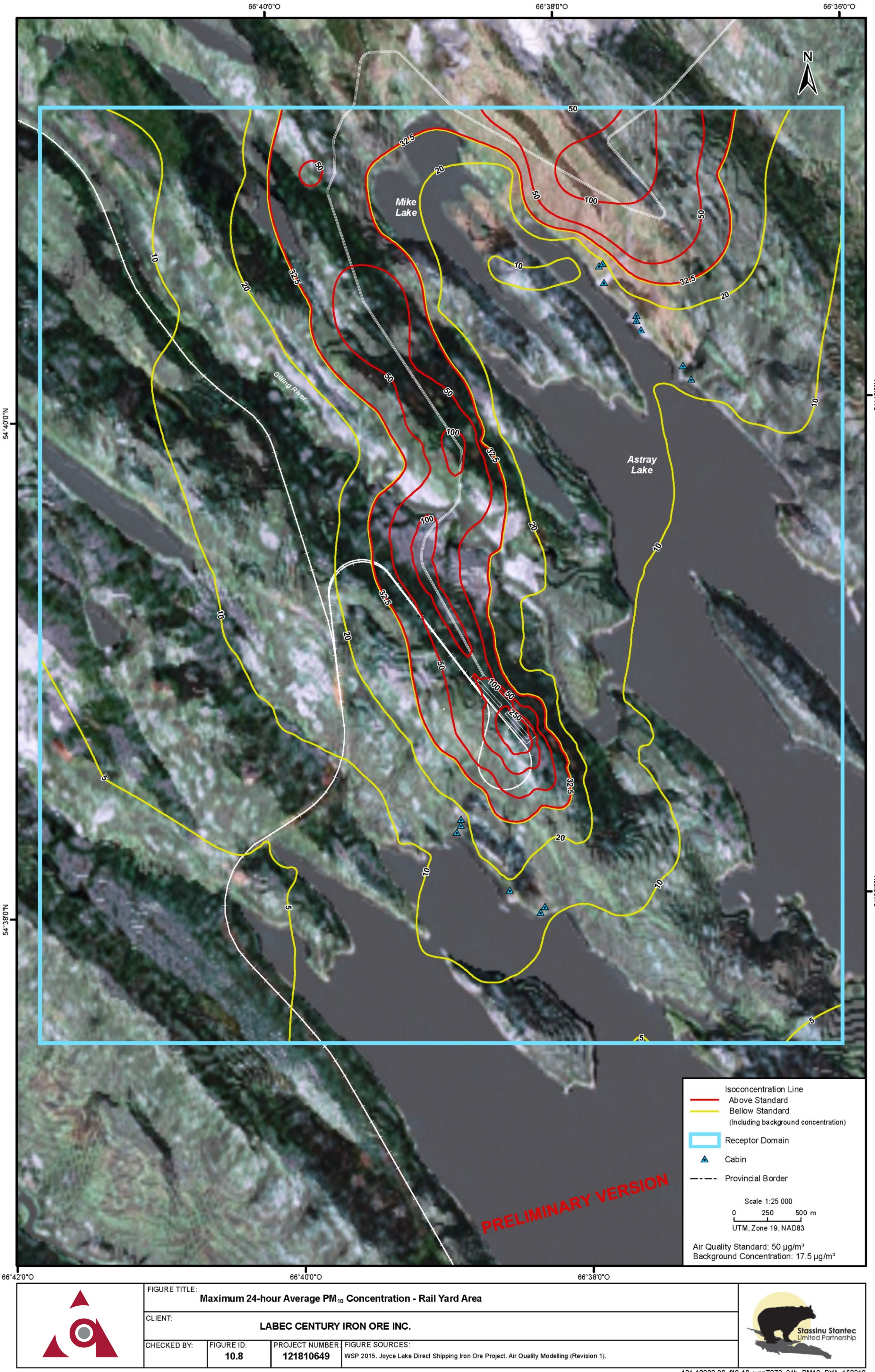

Figure 10.8 Maximum 24-hour Average PM_{10} Concentration – Rail Yard Area

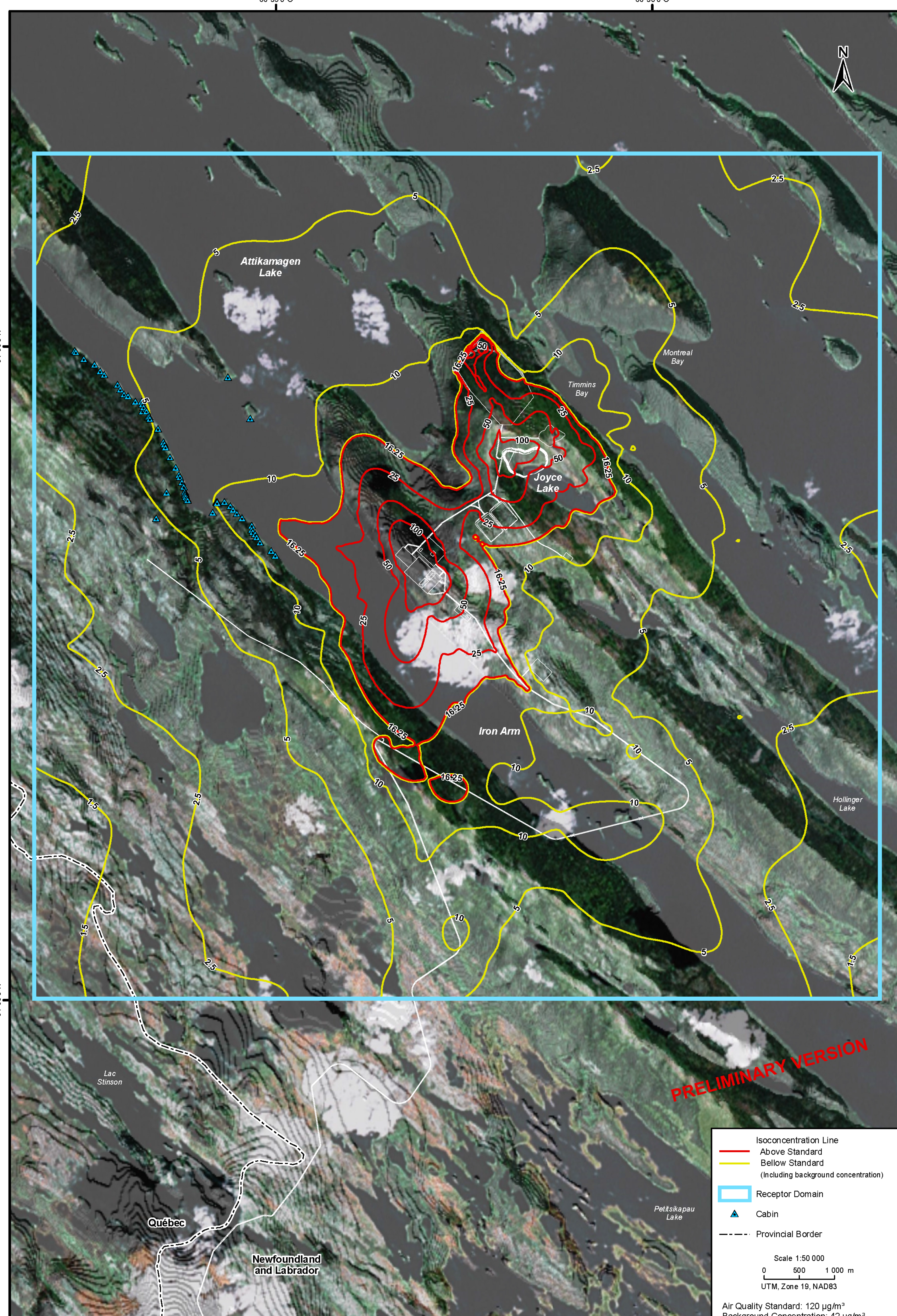

FIGURE TITLE: Maximum 24-hour Average $PM_{2.5}$ Concentration - Mine Area

CLIENT: LABEC CENTURY IRON ORE INC.

