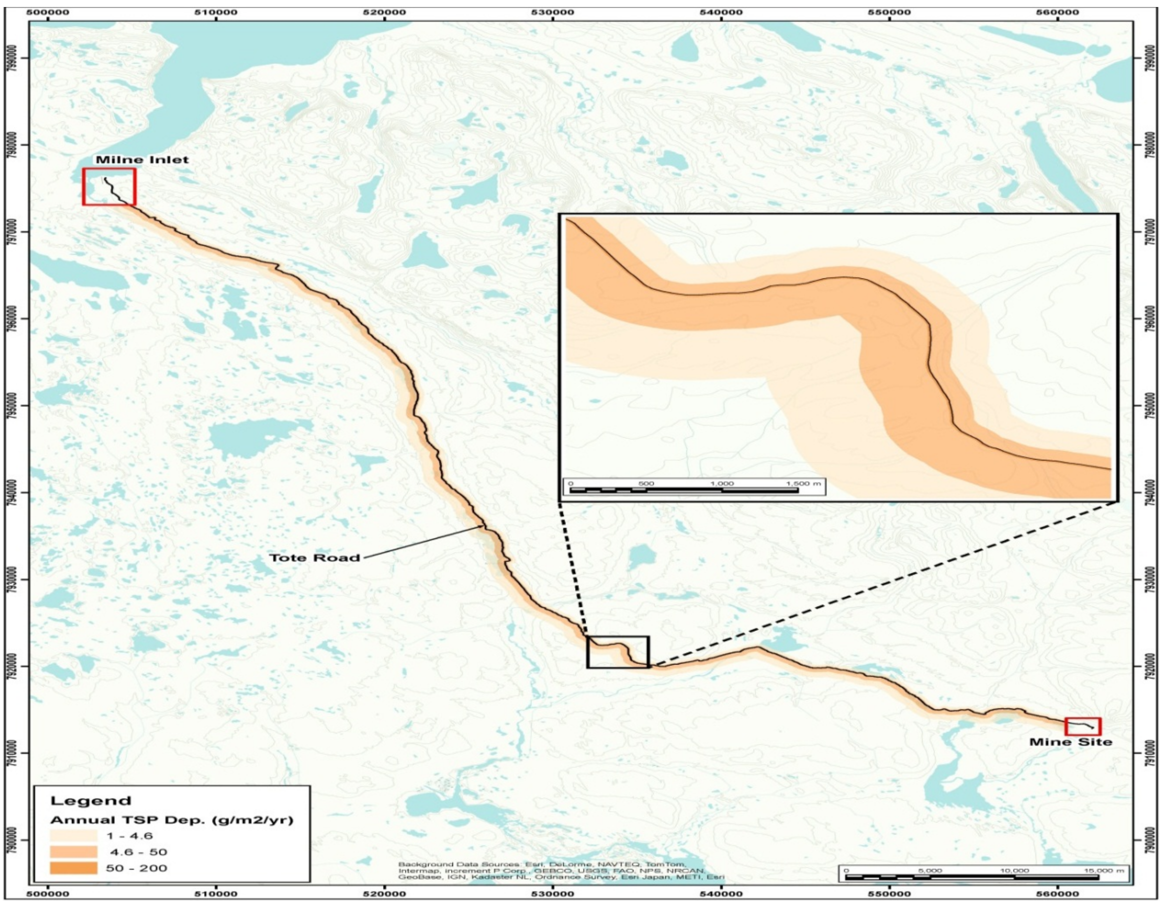

Figure 5-2.16 Annual TSP Deposition along the Tote Road (New)

2.6.3.3 Ship in Transit Milne Port **(Change)**

The current shipping window in Milne Inlet is 90 days during summer. All shipping traffic will enter Eclipse Sound via Baffin Bay and sail down Milne Inlet to Milne Port. Ships will be equipped with three 2 MW "hotel power" generators. Emissions from these ships will meet Regulation 14 of the International Marine Organization (IMO). Sulphur dioxide (SO_2) emission rates are based on 3.5 % fuel sulphur in the main and auxiliary engines when the ship is in transit. In absence of ship information, it is conservatively assumed that the vessels will each require about 16-17 MW propulsion in open water at 13 knots.

The major emissions from a ship in transit are NO_2 and SO_2. Emissions have been modelled as a series of area sources (representing the shipping lane) consisting of 12 individual area sources of 1,500 m x 150 m. Altogether, the modelling covered an 18 km length of the shipping lane, starting from the dock at Milne Port and heading towards open sea. It has been assumed that the ship takes about an hour to reach full speed of 13 knots. Emissions are calculated for each area source individually depending on the time spent, and start and end speed of the ship in each area source. Figures 5-2.17 and 5-2.18 show concentration contours for predicted maximum 1-hour NO_2 and SO_2 concentrations for a ship in transit.

Predicted worst-case 1-hour NO_2 levels generally remain within the applicable threshold, except perhaps immediately adjacent to the ship when it first begins to move forward under high load, but is still at low speed. Worst-case SO_2 levels exceed the Nunavut threshold within the first few kilometers where the ship is accelerating but is still well below cruising speed. The impact reaches the main land but is mostly contained within the LSA. Once the ship is at cruising speed, SO_2 levels are within the applicable threshold, except very close to the shipping lane.

2.6.3.4 Mine Site **(Change)**

The emission inventory for the Mine Site is summarized in Table 5-2.12. The following are noted relative to these emission estimates:

- The main source of TSP, PM_{10} and $PM_{2.5}$ emissions is the mobile equipment operating in the pit and on the haul roads, accounting for 93 %, 95 %, and 76 % of total TSP, $PM_{10,}$ and $PM_{2.5}$ emissions, respectively. These emissions were assumed to occur continuously even though precipitation events can suppress dust emissions.
- Power generation accounts for 83 % of SO_2 emissions. Mobile equipment accounts for 60 % and 97 % of the total NO_x and CO emissions, respectively. These combustion sources also contribute to TSP, PM_{10} and $PM_{2.5}$ emissions.