CHECKED BY:	FIGURE ID:	PROJECT NUMBER:	FIGURE SOURCES:
	10.9	121810649	WSP 2015. Joyce Lake Direct Shipping Iron Ore Project. Air Quality Modelling (Revision 1).

Stassinu Stantec Limited Partnership

121-18002-00_f10-11_wspT073_24H_PM25_Mine_150210

Figure 10.9 Maximum 24-hour Average $PM_{2.5}$ Concentration – Mine Area

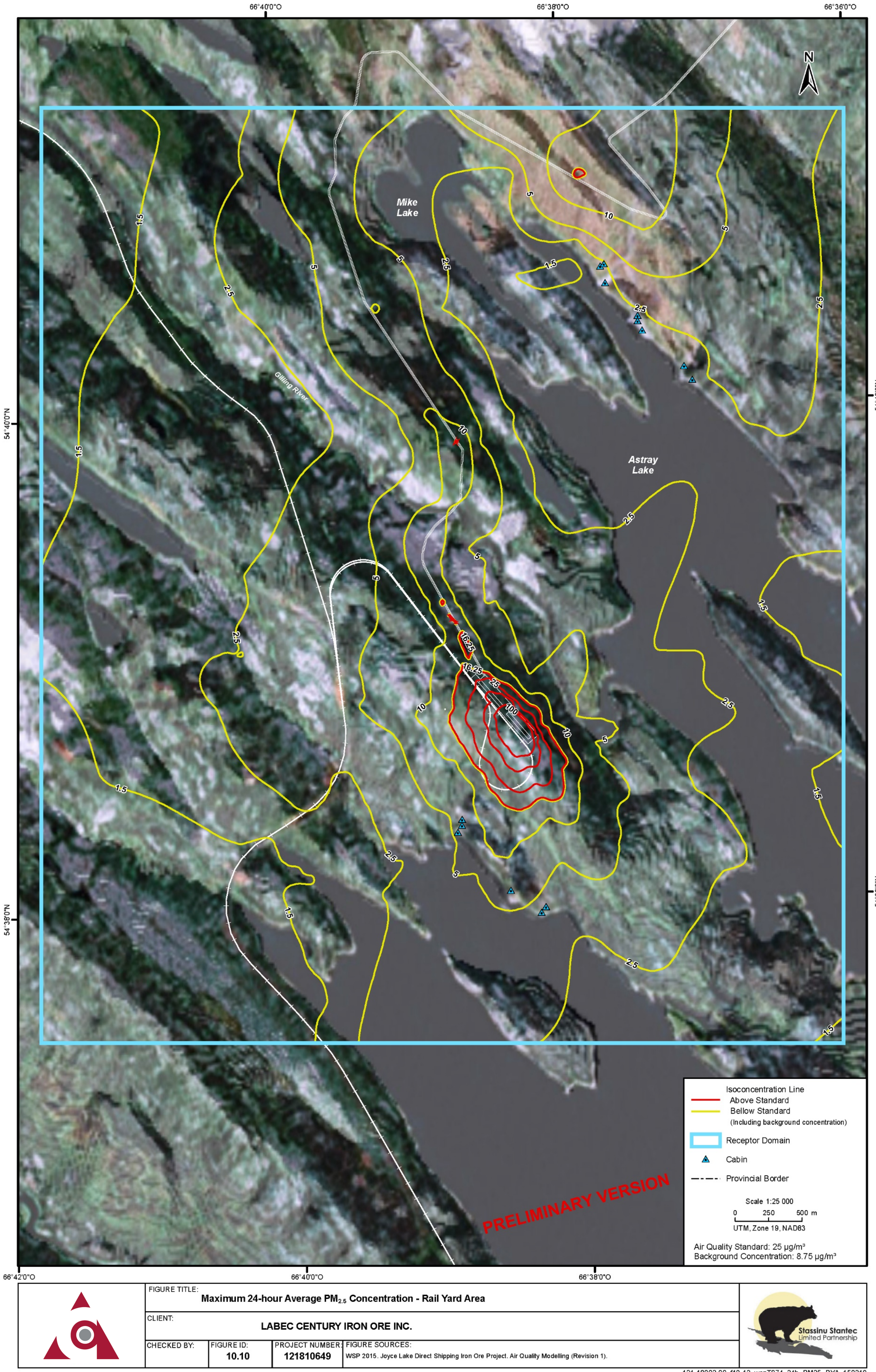

Figure 10.10 Maximum 24-hour Average $PM_{2.5}$ Concentration – Rail Yard Area

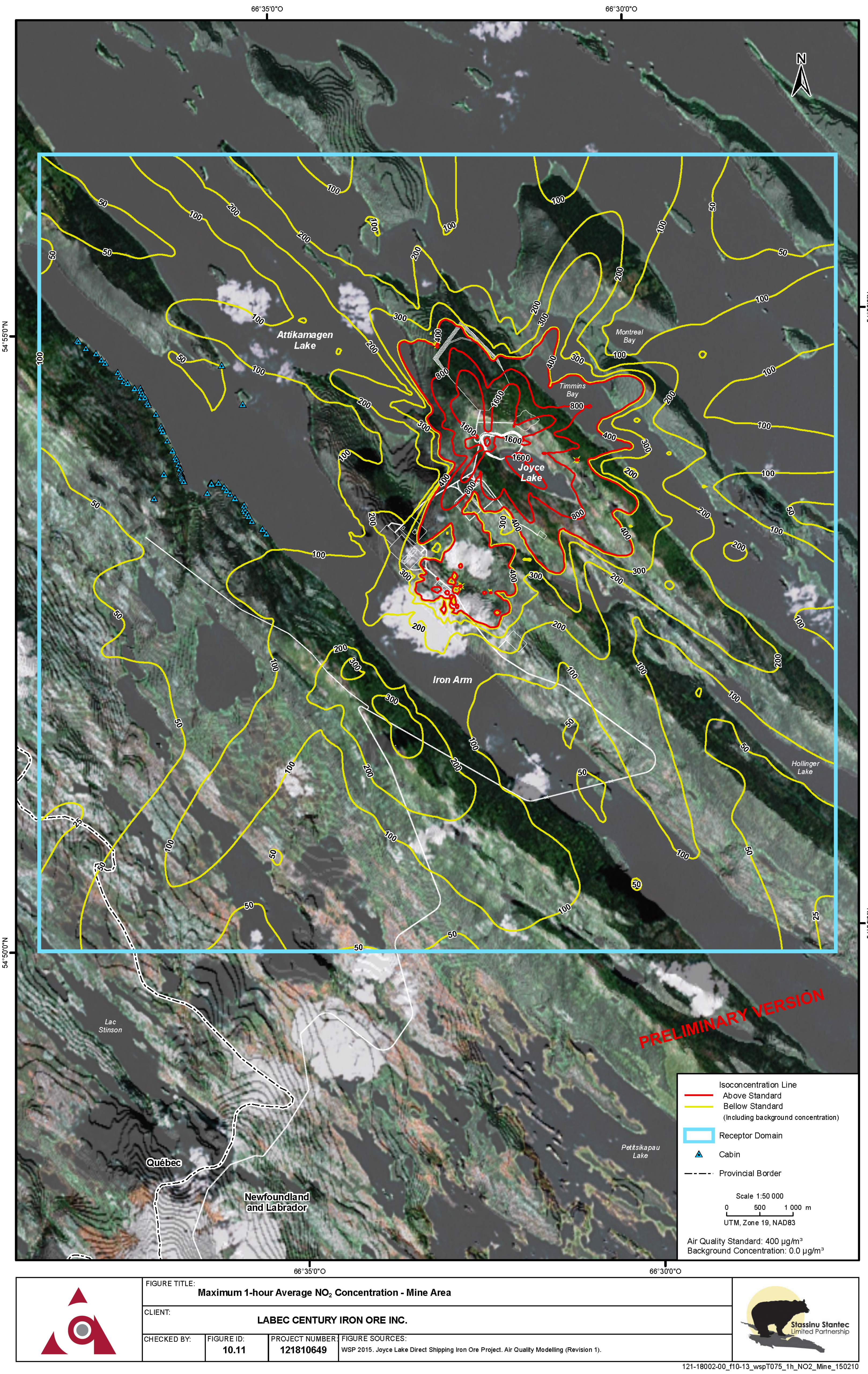

Figure 10.11 Maximum 1-hour Average NO_2 Concentration – Mine Area

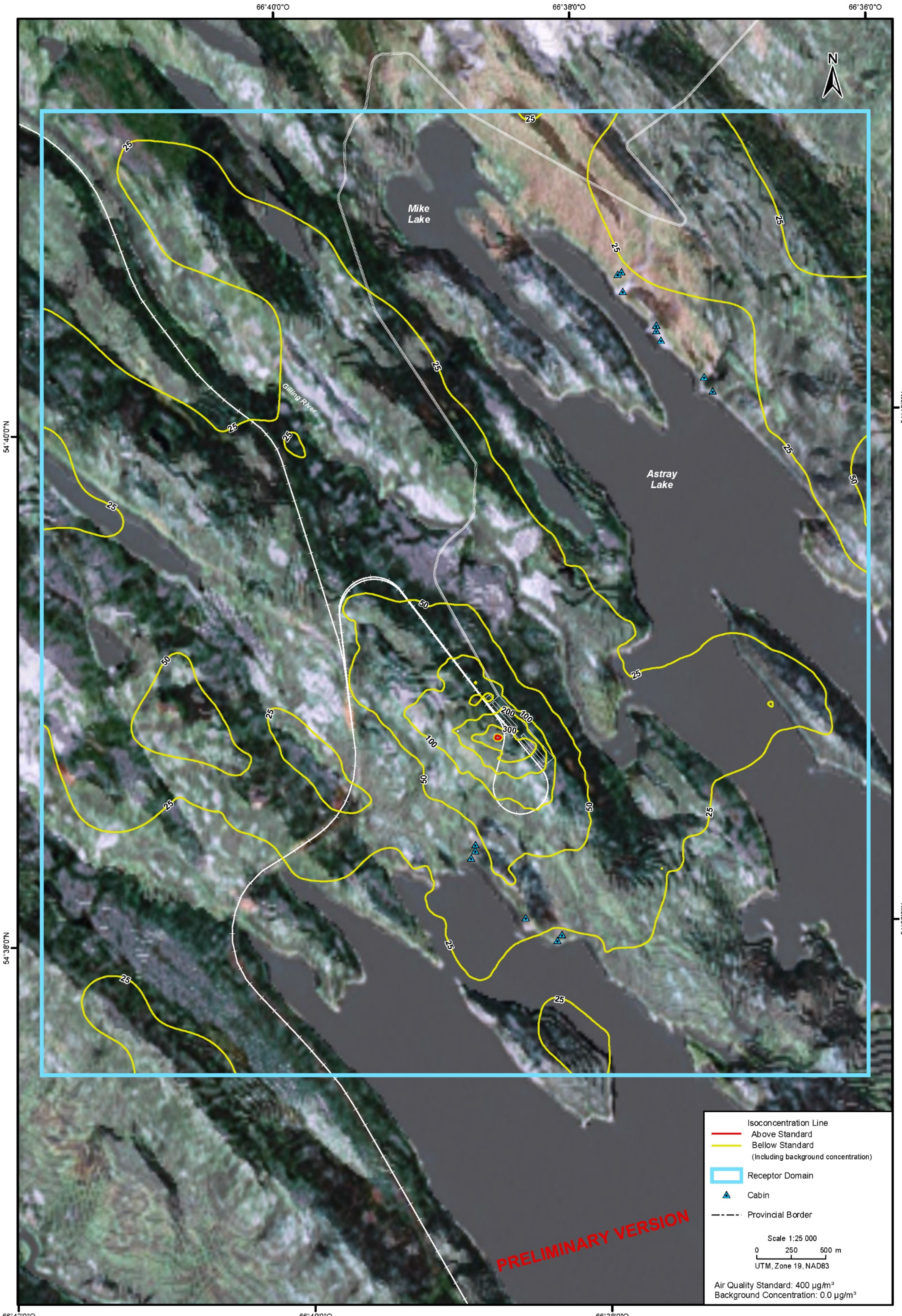

FIGURE TITLE: Maximum 1-hour Average NO_2 Concentration - Rail Yard Area

CLIENT: LABEC CENTURY IRON ORE INC.

CHECKED BY:	FIGURE ID:	PROJECT NUMBER:	FIGURE SOURCES:
	10.12	121810649	WSP 2015. Joyce Lake Direct Shipping Iron Ore Project. Air Quality Modelling (Revision 1).

Stassinu Stantec Limited Partnership

121-18002-00_f10-14_wspT076_1h_NO2_RYA_150210

Figure 10.12 Maximum 1-hour Average NO_2 concentration – Rail Yard Area

10.6.2 Assessment of Project-Related Environmental Effects on Acoustics

Construction

Project Construction includes removal and storage of overburden of the open-pit mine, dewatering of Joyce Lake, and the preparation of ore, ROM and waste rock stockpiling areas. Overburden removal will require machinery such as bulldozers, excavators, and graders, which will generate noise on-site.

Infrastructure construction includes a rock causeway and a new road for hauling iron ore products for final delivery to rail cars, a crushing and screening process plant to process the raw ore, several ancillary buildings and associated supporting infrastructure (e.g., accommodations camp, pump houses, power plant, fuel depot) to support work crews, a new rail loop and load-out facility. Infrastructure construction will also require heavy earth moving equipment resulting in noise emissions. Additional noise emissions will occur from, welding, and the transportation of goods and personnel.

The spatial extent of the Construction phase will match the extent of the Operation and Maintenance phase; however, the intensity of construction activity will be lower than the intensity of activities during the Operation phase, and the duration will be shorter. As the Operation and Maintenance phase will be longer in duration and employ more equipment the Operation and Maintenance phase was used as the worst case for the evaluation of noise effects and was conservatively used to determine the overall effect of the Project on the acoustic environment (see below).

Operation and Maintenance

Project Operation and Maintenance will result in noise emissions from open pit mining activities, ore processing at the crushing and screening process plant and pre- and post-processing stockpiling, waste rock transportation and disposal, and products transportation, including rail load-out and transportation along the new rail loop.

Resource extraction begins with the drilling and blasting of initial surface material and the excavation and hauling of raw iron ore. For blasting, holes are drilled at regular intervals prescribed by the blasting plan, and explosive charges are introduced at each hole. The blasting sequence is designed with delay links to occur to improve rock fragmentation, which produces a sustained roar rather than a singular pulse. This reduces peak sound pressure levels and results in a more efficient blast for resource extraction.

After blasting, hydraulic excavators are employed to load the raw ore to haulage trucks. The additional fracturing from the hydraulic excavators and the vehicle exhausts are the primary sources of noise during this process.

The raw ore haul trucks will transport the ore from the mine to the crushing and screening process plant. Hauling activities will also include removing waste rock from the open pit, and transporting it to the waste rock stockpile area. Noise emissions from hauling will primarily occur from vehicle exhaust from the haul trucks, although noise will also occur from the loading and unloading of materials from each vehicle.