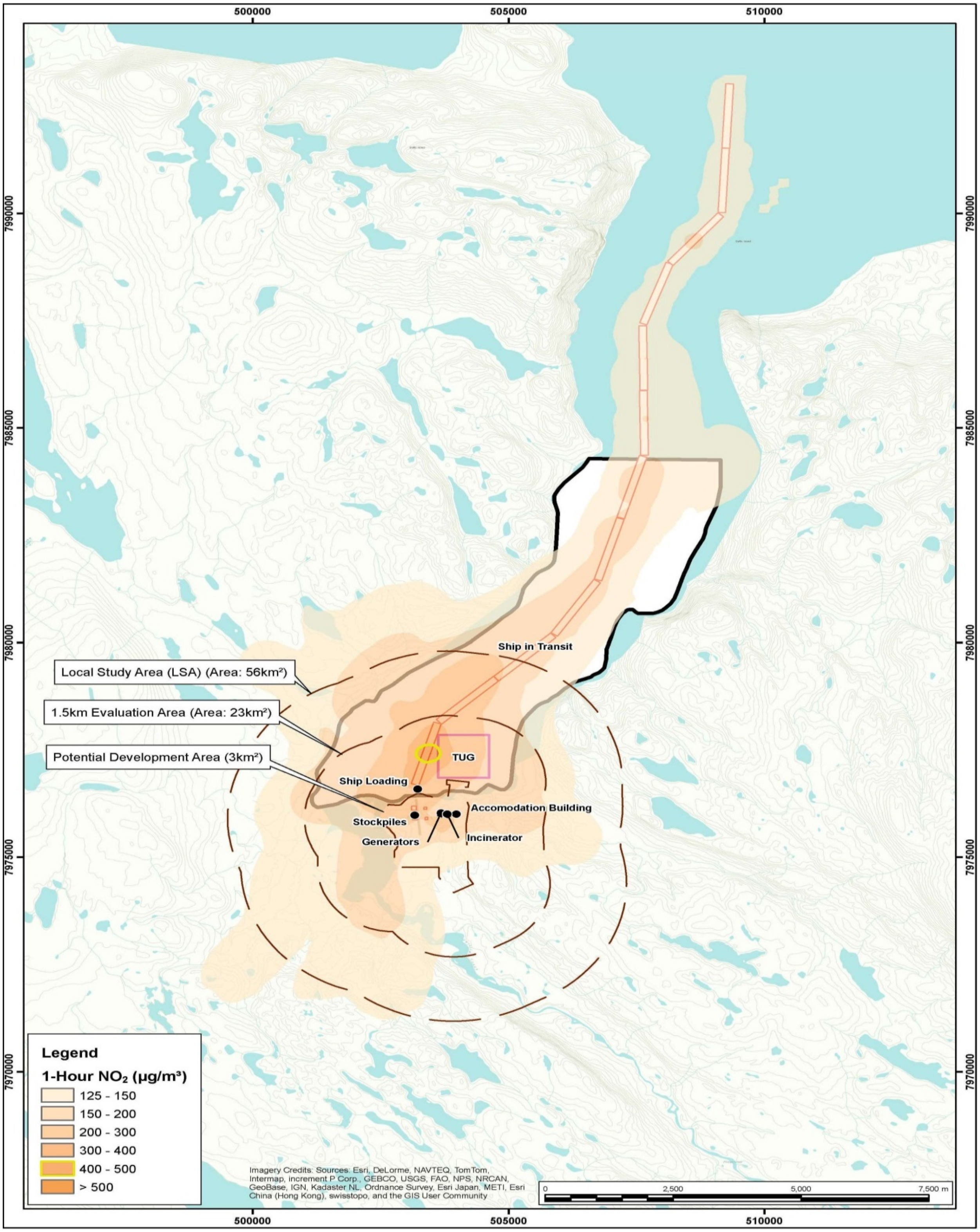

Figure 5-2.17 Maximum 1-hour NO_2 Concentrations for Ship in Transit (New)

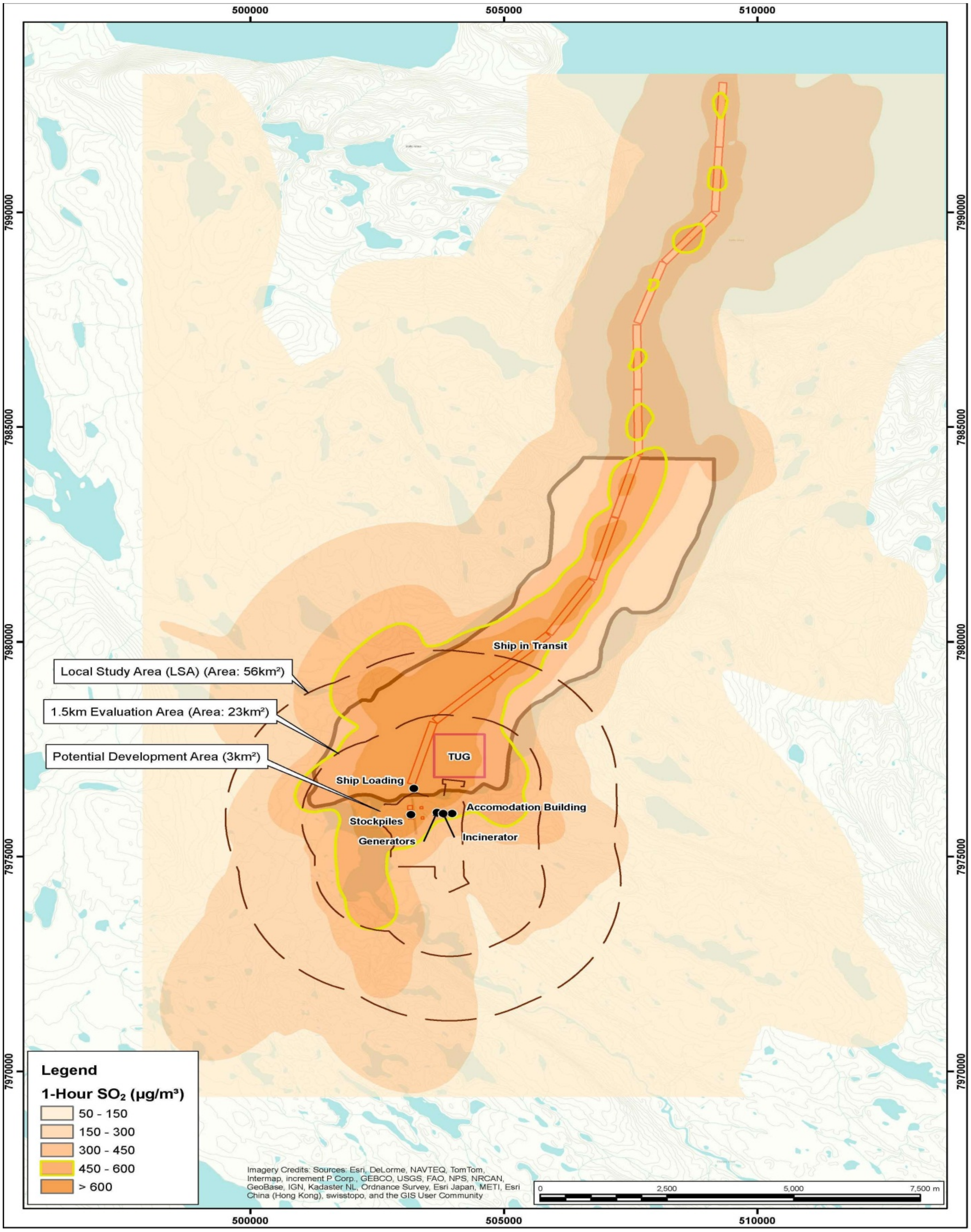

Figure 5-2.18 Maximum 1-hour SO_2 Concentrations for Ship in Transit (New)

Table 5-2.11 Emission Sources and Estimated Annual Emissions Due to the Mine Site (Change)

Source Description	TSP	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO
In pit operations						
Blasting	10.4	5.42	0.31	0	0	0
Dozing/grading/drilling	14,000	8690	577	0	0	0
Mobile equipment	3,900	1,080	118	0.02	1,040	944
Sub-total	**18,000**	**9,780**	**696**	**0.02**	**1,040**	**944**
Stockpile emissions						
Fines/lump stockpile	1.26	0.66	0.12	0	0	0
Sub-total	**1.26**	**0.66**	**0.12**	**0**	**0**	**0**
Bulk Handling						
Stackers, Reclaimers, Conveyors	342	162	24.5	0	0	0
Sub-total	**342**	**162**	**24.5**	**0**	**0**	**0**
Railway						
Idling Locomotives	0.66	0.66	0.66	1.02	12.4	5.3
Sub-total	**0.66**	**0.66**	**0.66**	**1.02**	**12.4**	**5.3**
Point Sources						
Power Generators (3 units)	103	103	103	4.7	2,450	151
Incinerator	4.04	4.04	4.04	0.0	6.07	0.43
Sub-total	**107**	**107**	**107**	**4.7**	**2,450**	**151**
Tote Road						
Mary River Modelled Section	885	241	91.5	0.002	78.4	78.4
Sub-total	**885**	**241**	**91.5**	**0.002**	**78.4**	**78.4**
Total	**19,336**	**10,291**	**920**	**5.7**	**3,581**	**1,179**

NOTE(S):
1. Estimated annual emissions are reported in tonnes/year.

Aircraft will be a source of combustion emissions. However, given the intermittent nature of this source and the short aircraft operation times in the study area relative to the longer averaging times of the indicator thresholds for the combustion contaminants (i.e., SO_2, NO_x and CO), the air quality effects are expected to be minimal and were therefore not assessed through dispersion modelling.

Maximum predicted concentrations are superimposed on a map centred on the Mine Site (Figures 5-2.1 to 5-2.5)