Mining operations will employ a dry-circuit crushing and screening process plant, consisting of three mobile units, running during the warmer months – approximately 240 days per year. A series of two crushers and two screens will process the raw ore. The noise emissions from the process will mostly occur from the cone and jaw crushers as they crush the ore and reduce its size to both lump ore and sinter feed.

After upgrading, the products will be hauled 43 km across the rock causeway and along the haul road, to the Astray rail loading facility for railing to the Sept-Îles port. Noise emissions from hauling will predominantly occur from the loading and unloading of the trucks, and from vehicle exhaust. Noise emissions will also occur from the locomotives' engine exhaust and from wheel-to-rail friction during the loading process at the rail loop.

10.6.2.1 Mitigation of Project Environmental Effects

Construction

The majority of noise emissions during Project Construction will result from heavy-duty equipment. The most effective approach to attenuating noise emissions during Project Construction is to abide by strict maintenance routines for all equipment and the proper deployment of mufflers. Additional noise mitigation approaches during the Construction phase includes:

- Speed restrictions
- Reduction of equipment back-up alarms
- Use of a Labec Century noise/dust complaint resolution procedure
- Advance warning to nearby sensitive receptors (e.g., cabin occupants) of noise-causing activities

Operation and Maintenance

Noise emissions during Project Operation and Maintenance will result from ore extraction and processing, and loading and off-loading material at various locations. In addition to mitigation measures employed for construction activities as presented above, mitigating noise emissions from mining activities will include:

- Selecting stockpiling sites that are as far away from sensitive receptors as practically feasible
- Where significant noise emissions occur from the railway, the use of speed restrictions in the loading loop

10.6.2.2 Characterization of Residual Project Environmental Effects

Construction

Project Construction will affect the acoustic environment in same areas that are affected during Operation and Maintenance, but will be temporary and short-term. The distances to sensitive receptors are sufficient so that individual sound is unlikely to be distinguished, but an industrial "hum" may be perceived in the closest receptors.

Therefore, the effect of Project Construction on a change in the acoustic environment are predicted to be moderate in magnitude, local in geographic extent, short term in duration, regular in frequency and reversible.

Operation and Maintenance

Year 1 of Project operation will represent the worst case for acoustic effects as mining tonnage is at its maximum and the mine pit is at its highest elevation (WSP 2015b). Acoustic modelling of the Project was therefore completed for Year 1 of operation.

The number and type of equipment required to complete mining activities during the peak production period were included in the acoustic model SoundPLAN v7.1 (Table 10.24). SoundPLAN calculates sound pressure levels from project activities by explicitly accounting for topographical features and site infrastructure geometry. SoundPLAN is capable of calculating attenuation and noise abatement from natural barriers and purpose-built barriers, and conforms to ISO standard 9613 Parts 1 and 2 when predicting sound pressure levels.

Table 10.24 Sound Power Level of Equipment Used in Acoustic Modelling

Location	Equipment	Sound Power Level (dBA)	Number of Piece
Mine and Process Plant	Cat 785D 150-tonne Haulage Truck	121	15
	Komatsu PC-1250 Excavator	109	4
	CAT 345 Excavator	107	1
	CAT D8T Track Dozer	121	2
	CAT 14M Grader	110	2
	Water/Sand Truck	118	1
	Production Drill	125	3
	CAT 988 Wheel Loader	114	5
	CAT 980 Wheel Loader	113	2
	Jaw Crusher	125	1
	Cone Crusher	119	1
Railway	CAT 988 Wheel Loader	114	4
	Smithco Side Dump Trailer	112	8
	Train in Straight Line	100 dBA/m	1
	Train in Curve	111 dBA/m	1
Source: WSP 2015b			

Sound power levels used to predict sound pressure levels resulting from the operation of the Project were based on manufacturing specification and other projects of similar scope (WSP 2015b).

A usage cycle of 100% was conservatively applied to all pieces of equipment used in the acoustic modelling. Equipment units required to dewater Joyce Lake (i.e., pumps) were not included in the model, as the noise from such equipment will be negligible compared to other mining equipment, like the mining trucks. Terrain features were included in the model (WSP 2015b).

In addition to the spatial distribution of the sound levels, tabulated results at the discrete receptors used to measure baseline noise levels are included in Tables 10.25 and 10.26. The results of the acoustic modelling are presented in Figures 10.13 and 10.14. The isopleths in these figures represent the predicted sound levels in dBA.

Table 10.25 Predicted Sound Levels (L_d, L_n, L_{dn}) at Discrete Receptors for Year 1 of Operation

Receptor Point	Predicted Sound Level (dBA)		
	Daytime Sound Level (L_d - 7 am to 10 pm)	Night-time Sound Level (L_n - 10 pm - 7 am)	Day-Night Average Sound Level (L_{dn})
P1	38	38	44
P2	43	43	50
P3	34	35	41
P4	43	45	51
P5	44	44	50
Note: Sound levels rounded to 1 DBA, ref: 2 * 10-5 Pa Source: WSP 2015b			

Table 10.26 Sound Power Level of Equipment Used in Acoustic Modelling

Receptor Point	Baseline L_{dn} (dBA)[a]	Baseline % HA	Baseline + Operations L_{dn} (dBA)[a]	Baseline + Operations % HA	Change in % HA	Exceeds Change of 6.5% (Yes or No)
P1	33.8	0.3	44	1.1	0.8	No
P2	35.3	0.3	50	2.1	1.8	No
P3	36.4	0.4	41	0.8	0.4	No
P4	32.9	0.2	51	2.4	2.2	No
P5	39.6	0.6	50	2.3	1.7	No
Note: [a] Noise level rounded to 1 dBA, ref: $2x10^{-5}$ Pa. Source: WSP 2015b						

Predicted sound pressure levels as a result of Project activities during Operation and Maintenance are within levels recommended by Health Canada. While sound pressure levels at nearby receptors from the Project do increase beyond baseline conditions, the corresponding increase in %HA is minimal.

The effect of the Project Operation and Maintenance on a change in the acoustic environment is therefore predicted to be low in magnitude, local in geographic extent, medium in duration, continuous during the life of the Project and reversible.

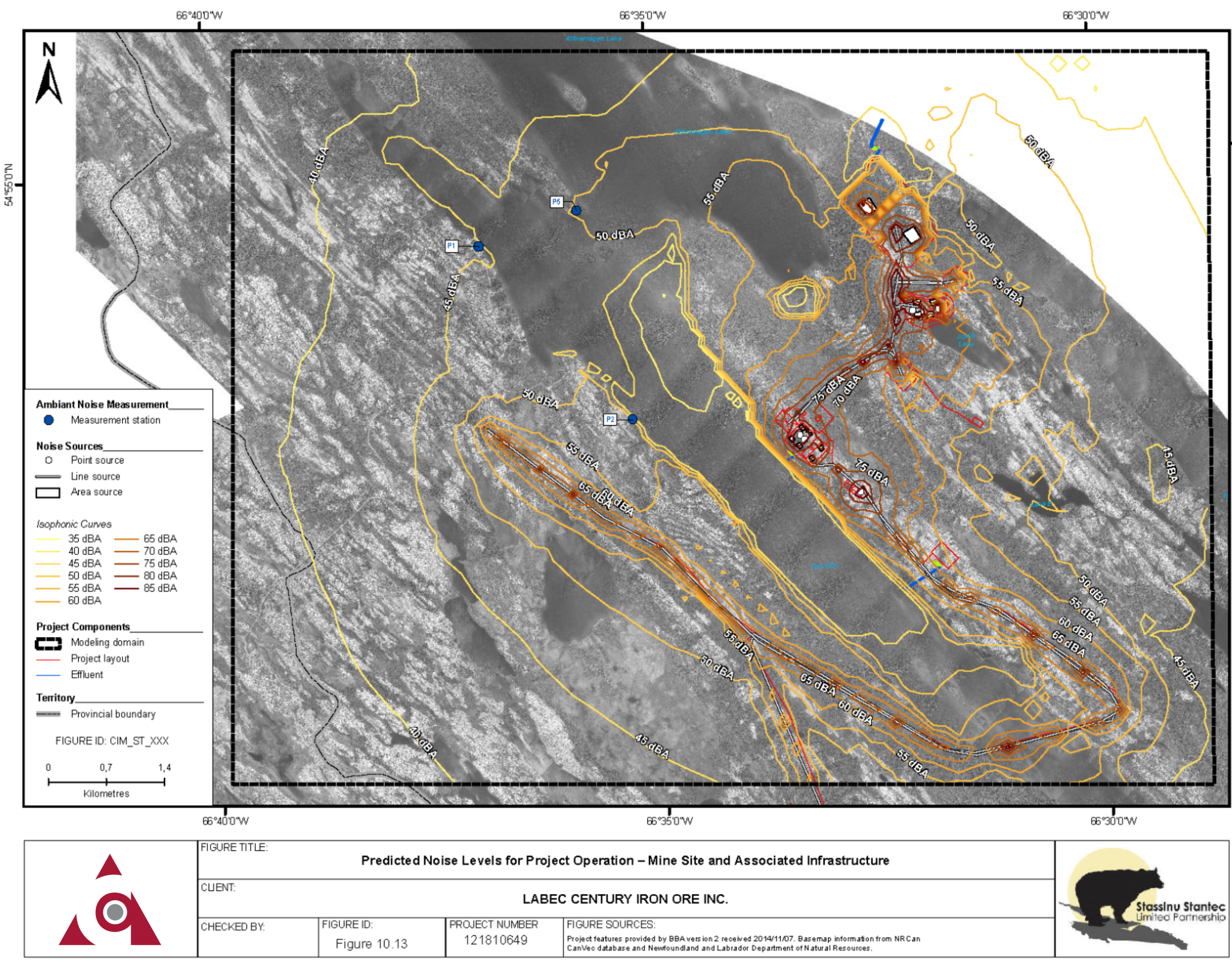

Figure 10.13 Predicted Noise Levels for Project Operation – Mine Site and Associated Infrastructure

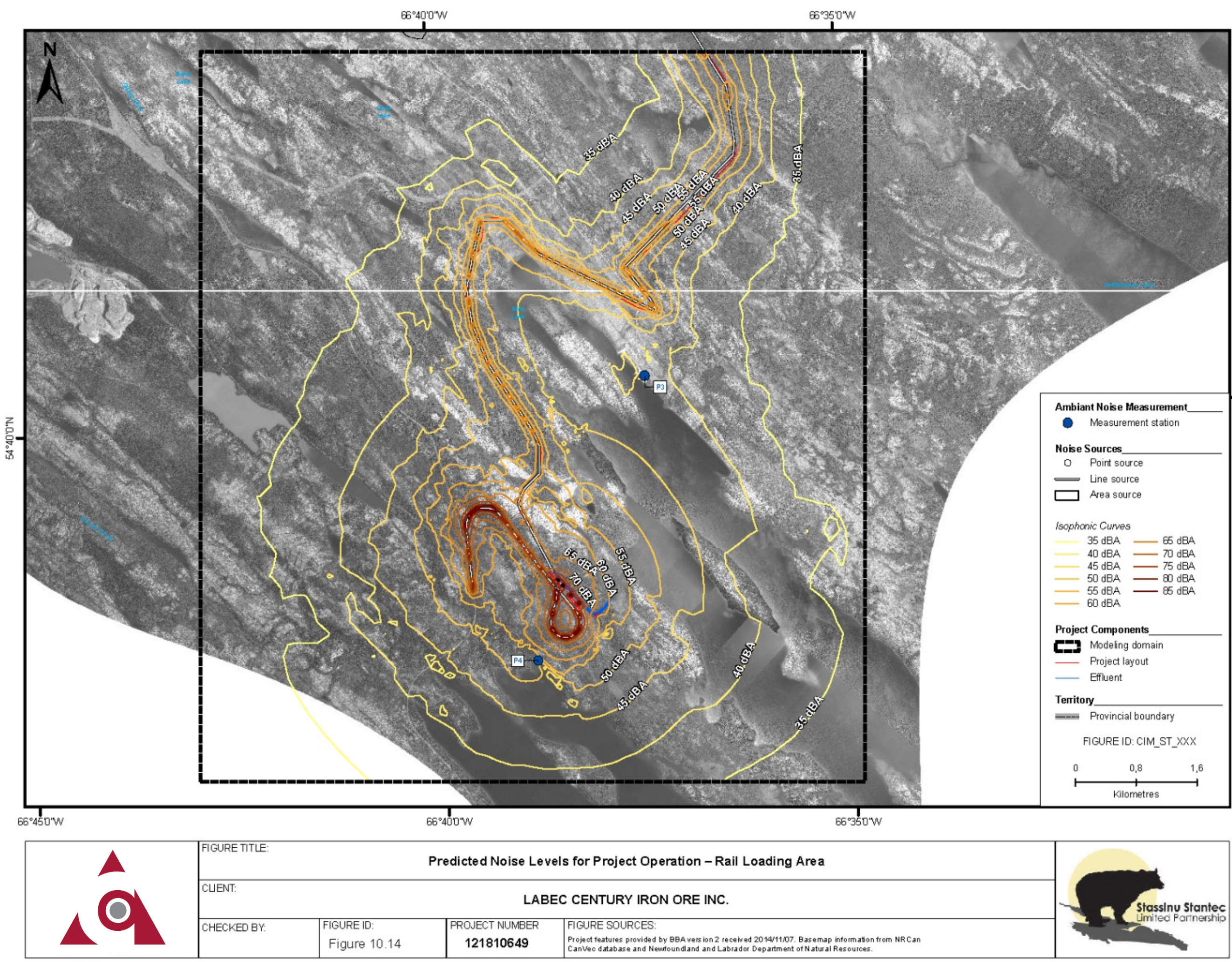

Figure 10.14 Predicted Noise Levels for Project Operation – Rail Loading Area

10.6.3 Assessment of Project-Related Environmental Effects on Greenhouse Gases

Construction

The substantive sources of direct GHG emissions during construction are the mobile and stationary equipment exhausts and blasting using an ANFO emulsion. Land clearing, specifically deforestation, also contributes to the direct GHG emissions during the construction phase only. Land clearing activities, such as deforestation, impacts the forest's natural carbon sinks and causes the loss of the GHG sequestration. The loss of carbon sequestration from land clearing was estimated and included in the total construction emissions.

The GHG emissions consist primarily of CO_2, with smaller amounts of CH_4 and N_2O. Greenhouse gases also include perfluorocarbons (PFC), hydrofluorocarbons (HFC), sulfur hexafluoride, and nitrogen trifluoride. These gases (PFC, HFC, sulfur hexafluoride, and nitrogen trifluoride) are expected to be released in insubstantial amounts or not at all and are therefore not considered any further in the GHG assessment.

As per the Strategic Assessment of Climate Change (ECCC 2020a), the GHG emissions are to also include indirect emissions associated with the consumption of purchased electricity and those from shipping of products and delivery of supplies from outside the project boundary. Other indirect GHG emissions associated with upstream sources such as production of purchased materials and upstream transportation and distribution have not been evaluated for this assessment. Emissions from the employee travel to-site (air and on-road) were also included in the indirect emissions.