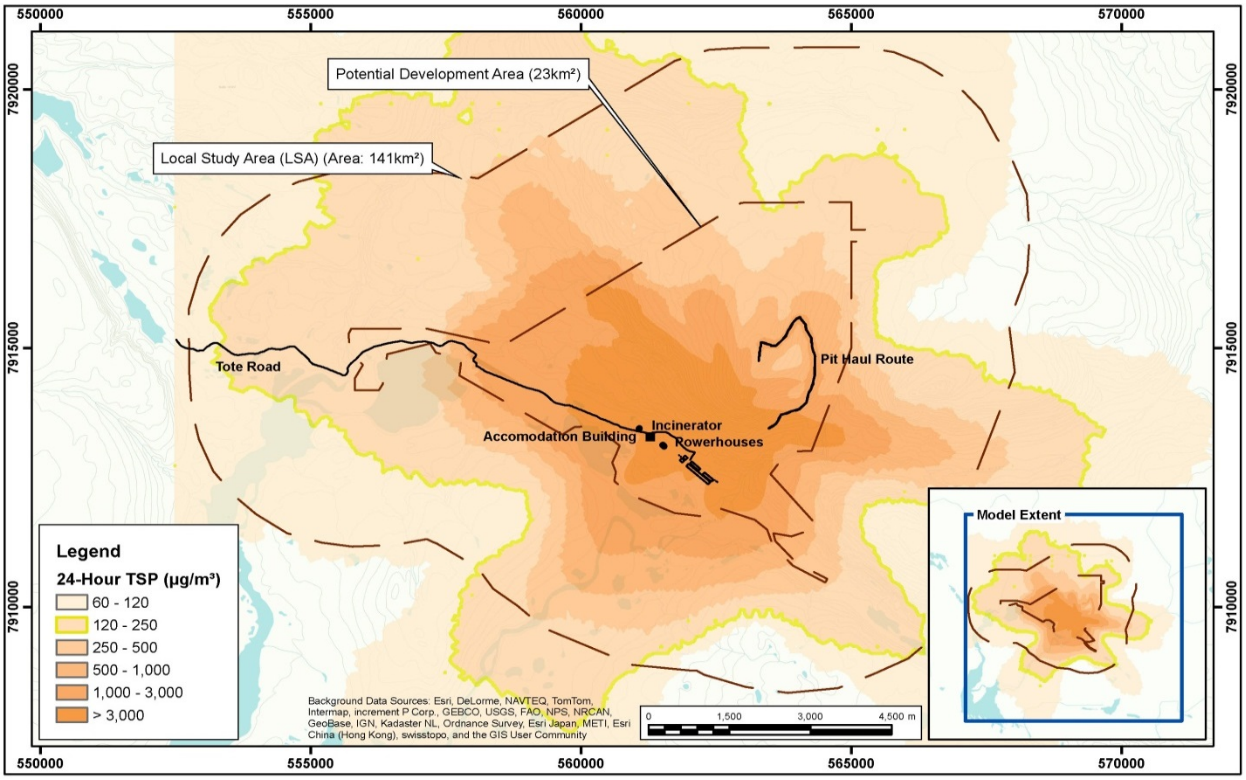

Figure 5-2.1 Maximum 24-hour TSP Concentrations (Change)

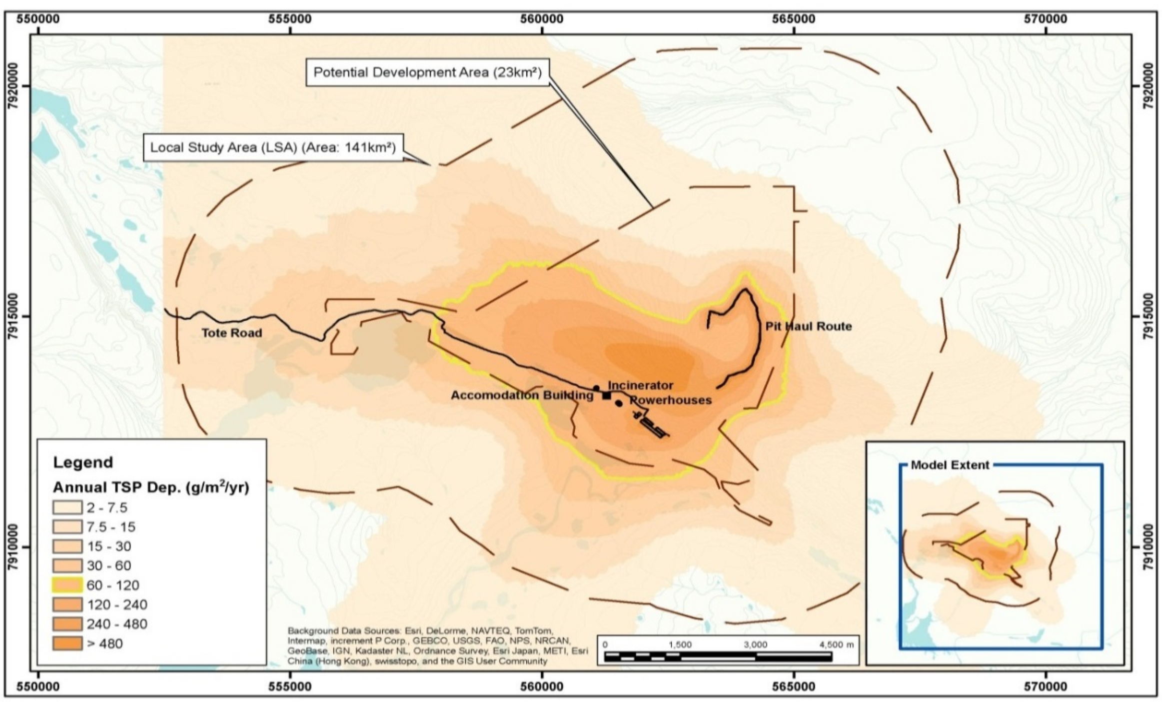

Figure 5-2.2 Annual TSP Deposition (Change)

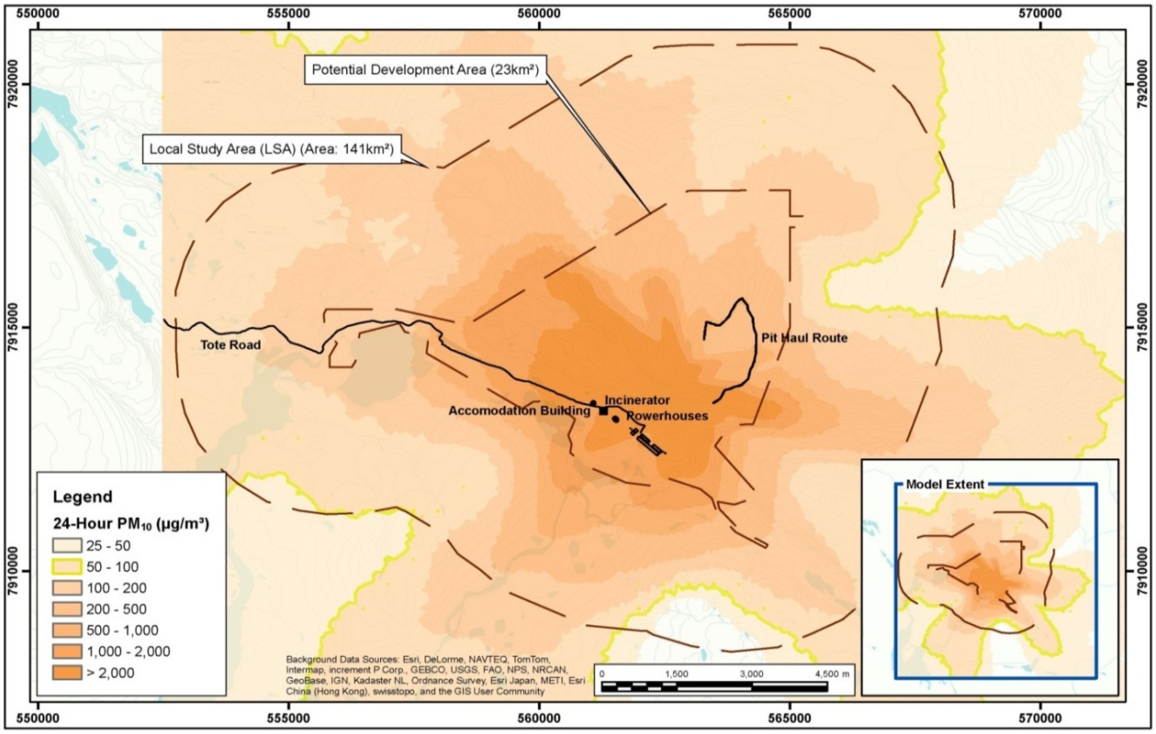

Figure 5-2.3 Maximum 24-hour PM_{10} Concentrations (Change)

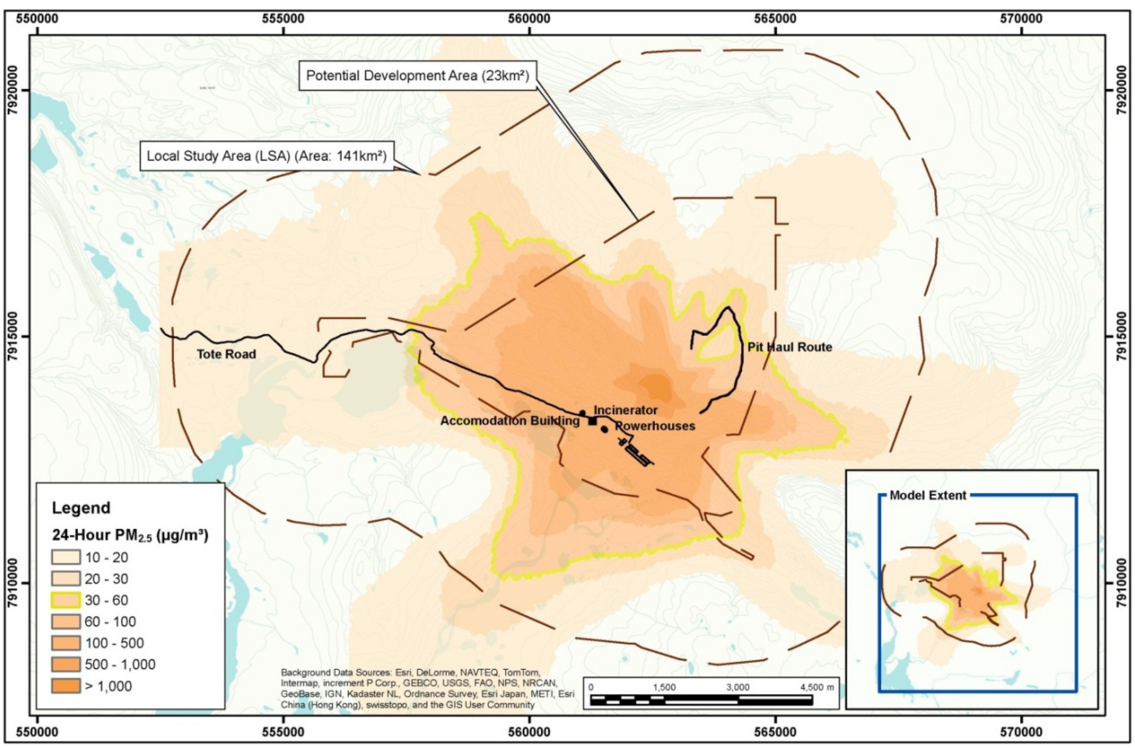

Figure 5-2.4 Maximum 24-hour $PM_{2.5}$ Concentrations (Change)

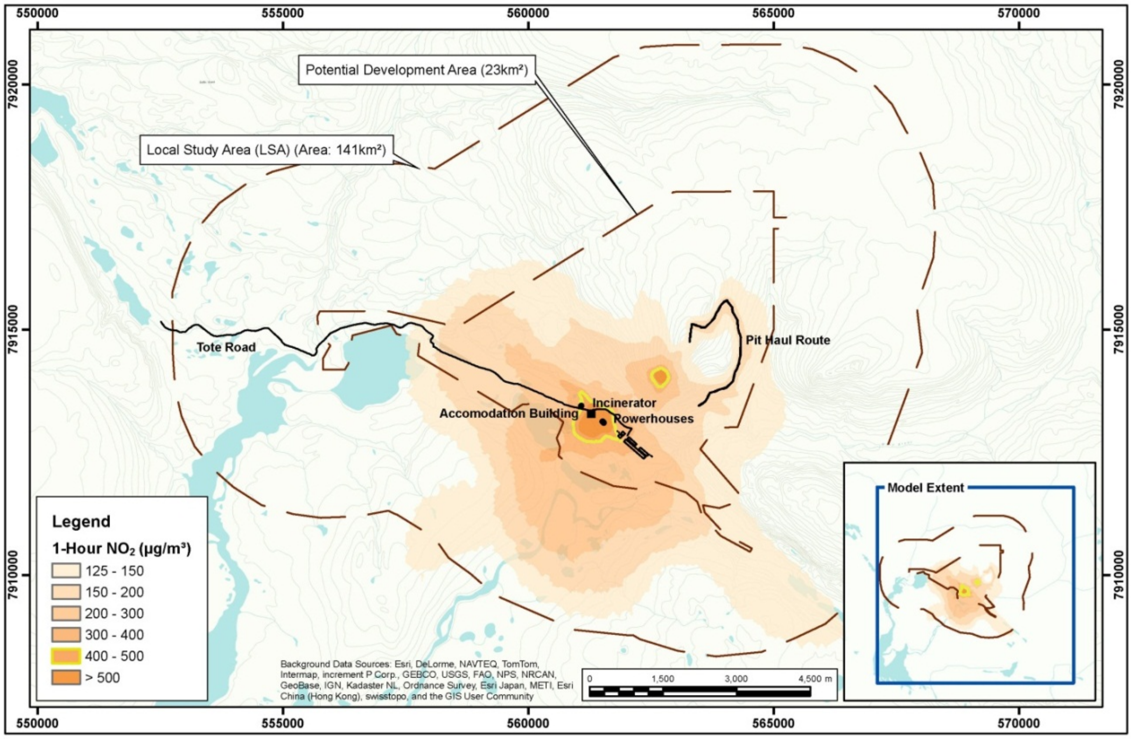

Figure 5-2.5 Maximum 1-hour NO_2 Concentrations (Change)

These figures are described by contaminant in the following sections. Concentration plots for the remaining averaging times and contaminants are provided in Appendix 5C-5. For plots not shown, maximum predicted CO and SO_2 concentrations and deposition levels are generally less than their respective thresholds beyond the LSA.

TSP Concentrations

High TSP concentrations are predicted to occur in the vicinity of the Mine Site. The maximum predicted 24-hour TSP concentrations are predicted to exceed the indicator threshold of 120 µg/m^3 within the LSA. Concentrations beyond the LSA are less than threshold, with the exception of small areas to the east, northwest, and southwest of the site. It should be noted that these values represent the maximum 24-hour concentrations under worst-case meteorological and maximum operating conditions.

Metals Concentrations

Concentrations of the metals are not shown in the concentration contour plots, but are interpreted from the plot of 24-hour TSP concentrations. Iron, based on the metals analysis of the iron ore, could account for up to 72 % of the TSP. Iron concentrations in excess of the indicator threshold of 4 µg/m^3 extend well beyond the LSA.

Manganese, based on the metals analysis of the iron ore, could account for up to 2.9 % of the TSP. Concentrations in excess of the indicator threshold of 2.5 µg/m^3 extend beyond the LSA.

Arsenic, based on the metals analysis of the iron ore, could account for up to 0.08 % of the TSP. Concentrations in excess of the indicator threshold of 0.3 µg/m^3 are limited to the LSA.

Calcium, based on the metals analysis of the iron ore, could account for up to 2 % of the TSP. Concentrations in excess of the indicator threshold of 10 µg/m^3 (expressed as calcium oxide) are limited to the LSA.

Cobalt, based on the metals analysis of the iron ore, could account for up to 0.01 % of the TSP. Concentrations in excess of the indicator threshold of 0.1 µg/m^3 are limited to the LSA.

TSP Deposition

The annual TSP deposition levels are predicted to exceed the threshold of 60 g/m^2/year, however, they are generally contained within the LSA.

PM_{10} Concentrations

High PM_{10} concentrations are predicted to occur in the vicinity of the Mine Site. The maximum predicted 24-hour PM_{10} concentrations are predicted to exceed the indicator threshold of 50 µg/m^3 within the LSA. Concentrations above the threshold extend a few kilometres beyond the LSA in some areas. It should be noted that these values represent the maximum 24-hour concentrations under worst-case meteorological and maximum operating conditions.

$PM_{2.5}$ Concentrations

High 24-hour $PM_{2.5}$ concentrations in excess of the Indicator Threshold of 30 µg/m^3 are limited to the PDA. Concentrations beyond the LSA generally fall below 10 µg/m^3, with the exception of small zones southwest of the site. These values represent the maximum 24-hour concentrations under worst-case meteorological and maximum operating conditions.

NO_2 Concentrations

High 1-hour NO_2 concentrations in excess of the indicator threshold of 400 µg/m^3 are limited to the PDA. Concentrations beyond the LSA generally fall below 125 µg/m^3. These values represent the maximum 1-hour concentrations under worst-case meteorological and maximum operating conditions.

Mitigation Measures

Three mitigation measures are incorporated into the design and have been included in the air quality assessment:

- For the Approved Project, most bulk material transfer points are enclosed and the emissions are controlled by dust collectors, which vent back into the buildings;
- The crusher is enclosed and the emissions are controlled by a dust collector, which vents back into the building; and
- Good engineering practice in design of exhaust stacks for the power generators will reduce ground level concentrations.

Potential mitigation measures have been identified and are presented in the Air Quality and Noise Abatement Management Plan (FEIS Addendum Appendix 10A).