Release of GHG emissions from human activities to the atmosphere is recognized to contribute to changes in local and global climate conditions. However, the environmental effect of the GHG emissions from any specific facility on global climate change cannot be measured (CEA Agency 2003). Nevertheless, the change in GHG emissions associated with the Project can be quantified and placed in context with jurisdictional (provincial, national, global) and industry-wide emissions and reduction targets.

Operation and Maintenance

The substantive sources of direct GHG emissions during operation and maintenance are associated with the combustion of fossil fuels such as diesel and gasoline in the mobile and stationary equipment exhausts, blasting using an ANFO emulsion, and wastewater treatment. The GHG emissions consist primarily of CO_2, with smaller amounts of CH_4 and N_2O. Greenhouse gases also include PFC, HFC, sulfur hexafluoride, and nitrogen trifluoride. These gases are expected to be released in insubstantial amounts or not at all and are therefore not considered any further in the GHG assessment.

As per the Strategic Assessment of Climate Change (ECCC 2020a), the GHG emissions are to also include indirect emissions associated with the consumption of purchased electricity and those from shipping of products and delivery of supplies from outside the project boundary. Other indirect GHG emissions associated with upstream sources such as production of purchased materials and upstream transportation and distribution have not been evaluated for this assessment. Emissions from the employee travel to-site (air and on-road) were also included in the indirect emissions.

Release of GHG emissions to the atmosphere is recognized to contribute to changes in local and global climate conditions. However, the environmental effect of the GHG emissions from any specific facility on global climate change cannot be measured (CEA Agency 2003). Nevertheless, the change in GHG emissions associated with the Project can be quantified and placed in context with jurisdictional (provincial, national, global) and industry-wide emissions and reduction targets.

10.6.3.1 Mitigation of Project Environmental Effects

Construction

The primary measure for mitigating releases of GHGs during Project Construction will be the development and implementation of a GHG Management Plan. The Management Plan will include features to promote comprehensive equipment maintenance to maximize fuel efficiency, and anti-idling policies to avoid the unnecessary release of GHG emissions when equipment is not used. Many of the same mitigation procedures provided in Section 10.6.1.1, to mitigate levels of combustions gases would also aid at reducing GHG emissions. Several measures are planned to mitigate GHG emissions during Project construction; these include:

- Equipment and vehicle idling times will be reduced to the fullest extent possible in accordance with an idling policy.
- Cold starts will be limited to the extent possible.
- Usage of electric bus to transport employees to and from Schefferville and Kawawachikamach - recharged using hydroelectric grid power.
- Maintaining equipment proactively to improve/maintain fuel efficiency.
- Limiting speed of vehicles on the haul road and service road to improve fuel efficiency.
- Lighting will be turned off when not required.
- Vacant accommodations (e.g., during the winter) will be heated to the minimum extent necessary to prevent damage and improve power efficiency.
- Worker accommodations will be designed with sufficient ventilation so as to reduce the need to open windows and reduce heating efficiency.
- Worker accommodations will be insulated to reduce heating power requirements.
- Waste heat from generators will be partially captured and used to heat living and working spaces.
- Worker accommodation will offer a variety of plant-based foods to reduce the project's carbon footprint.

- Construction fly camps near rail loop can use compressed natural gas brought in by rail for fuel with higher efficiency and lower NO_X emissions than diesel fuel.
- Construction workers can be partially housed in town, using hydroelectric grid power for heating and power requirements.
- FIFO workers will be permitted to travel to Schefferville via rail instead of air to reduce fuel consumption.

Operation and Maintenance

The majority of the GHG emissions during Project Operation will result from the combustion of diesel fuel in mining equipment; mitigation can therefore primarily be accomplished through adherence to a comprehensive equipment preventative maintenance program to maintain the vehicles and improve fuel efficiency, and by implementing an idling policy (refer to Section 10.6.1.1). These features will be incorporated into a GHG Management Plan to reduce, where possible, GHG emissions from Project Operation and Maintenance. The GHG mitigation measures listed for construction will also be applied during the Project Operation and Maintenance phase.

10.6.3.2 Characterization of Residual Project Environmental Effects

Direct and indirect emissions of GHG were estimated for both the Construction and the Operation and Maintenance phases using site-specific activity data and published emission factors and emission estimation methods. Sample calculations of the GHG emission estimates are provided in Appendix AF.

The GHG emissions quantified from land clearing only occur during the construction phase and include the removal of stored carbon through tree clearing. The GHG emissions were estimated using published quantities of carbon stored based on forest genus (conifer vs. deciduous), approximate age of forest, and area of land cleared provided by Century. The emissions from the combustion of fuel in the equipment used during land clearing were quantified under the on-site mobile equipment. The stored carbon values were sourced from an US Department of Energy report, Energy Information Administration. General Guidelines and Supporting Documents Establishing the Voluntary Reporting of Greenhouse Gases Program (2000). The forest genus and age were obtained from Natural Resource Canada's publication "A Descriptive Inventory of Canada's Forest Regions" (1995) for the B13.a - Northeastern Transition (Forest and Baren) region.

The GHG emissions from explosives detonation during operations and construction were estimated using an emission factor (0.189 t CO_2/tonne explosives) recommended by the Mining Association of Canada (MAC 2014) and predicted annual explosive quantities.

The GHG emissions from the accommodation camp's wastewater treatment during operations were estimated following methods outlined in the Western Climate Initiative (WCI) Method Final Essential Requirements of Mandatory Reporting (2010) and design parameters obtained from the manufacture.

Emissions from off-road mobile equipment during construction and operation were estimated using diesel combustion emission factors from the ECCC NIR (ECCC 2020b) paired with fuel consumptions rates. The estimated fuel usages were provided by Century. Similarly, emissions from on-site on-road transportation (including haul trucks) were estimated using combustion emission factors from the ECCC 2020 NIR, based on fuel type and vehicle size, and fuel consumption provided by Century. Estimated annual fuel usages for the peak construction year and peak operation year are presented per individual vehicle/piece of equipment in Tables AF.4 and AF.5, respectively, of Appendix AF The GHG emission factors used for the on-site mobile equipment are presented in Table 10.27.

Table 10.27 Transportation and Mobile Equipment Emission Factors

Vehicle Class	CO_2 EF (g/L)	CH_4 EF (g/L)	N_2O EF (g/L)
Light-Duty Diesel Trucks[a]	2,681	0.068	0.21
Heavy-Duty Diesel Vehicles[a]	2,681	0.14	0.082
Light-Duty Gasoline Vehicles[b]	2,307	0.52	0.20
Off-Road Diesel Equipment [c]	2681	0.073	0.022

Notes:
[a] Emission factors used for on-road diesel vehicles with "Moderate Control"
[b] Emission factors used for on-road gasoline vehicles with "Oxidation Catalysts"
[c] Emission factors used for off-road diesel >19 kW, Tier 1-3
Source: 2019 NIR (ECCC 2020b)

Emissions from stationary combustion during construction and operations were estimated using the estimated fuel usages, provided by Century, and emission factors from ECCC's publication "2020 Canada's Greenhouse Gas Quantification Requirements" (ECCC 2020c). The GHG emission factors used for stationary combustion are presented in Table 10.28.

Table 10.28 Stationary Combustion Emission Factors

Fuel Type	CO_2 EF (kg/kL)	CH_4 EF (kg/kL)	N_2O EF (kg/kL)
Diesel	2,681	0.08	0.02

Source: 2020 Canada's Greenhouse Gas Quantification Requirements (ECCC 2020c).

The indirect GHG emissions from electricity consumption during construction and operations were calculated using the electricity consumption emission factor for Newfoundland and Labrador (27 g CO_{2eq}/kWh) from the ECCC NIR (ECCC 2020b) and the estimated annual electricity usage at the site during the peak operational year.