2.6.3.5 Railway (No Change)

2.6.3.6 Steensby Port (No Change)

Table 5-2.12 Emission Sources and Estimated Annual Emissions due to Steensby Port (No Change)

Figure 5-2.6 Maximum 24-hour TSP Concentrations (No Change)

Figure 5-2.7 Annual TSP Deposition (No Change)

Figure 5-2.8 Maximum 24-hour PM_{10} Concentrations (No Change)

Figure 5-2.9 Maximum 24-hour $PM_{2.5}$ Concentrations (No Change)

Figure 5-2.10 Maximum 1-hour NO_2 Concentrations (No Change)

2.6.4 Potential Effects and Proposed Mitigation - Closure/Post-closure (No Change)

2.6.5 Assessment of Residual Effects (Change)

Residual effects are those that remain when all mitigation options have been incorporated into the Project design and operation. The criteria identified in Table 5-2.14 were used to rate the effects on air quality of these residual effects from project activities. These criteria are consistent with but differ slightly from the assessment criteria defined in Volume 2, Section 3, having been modified to account for the nature of air quality effects. The overall rating as presented in Table 5.2-15 is a professional judgment based on consideration of the magnitude in relation to indicator thresholds, the geographic extent, the duration, the frequency, the reversibility of the effects, and the certainty and probability of the occurrence.

Table 5-2.13 Residual Effect Rating Criteria used for the Air Quality Assessment (No Change)

Table 5-2.14 Effects Assessment Summary: Air Quality (Change)

Potential Effect			Evaluation Criteria				
Project Activity	**Direction and Nature of Interaction**	**Mitigation Measure(s)**	**Magnitude**	**Duration**	**Frequency**	**Extent**	**Reversibility**
Milne Inlet site operations	Negative: increased concentrations of CACs	Emission controls on fugitive emission sources	Level II for: TSP, metals, TSP deposition, PM_{10}, $PM_{2.5}$, and Other CACs	Level III for TSP Deposition Level II for all other parameters	Level III	Level I	Level I
Mine site operations	Negative: increased concentrations of CACs	Emission controls on fugitive emission sources	Level III for: TSP, metals, TSP deposition, PM_{10}, $PM_{2.5}$, and NO_2	Level III for TSP Deposition Level II for all other parameters	Level III	Level I for $PM_{2.5}$ and NO_2 and most metals Level II for PM_{10}, TSP, TSP deposition, and Mn	Level III for TSP deposition Level I for all other parameters
			Level II for all other CACs and PAI	Level II	Level III	Level I	Level I

Table 5-2.14 Effects Assessment Summary: Air Quality (Change) (Cont'd)

Potential Effect			Evaluation Criteria				
Project Activity	**Direction and Nature of Interaction**	**Mitigation Measure(s)**	**Magnitude**	**Duration**	**Frequency**	**Extent**	**Reversibility**
Rail operations	Negative: increased concentrations of CACs	None	Level I or II for all contaminants	Level II	Level III	Level I	Level I
Steensby operations	Negative: increased concentrations of CACs	Emission controls on fugitive emission sources	Level III for: TSP, metals, TSP deposition, PM_{10}, $PM_{2.5}$, and NO_2	Level III for TSP Deposition Level II for all other parameters	Level III	Level I	Level III for TSP deposition Level I for all other parameters
			Level II for all other CACs and PAI	Level II	Level III	Level I	Level I
Construction and Closure Phases	Negative: increased concentrations of CACs	Best practices to minimize air emissions	Level III for: TSP, metals, TSP deposition, PM_{10}, and $PM_{2.5}$	Level III for TSP Deposition Level II for all other parameters	Level III	Level I	Level III for TSP deposition Level I for all other parameters
			Level II for all other CACs and PAI	Level II	Level III	Level I	Level I

NOTE(S):
1. CACs = CRITERIA AIR CONTAMINANTS [TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO].

The project residual effects to air quality can thus be summarized:

- The ambient concentrations of the air quality parameters are at a Level I or II for all phases of the Project. Concentrations in excess of the thresholds are predicted to generally be confined to the LSA, and the effects are fully reversible.

The residual air quality effects are predicted to be not significant (Table 5-2.16).

Table 5-2.15 Significance of Residual Air Quality Effects (No Change)

2.6.6 Prediction Confidence (No Change)

2.6.7 Follow Up (Change)

The air quality assessment has identified TSP, metals, and PM_{10} and concentrations at Milne Port and the Mine Site as potential concerns. The Air Quality and Noise Abatement Management Plan presented in FEIS Addendum Appendix 10A describes plans for monitoring air quality.

2.7 IMPACT STATEMENT (NO CHANGE)

2.8 AUTHORS (NO CHANGE)

SECTION 3.0 - NOISE AND VIBRATION (CHANGE)

3.1 BASELINE SUMMARY (CHANGE)

A detailed baseline assessment conducted in 2007 is documented in a baseline noise assessment report (FEIS, Appendix 5D-1).

Baseline Noise Environment – Milne Inlet Noise

Table 5-3.1 shows measured ambient baseline noise values for Milne Inlet. At these levels, noise would be described as faint.

Table 5-3.1 Baseline Noise Monitoring Results (Change)

Site	L_{eq} (24 h) (dBA)	L_{eq} (Day, 15h) (dBA)	L_{eq} (Night, 9h) (dBA)	Minimum L_{eq} (1 h) (dBA)	Maximum L_{eq} (1 h) (dBA)
Milne Inlet	30	31	29	21	35

Figure 5-3.1 Noise Baseline Measurement Sites (No Change)

Figure 5-3.2 Noise Local Study Area - Mine Site (No Change)

Figure 5-3.3 Noise Local Study Area - Steensby Inlet (No Change)

Local Study Area

Figure 5-3.15 show the LSAs and PDAs selected for this assessment for the Milne Inlet.

3.2 ISSUES SCOPING (CHANGE)

Noise and Vibration Issues

The construction of the ERP will add the following infrastructure to the Approved Project:

1. Additional realignment of the Tote Road as a result of design optimization,
2. Use of additional borrow pits and quarries to upgrade the Tote Road and complete the earthworks at Milne Port site which will include:
    a. Construction of the ore pad;
    b. Relocation of the airstrip; and
    c. Construction of the ore dock.

The operation period of the Early Revenue Phase (ERP) will increase extraction volume of ore from 18 Mt/a to 21.5 Mt/a. Associated changes in activity will include:

1. Haulage of ore along the Tote Road;
2. Increase in dust deposition along Tote Road; and
3. Increase in noise at Milne Port due to stockpiling and ship loading activities.

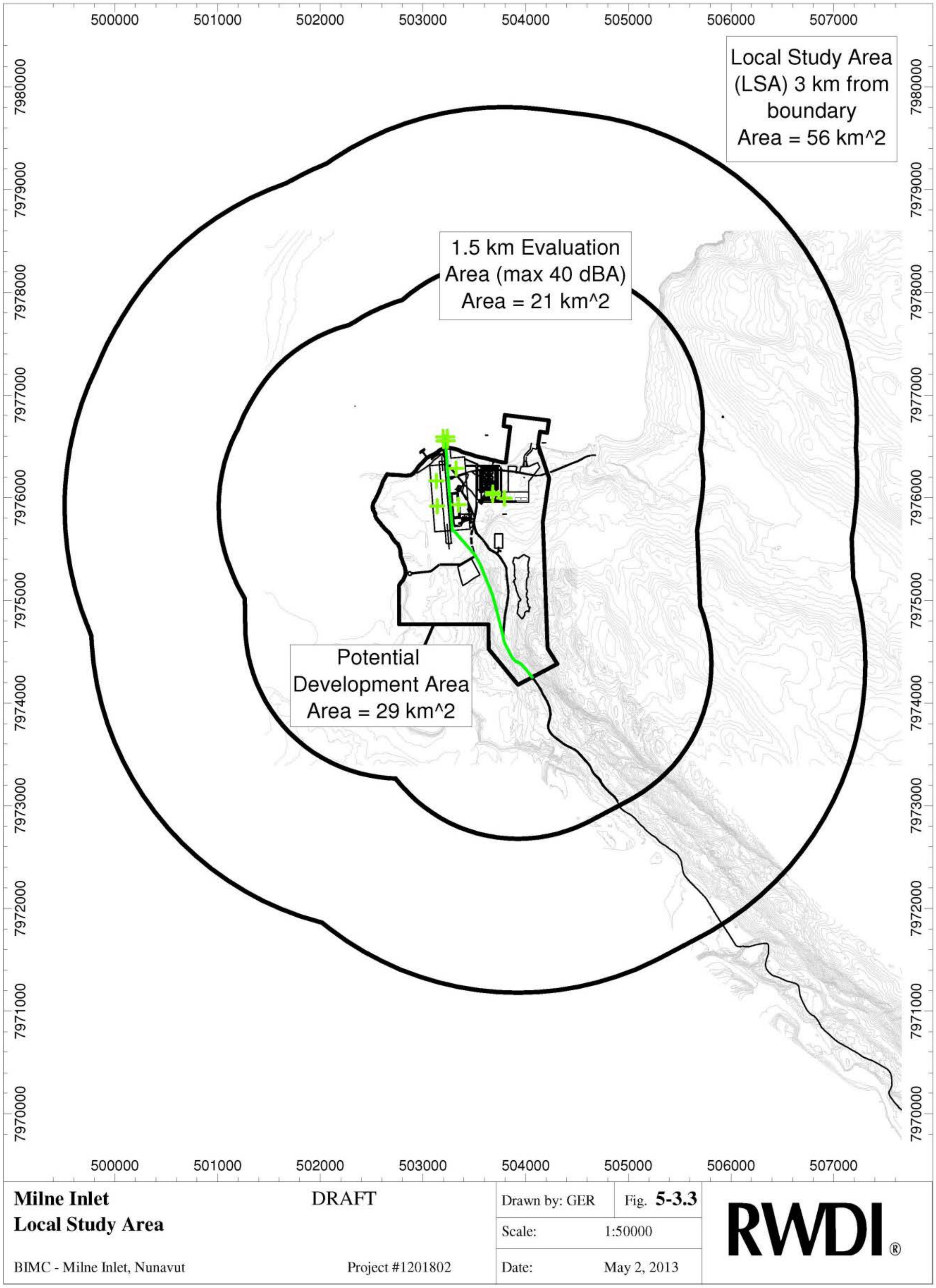

Figure 5-3.15 Noise Local Study Area – Milne Inlet (New)

Table 5-3.2 Key Issues for Noise and Vibration (No Change)

Table 5-3.3 Summary of Noise and Vibration Key Indicators (No Change)

3.3 NOISE (CHANGE)

3.3.1 Assessment Methods (No Change)

Table 5-3.4 Modelling Parameters Used in the Analysis (No Change)

Table 5-3.5 Noise Assessment Approach (No Change)

Table 5-3.6 Typical Ranges of Commonly Encountered Sound Levels (No Change)

3.3.2 Potential Effects and Proposed Mitigations - Construction Phase (No Change)

3.3.2.1 Mine Site (No Change)

3.3.2.2 Milne Port (Change)

Estimate of Noise Effects (Change)

Construction activities at Milne Port have the potential to generate noise that will be audible out to 1.5 km from the facility. Noise levels at some locations within the construction area may be moderate to loud. This may affect the aesthetic use of the eastern end of the beach by residents of Pond Inlet or other communities, if or when they seek to use the area for camping during the Operations Phase. The duration of effect from construction activities is short-term, the frequency of effect is occasional and the effect is reversible. The effect is anticipated to be insignificant.

Conclusions

Elevated noise levels may occur near construction activity. However, significant effects are not anticipated.

3.3.2.3 Steensby Port (No Change)

3.3.2.4 Railway (No Change)

3.3.3 Potential Effects and Proposed Mitigations – Operations Phase (No Change)

3.3.3.1 Mine Site (No Change)

Table 5-3.7 Mine Site Modelled Noise Levels - Operations Phase (No Change)

Table 5-3.8 Mine Site Modelled Indoor Noise Levels - Operations Phase (No Change)

Figure 5-3.4 Mine Site Noise Contour Plot - Operations Phase – Summer (No Change)

Figure 5-3.5 Mine Site Noise Contour Plot - Operations Phase – Winter (No Change)

3.3.3.2 Milne Port (Change)

Noise emission level estimates applied in the noise assessment are provided in Appendix 5D-1.

Noise Mitigation Measures

Exhaust stacks and air inlets and exhausts for the power generators will include silencers (mufflers).

Operational Noise Levels

Worst-case predicted operational noise levels for Milne Port are summarized in Table 5-3.17. Graphical representation of summer and winter operations is provided in Figures 5-3.16 and 5-3.17, respectively. Predicted operational noise levels inside the worker accommodation building (with windows closed) are represented by a Balanced Noise Criterion (NCB) level, and are summarized in Table 5-3.18.

Table 5-3.17 Milne Site Modelled Noise Levels - Operations Phase (New)

Modelling Parameters	Seasonal Sound Level at Location (L_{eq}(1-hour), dBA)	
	Summer	Winter
1.5 km from PDA	15 to 40	13 to 40
Worker Accommodation Building	43 to 61	43 to 61

Table 5-3.18 Milne Site Modelled Indoor Noise Levels - Operations Phase (New)

Modelling Parameters	Maximum Seasonal Sound Level at Location (Balanced Noise Criterion)	
	Summer	Winter
Worker Accommodation Building	NCB 42	NCB 42

Hunters or community members camping near the cabin east of the port site will likely hear noise from the Project. The maximum predicted noise level of 40 dBA is equivalent to the typical background noise level in an office building caused by ventilation systems or noise from a flowing stream. Due to proximity of the camping location to a stream and to the ocean, it is likely that this area already experiences similar background noise levels.

The predicted worst case NCB rating is NCB 42 at the accommodations building. This is slightly above the recommended rating of NCB 40.

Conclusions

The results of the noise assessment for the Milne Port site can be summarized as follows:

- Mitigation features will be incorporated into the design of the accommodation building to attenuate noise;
- Predicted worst-case noise levels range from 13 to 40 dBA, 1.5 km from the PDA;
- The predicted worst-case NCB rating is NCB 42 at the accommodations building. This is slightly above the acceptable rating of NCB 40;
- The predicted worst-case noise level at the cabin is equal to or less than 40 dBA during the summer and winter months; and
- There are no major sources of vibration related to the Milne Port operations.

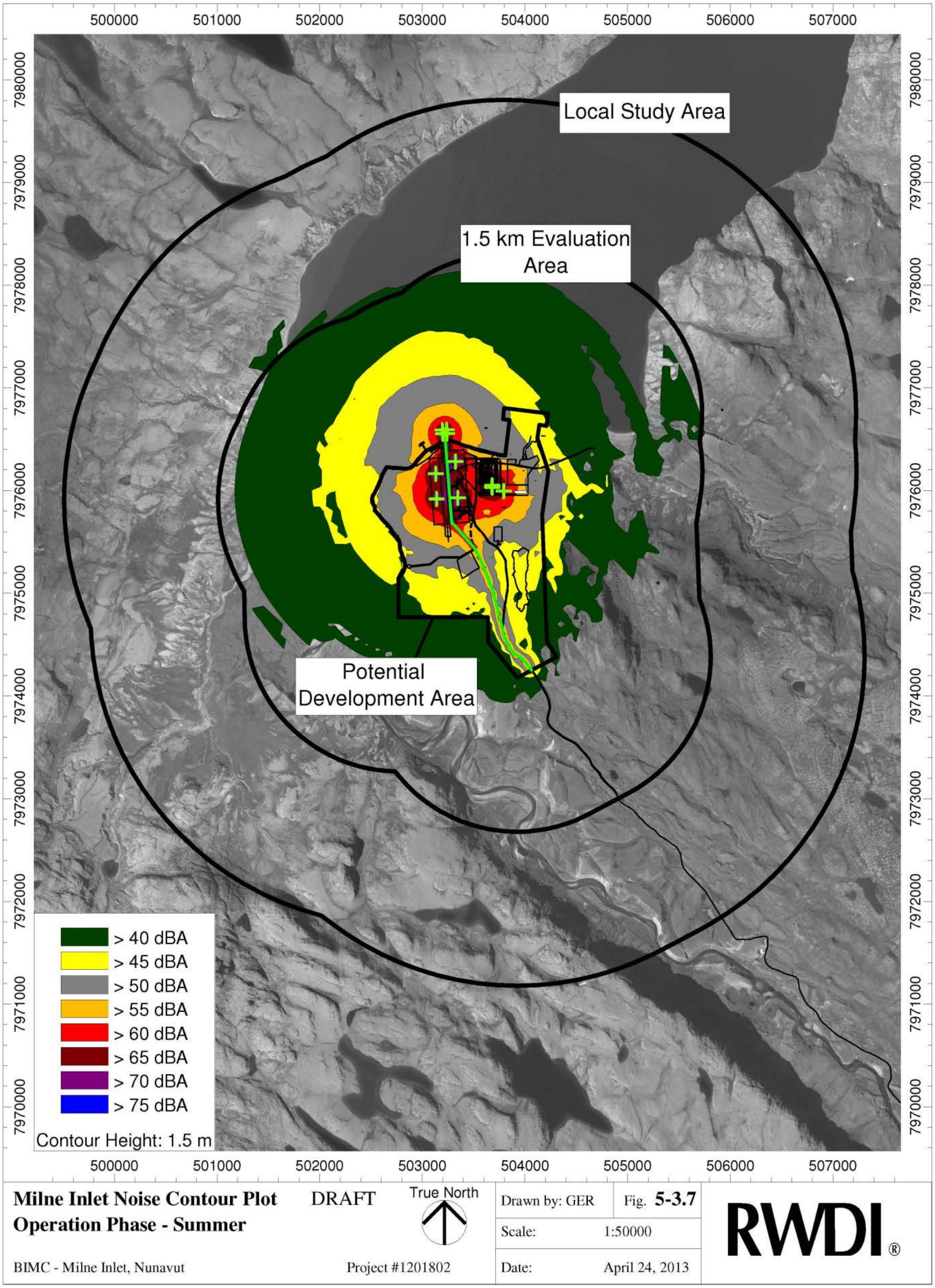

Figure 5-3.16 Milne Port Noise Contour Plot - Operations Phase – Summer (New)