The indirect GHG emission associated with supply delivery, product shipping (operation only), and employee travel during construction and operation were calculated using estimated fuel usages and emission factors specific to the mode of transport. Fuel usages were estimated based on travel distances, number of trips, and fuel economies. For supply and product shipping, the on-land distance as far as the Port of Sept-Iles was assessed. This was assumed as the original supplier and final production destinations are unknown and may change over the Project timeline.

For shipping, via diesel transport truck, a fuel economy based on the average of the Canadian trucking industry (39.5 L/100 km) as reported by NRCan (2019). Supplies and product will also be shipped via rail, in which the fuel usage was estimated using the average (689) revenue tonne-kilometre per litre of fuel from the Bureau of Transportation Statistics for 2019 (BTS 2019) and the provided tonnes transported and distance.

For aviation fuel used in employee air travel, the fuel usage was based on average travel speed and average fuel consumption for the assumed flight models (Dash 8-100 for flights from St. John's to Schefferville and Pilatus PC-12 for flights from Labrador City to Schefferville) based on model specifications (Pilatus 2015, CemAir 2021). Employees will travel from Schefferville to site via Lion Electric C model electric buses, in which the electricity usage was estimated based on the required electricity per charge and the milage per charge, based on manufacturer specifications (Lion Electric C 2021). The emission factors for aviation fuel and diesel trains are presented in Table 10.29. The emission factors for the transport trucks used for shipping were previously presented in Table 10.27 (for Heavy-Duty Diesel Vehicles). The electricity consumption emission factor for Newfoundland and Labrador (27 g CO_{2eq}/kWh) was used for the electric buses.

Table 10.29 Shipping Transportation Emission Factors

Source Type	CO_2 EF (kg/kL)	CH_4 EF (kg/kL)	N_2O EF (kg/kL)
Diesel Train	2,671	0.15	1.00
Aviation Turbo Diesel	2,560	0.029	0.071
Source: 2020 Canada's Greenhouse Gas Quantification Requirements (ECCC 2020c).			

Construction

Direct releases of GHGs during the construction of the Project will occur from the following activities, site preparation, construction of roads, construction of site buildings and associated infrastructure, construction of the causeway and construction of the railway and load out facility. Indirect releases of GHGs during the construction of the Project will occur from electricity usage, and from off-site transportation (rail, truck, air) for supplies delivery and employee travel. Sample calculations of the GHG emission estimates are provided in Appendix AF.

The maximum estimated annual GHG emissions (both direct and indirect) from Project construction activities are presented in Table 10.30. Sample calculations of the GHG emission estimates are provided in Appendix AF. The site construction direct GHG emissions include emissions from heavy off-road equipment, on-road trucks and vehicles, stationary generators, blasting and land clearing. Indirect GHG emission from site construction include electricity usage and off-site transportation (rail, truck, air) for supplies delivery and employee travel.

Approximately 29.9 kt CO_{2eq} are estimated to be released (including both direct and indirect) during the construction year with the highest GHG emissions. Conservatively assuming continuous release of the maximum year GHG emissions over the construction period, the total GHG emissions during construction, assuming a duration of 20 months, are estimated to be 49.8 kt CO_{2eq}.

Table 10.30 Summary of Maximum GHG Emissions during Construction (annual)

Activity	Units	CO_2	CH_4	N_2O	Total (expressed as CO_{2eq})
ANFO Blasting [a]	t/y	449.1	-	-	449.1
Stationary Combustion [b]	t/y	3,287	0.10	0.02	3,297
On-Road Transportation [c]	t/y	9,385	0.49	0.29	9,485
Off-Road Mobile Equipment [c]	t/y	12,440	0.34	0.09	12,476
Land Clearing [d]	t/y	107,015	-	-	107,015
Shipping of Delivered Supplies (indirect) [c]	t/y	209.9	0.01	0.04	220.6
Electricity Consumption (indirect) [d]	t/y	0.9	-	-	0.9
Employee Travel [c,d]	t/y	1,517.9	0.02	0.04	1,530.9
Direct Emissions	t/y	**136,500**	**0.92**	**0.41**	**136,657**
Indirect Emissions	t/y	**1,728.7**	**0.0**	**0.1**	**1,752.4**
Total (direct + indirect)	t/y	**138,228**	**1**	**0**	**138,409**

Notes:
a Based on MAC emission factors (MAC 2014)
b Based on ECCC's 2019 Canada's Greenhouse Gas Quantification Requirements (ECCC 2019e)
c Based on ECCC emission factors provided in Table A6-13 of the NIR (ECCC 2020b)
d Based on ECCC's Deforestation model and guidelines "Overview of methodology to develop deforestation parameters for modelling projected GHG emissions" (ECCC 2020d)
d Based on electricity consumption emission factor for Newfoundland and Labrador (27 g CO_{2eq}/kWh) from Table A13-2 the ECCC NIR (ECCC 2020b)

The on-road transportation and off-road mobile equipment emissions that are presented in Table 10.31 are presented again in Table AF.4 of Appendix AF separated by specific equipment/vehicle. The estimated fuel usage per vehicle/equipment are also provided in Table AF.4.

The contribution of the maximum estimated annual GHG emissions from Project construction (direct and indirect) to provincial and federal totals are presented in Table 10.31. On an annual basis, Project construction contributes a maximum of 1.41% and 0.024% to provincial and national GHG emission totals, respectively, and 1.56% to the national Mineral Product GHG emission totals.

The effect of Project Construction on a change in GHG emissions is predicted to be moderate in magnitude, global in geographic extent, short term in duration, regular frequency throughout the construction phase, and irreversible. The residual effect is considered irreversible as effects related to the release of GHG emissions from Project construction would not be reversible for at least 100 years.

Table 10.31 Estimated Contribution of Construction GHG Emissions to Federal and Provincial Totals

Parameter	Units	CO_2	CH_4	N_2O	Total (expressed as CO_{2eq})
Construction GHG Emissions (direct & indirect)	t/y	138,228	0.9	0	138,409
Newfoundland and Labrador GHG Emissions	kt/y	9,780	900	140	11,000
National GHG Emissions	kt/y	587,000	91,000	38,000	729,000
National Mineral Product GHG Emissions	kt/y	-	-	-	8,900
Project Construction Contribution to NL GHG Emissions	%	1.41%	0.00%	0.00%	1.26%
Project Construction Contribution to National GHG Emissions	%	0.024%	0.000%	0.000%	0.019%
Project Construction Contribution to National Mineral Product GHG Emissions	%	-	-	-	1.56%

Notes:
[a] Provincial and national GHG emission totals from ECCC NIR (ECCC 2020b)
[b] Provincial and national GHG emission totals include other fluorinated GHGs

Operation and Maintenance

The maximum estimated annual GHG emissions from Project operations are presented in Table 10.32. Sample calculations of the GHG emission estimates are provided in Appendix AF. The operations direct GHG emissions include emissions from heavy off-road equipment, on-road trucks and vehicles, stationary combustion, blasting, and wastewater treatment. The operations indirect GHG emissions include electricity consumption and transportation (on-road, rail, air) related to supplies and product deliveries and employee travel. Approximately 60.2 kt CO_{2eq} direct emissions are estimated to be released during the year of operation with maximum GHG emissions (Year 3). The estimated total indirect GHG emissions during operations is 10.2 kt CO_{2eq}/year, which is approximately 17% of the total direct annual GHG emissions (60.2 kt CO_{2eq}/year). Indirect GHG emissions are included into the annual GHG emissions totals for the Project in Table 10.32.

The on-road transportation and off-road mobile equipment emissions that are presented in Table 10.32 are presented again in Table AF.5 of Appendix AF separated by specific equipment/vehicle. The estimated fuel usage per vehicle/equipment are also provided in Table AF.5.