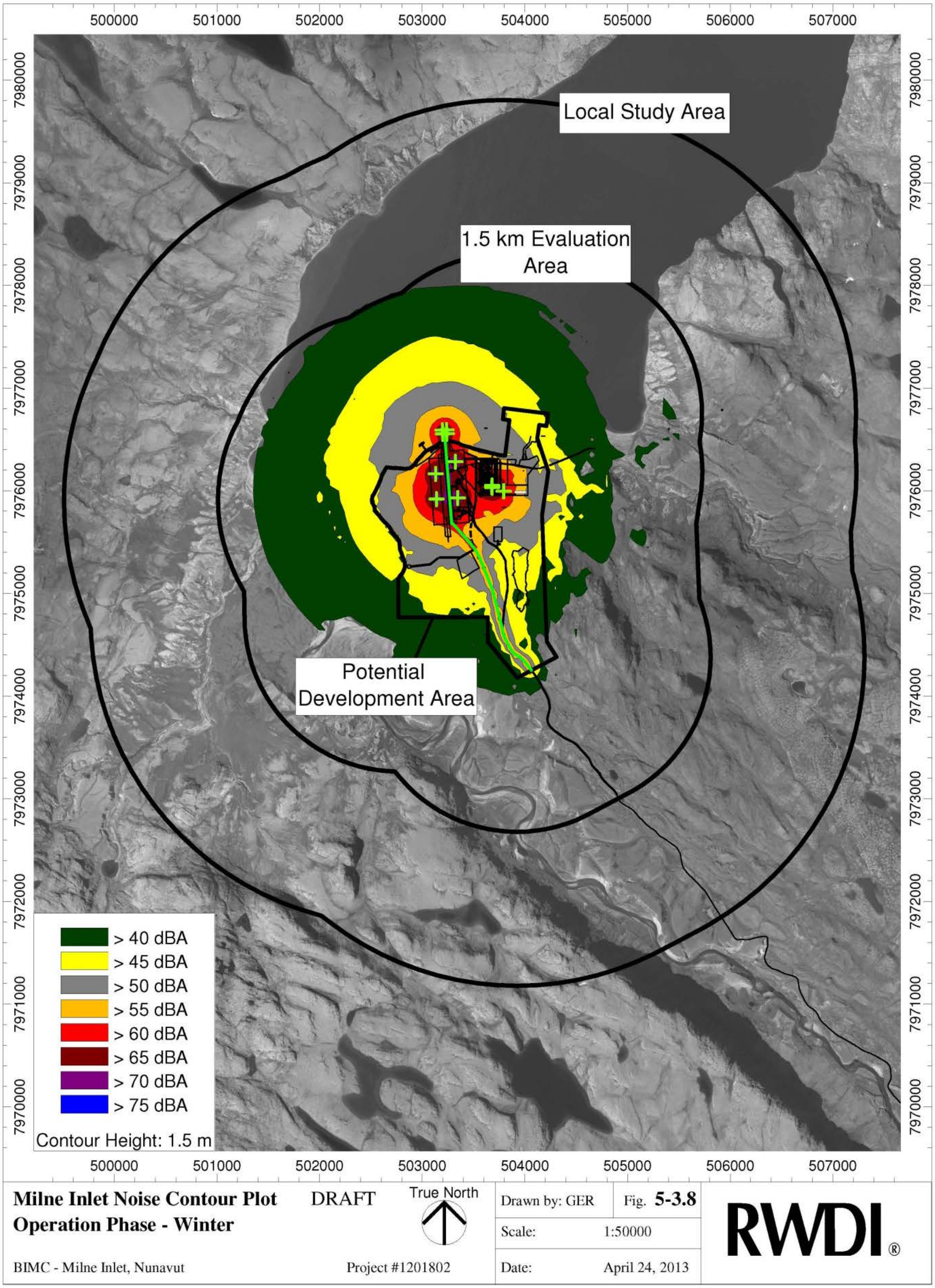

Figure 5-3.17 Milne Port Noise Contour Plot - Operations Phase – Winter (New)

3.3.3.3 Steensby Port (No Change)

Table 5-3.9 Operational Noise Levels - Steensby Port (No Change)

Table 5-3.10 Steensby Port Modelled Indoor Noise Levels - Operations Phase (No Change)

Figure 5-3.6 Steensby Port Noise Contour Plot - Operations Phase – Summer (No Change)

Figure 5-3.7 Steensby Port Noise Contour Plot - Operations Phase – Winter (No Change)

Figure 5-3.8 Rail Noise Levels vs. Distance from Track Centre-line (No Change)

3.3.3.4 Milne Inlet Tote Road (Change)

Milne Inlet Tote Road connects Milne Port to the Mine Site. During the Construction Phase, the road will be upgraded to carry haul truck traffic. During the Operations Phase, the primary purpose of the road will be year-round hauling of ore. During the shipping season, the road may also be used for transportation of oversized equipment that cannot be delivered to the Mine Site via rail.

Noise Effects

Predicted average hourly sound levels from truck traffic along the Tote Road are expected to be minor. Anticipated hourly average noise levels (L_{eq}(1-hour)) from road operations were calculated using the ISO 9613 environmental noise propagation algorithms (ISO, 1993 & 1996) and are shown in Figure 5-3.18.

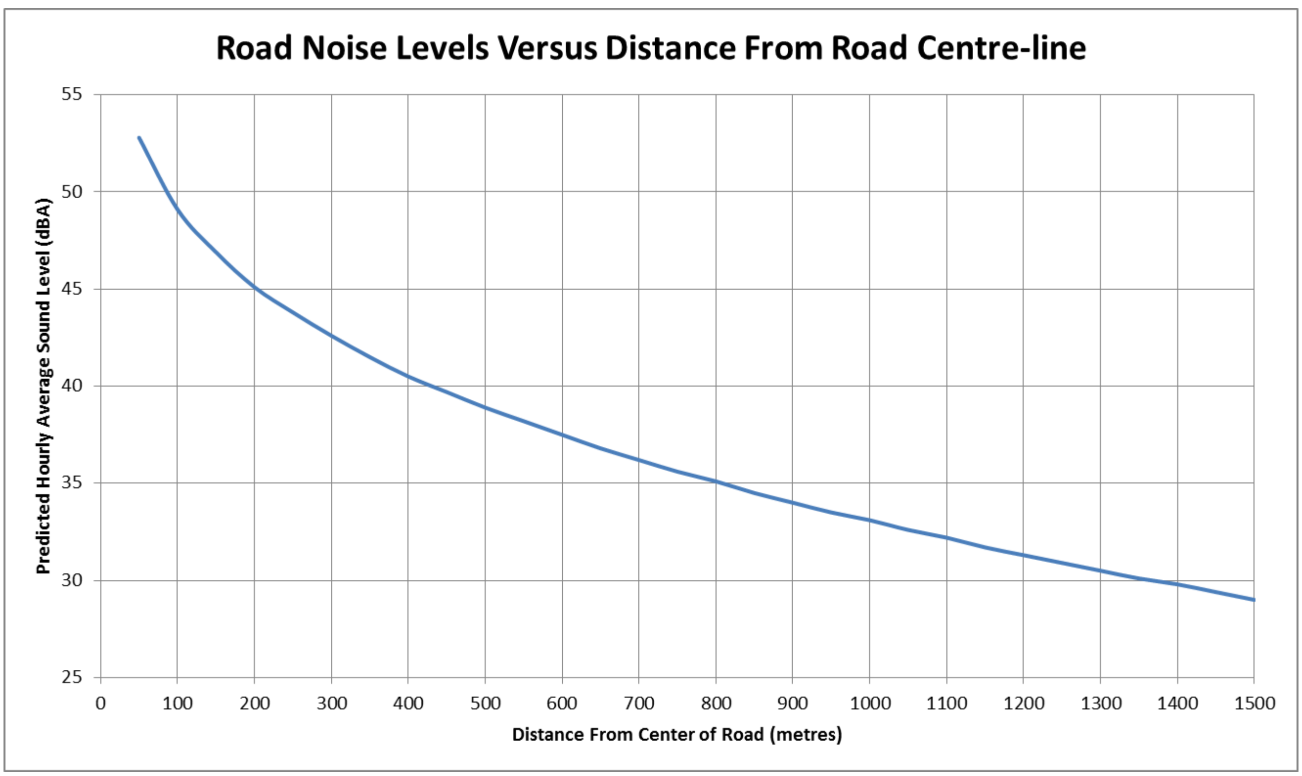

Figure 5-3.18 Road Noise Levels vs. Distance from Road Centre-line (New)

3.3.3.5 Aircraft (Change)

The Milne Port airstrip will be eventually is relocated east of the ore stockpile area once construction of the Approved Project begins and the airstrip will be in service mostly during the Construction Phase. Therefore, the assessment of noise related to air traffic at Milne Port remains as was assessed in the FEIS.

3.3.4 Assessment of Residual Effects (Change)

Potential noise effects discussed above are presented in Table 5-3.11. Residual effects from noise at Milne Port are considered minimal. Noise effects are reversible. The significance of potential residual effects is summarized in Table 5-3.12.

Table 5-3.11 Effects Assessment Summary: Noise (Change)

Potential Effects			Evaluation Criteria				
Project Activity	**Direction and Nature of Interaction**	**Mitigation Measure (s)**	**Magnitude**	**Duration**	**Frequency**	**Extent**	**Reversibility**
Milne Inlet and Tote Road operations	Negative: increased noise levels	Mufflers on mobile equipment	Level II	Level II: Medium term (life of the project)	Level III: Frequent	Level I: Confined to the LSA	Level 1: fully reversible
Construction and Closure Phases: all	Negative: increased noise levels	Mufflers on mobile equipment	Level II	Level I: Short term (throughout construction and closure operations)	Level III: Frequent	Level I: Confined to the LSA	Level 1: fully reversible

Table 5-3.12 Significance of Residual Noise Effects (Change)

Effect	**Significance of Predicted Residual Environmental Effect**		**Likelihood (1)**	
			Probability	**Certainty**
	Significance Rating	**Level of Confidence**		
Increase in noise levels	N	3	3	3

Key
Significance Rating: S = Significant, N = not Significant, P = Positive
Level of Confidence[1] : 1 = Low; 2 = Medium; 3 = High
Likelihood - only applicable to significant effects
Probability: 1 = Unlikely; 2 = Moderate; 3 = Likely
Certainty[2]: 1 = Low; 2 = Medium; 3 = High

NOTE(S):
1. LEVEL OF CONFIDENCE IN THE ASSIGNMENT OF SIGNIFICANCE.
2. CERTAINTY AROUND THE ASSIGNMENT OF LIKELIHOOD.

3.3.5 Prediction of Confidence (No Change)

Figure 5-3.9 Mine Site Noise Exposure Forecast, Eastward takeoffs (No Change)

Figure 5-3.10 Mine Site Noise Exposure Forecast, Westward takeoffs (No Change)

Figure 5-3.11 Steensby Port Noise Exposure Forecast, Eastward takeoffs (No Change)

Figure 5-3.12 Steensby Port Noise Exposure Forecast, Westward takeoffs (No Change)

3.3.6 Follow-Up (No Change)

3.4 VIBRATION (CHANGE)

3.4.1 Assessment Methods (No Change)

Table 5-3.13 Vibration Assessment Approach (No Change)

3.4.2 Potential Effects and Proposed Mitigation - Construction and Closure Phases (Change)

3.4.2.1 Mine Site (No Change)

3.4.2.2 Milne Port (Change)

There are no major sources of vibration associated with Milne Port operations, and therefore no notable vibration effects are expected.

3.4.2.3 Steensby Port (No Change)

3.4.2.4 Railway (No Change)

3.4.2.5 Milne Inlet Tote Road (Change)

Milne Inlet Tote Road connects Milne Port to the Mary River site. During the Construction Phase, the road will be upgraded to carry haul truck traffic. During the Operations Phase, the primary purpose of the road will be year round hauling of ore.

Vibration effects from truck traffic along the haul route are not anticipated.

3.4.3 Potential Effects and Proposed Mitigation – Operations (No Change)

3.4.3.1 Mine Site (No Change)

Table 5-3.14 Vibration Levels - Mine Site Operations Phase (No Change)

Figure 5-3.13 Vibration Levels Resulting from Blasting in the Open Pit (No Change)

3.4.3.2 Milne Port (No Change)

3.4.3.3 Milne Inlet Tote Road (No Change)

3.4.4 Steensby Port (No Change)

3.4.5 Railway (No Change)

Figure 5-3.14 Predicted Rail Vibration vs. Distance from Track Centre-line (No Change)

3.4.6 Assessment of Residual Effects (Change)

Table 5-3.15 presents a summary of the potential effects. Vibration effects are predicted to have no significant effects during the Operation and Closure Phases. Minor vibration effects will exist throughout the Construction Phase. These effects are confined to the LSA and are fully reversible.

Table 5-3.15 Effects Assessment Summary: Vibration (Change)

Potential Effects			Evaluation Criteria				
Project Activity	**Direction and Nature of Interaction**	**Mitigation measures**	**Magnitude**	**Duration**	**Frequency**	**Extent**	**Reversibility**
All operations	Negative: increased vibration levels	None	Level I	Level II: life of the project	Level III: Frequent	Level I: confined to LSA	Level I: reversible
Construction Phase: all	Negative: increased vibration levels	None	Level I	Level I: Short term - Construction Phase	Level III: Frequent	Level I: confined to LSA	Level I: reversible
Closure Phase: all	Negative: increased vibration levels	None	Level I	Level I: Short term	Level III: Frequent	Level I: confined to LSA	Level I: reversible

Residual effects for vibration will be minimal. The extent of effects is limited to areas directly surrounding Milne Port and the Tote Road. Vibration effects are considered to be reversible. The significance of potential residual effects is summarized in Table 5-3.16.

Table 5-3.16 Significance of Residual Vibration Effects (Change)

Effect	**Significance of Predicted Residual Environmental Effect**		**Likelihood [(1)]**	
	Significance Rating		**Level of Confidence**	**Certainty**
Increase in vibration levels	N	3	3	3

KEY:
Significance Rating: S = Significant, N = not Significant, P = Positive
Level of Confidence[1] : 1 = Low; 2 = Medium; 3 = High
Likelihood - only applicable to significant effects
Probability: 1 = Unlikely; 2 = Moderate; 3 = Likely
Certainty[2]: 1 = Low; 2 = Medium; 3 = High

NOTE(S):
1. LEVEL OF CONFIDENCE IN THE ASSIGNMENT OF SIGNIFICANCE.
2. CERTAINTY AROUND THE ASSIGNMENT OF LIKELIHOOD.

3.4.7 Prediction Confidence (No Change)

3.4.8 Follow-Up (No Change)

3.5 IMPACT STATEMENT (CHANGE)

The assessment concludes that potential effects of noise and vibration are *"not significant"*.

Noise

D038 noise guideline limits do not apply to construction activities; instead, good management practices will the potential for effects. All internal combustion engines used during construction will be fitted with appropriate muffler systems.

Modelling predictions for the Operations Phase indicate that noise levels at 1.5 km from the PDAs for the Milne Port will be as high as 40 dBA. D038 limits the sound level at 1.5 km from the fence line of a facility to 40 dBA.

Vibration

Vibration levels from the Construction Phase are not anticipated to be of concern on land. No specific vibration controls are required.

3.6 AUTHORS (CHANGE)

This noise impact statement was prepared by Gillian Redman, M.Sc (Project Coordinator), Kyle Hellewell, P.Eng (Senior Engineer) of RWDI AIR Inc., with the support of Peter VanDelden, Hon.B.Sc (Senior Noise Specialist), Alain Carrière, B.A., Dipl. Ecotox (Senior Project Manager) and Mike Lepage, M.Sc., ACM, CCM (Project Director).

SECTION 4.0 - REFERENCES (NO CHANGE)

SECTION 5.0 - DEFINITIONS AND ABBREVIATIONS (NO CHANGE)

5.1 DEFINITIONS (NO CHANGE)

5.2 ABBREVIATIONS (NO CHANGE)