Table 10.32 Summary of Maximum Estimated Annual GHG Emissions During Project Operation

Activity	Units	CO_2	CH_4	N_2O	Total (expressed as CO_{2eq})
ANFO Blasting [a]	t/y	929	-	-	929
Stationary Combustion [b]	t/y	13,796	0.40	0.10	13,837
On-Road Transportation [c]	t/y	31,066	1.62	0.96	31,391
Off-Road Mobile Equipment [c]	t/y	13,966	0.38	0.10	14,007
Wastewater Emissions [d]	t/y	-	1.05	-	26.3
Electricity Consumption (indirect) [e]	t/y	0.9	-	-	0.9
Shipping of Delivered Supplies & Product (indirect) [c]	t/y	9,364	0.52	2.91	10,244
Employee Travel [c,d]	t/y	301	0.00	0.01	485
Direct Emissions	t/y	59,757	3.45	1.16	60,191
Indirect Emissions	t/y	9,365	0.52	2.91	10,245
Total (direct + indirect)	t/y	69,123	3.97	4.07	70,436

Notes:
[a] Based on MAC emission factors (MAC 2014)
[b] Based on ECCC's 2019 Canada's Greenhouse Gas Quantification Requirements (ECCC 2019e)
[c] Based on ECCC emission factors provided in Table A6-13 of the NIR (ECCC 2020b)
[d] Based on WCI's equation 200-23 for anaerobic wastewater treatment (WCI 2010)
[e] Based on electricity consumption emission factor for Newfoundland and Labrador (27 g CO_{2eq}/kWh) from Table A13-2 the ECCC NIR (ECCC 2020b)

The contribution of the maximum estimated annual GHG emissions from Project operations (direct and indirect) to provincial and federal totals are presented in Table 10.33. On an annual basis, Project operation contributes a maximum of 0.64% and 0.010% to provincial and national GHG emission totals, respectively, and 0.79% to the national Mineral Product GHG emission totals.

Table 10.33 Estimated Contribution of Operation GHG Emissions to Federal and Provincial Totals

Parameter	Units	CO_2	CH_4	N_2O	Total (expressed as CO_{2eq})
Operations GHG Emissions (direct & indirect)	kt/y	69,123	3.97	4.07	70,436
Newfoundland and Labrador GHG Emissions	kt/y	9,780	900	140	11,000
National GHG Emissions	kt/y	587,000	91,000	38,000	729,000
National Mineral Product GHG Emissions	kt/y	-	-	-	8,900
Project Operations Contribution to NL GHG Emissions	%	0.71%	0.00%	0.00%	0.64%
Project Operations Contribution to National GHG Emissions	%	0.01%	0.00%	0.00%	0.010%
Project Operations Contribution to National Mineral Product GHG Emissions	%	-	-	-	0.79%

Notes:
[a] Provincial and national GHG emission totals from ECCC NIR (ECCC 2020b)
[b] Provincial and national GHG emission totals include other fluorinated GHGs

The overall GHG emissions from the expected lifetime of Project operation were projected using the GHG emissions calculated form the maximum year of GHG emissions during operation (Year 3), scaled by the annual mining rates for specific activities. Some activities (stationary combustion of generators, shipping and supplies deliveries, and electricity) were assumed to remain consistent each year. The projected GHG emissions are shown in Table 10.34 along with the material mined. The operation emissions over the lifetime of the Project are estimated to be approximately 505,502 tonnes CO_{2eq}. The annual GHG emissions from Project operation range from 13,863 to 68,223 tonnes CO_{2eq}. On an annual basis, the Project operation contribution to provincial and national GHG emissions totals range, from 0.13% to 0.64% and 0.002% to 0.010%, respectively.

Table 10.34 Projected Operation GHG Emissions Over the Lifetime of the Project

Year	Total Material Mined (kt)	Total GHG Emissions tonnes CO_{2eq}/y [a]
0	104	136,500
1	2,167	53,876
2	2,488	59,803
3	2,509	60,191
4	2,449	59,083
5	2,944	68,223
6	1,421	40,101
7	0	13,863
8	0	13,863
Total Lifetime	14,082	505,502

Notes:
[a] GHG emissions from each activity were scaled by either mining or milling rates. GHG emissions from on-site transportation and mobile equipment were separated by those related to the processing plant and those related to the mining.

Once operational, the Project will be regulated under the Newfoundland and Labrador *Management of Greenhouse Gas Act* (2016) starting in the year in which the annual GHG emissions are greater than 15,000 tonnes CO_{2eq}/year and continuing annually unless emissions are reduced below the threshold and an exemption has been granted. Starting in the year in which GHG emissions are greater than 25,000 tonnes CO_{2eq}/year, the Project will be subject to GHG reduction targets as per section 5 of the *Management of Greenhouse Gas Act* and regulated under a performance standard, measured in terms of GHG emissions per unit of output within the facility boundary, and continuing annually unless emissions are reduced below the threshold and an exemption is granted.

As the GHG emissions within the project boundary are expected to be regulated under a performance standard pursuant to the *Management of Greenhouse Gas Act* (section 5), they will not be subject to the *Revenue Administration Act* carbon tax provisions for years in which they are subject to a GHG reduction target. However, as facilities are not subject to GHG reduction targets until the fourth year of operation, the Facility will be subject to carbon tax under the Revenue Administration Regulations for years 1 through 3.

As the predicted annual GHG emissions are >25,000 CO_{2eq}/year during the first six operational years, the Project will be subject to the Best Available Control Technologies (BACT) requirements for activities inside the Project's boundaries, as outlined in section 12.1 of the *Management of Greenhouse Gas Reporting Regulations*. As such, the Project will be required to implement BACT to reduce their overall emissions. Mitigation and controls that will be applied to reduce GHG emissions have been presented in Section 10.6.3.1.

The effect of Project Operation and Maintenance on a change in GHG emissions is predicted to be moderate in magnitude, global in geographic extent, medium term in duration, continuous throughout the lifetime of the Project, and irreversible. The residual effect is considered irreversible as effects related to the release of GHG emissions from Project construction would not be reversible for at least 100 years.

10.6.4 Assessment of Project-Related Environmental Effects on Vibration

Construction

Project Construction will include site preparation and the construction of buildings and associated infrastructure, a rock causeway and the railway and load-out facility, all of which will use heavy equipment. Vibration is not expected to exceed the baseline conditions (i.e., natural vibration) at nearest sensitive receptors over 350 m away from the Project site.

Blasting may be required during the preparation of the open pit mine. Blasting is expected to be occasional and sporadic in nature. Blasting will involve a comprehensive blast design and will be implemented under a strictly controlled environment.

Operation and Maintenance

Three different types of vibration sources are possible during Operation and Maintenance: rail transportation; railway loading; and blasting.

The Project includes approximately 7 km of new rail loop to join to existing rail. Trains consisting of 240 gondola-style cars will arrive up to four times each week during summer months for the collection of products for shipment to Sept-Îles. Six tank cars will also travel to Schefferville carrying diesel fuel for power generation and for vehicle and equipment operations. Table 10.35 shows the vibration from rail operation at various setbacks assuming a twin locomotive. Table 10.36 shows the vibration from rail loading operations at various setbacks.

Table 10.35 Predicted Vibration from Rail Operation

Distance From Rail line (m)	Vibration Level (VdB)	Criteria (VdB)	Meeting Criteria?
100	60	72	Yes
200 or greater	Less than 56	72	Yes
300 or greater	Less than 51	72	Yes

Table 10.36 Predicted Vibration from Rail Loading

Distance From Rail line (m)	Vibration Level (VdB)	Criteria (VdB)	Meeting Criteria?
100	62	72	Yes
200 or greater	Less than 52	72	Yes
300 or greater	Less than 51	72	Yes

The nearest sensitive receptor (closest cabin) to the rail line is greater than 300 m away; therefore the rail vibration meets the criteria for rail operation and rail loading.

The blasting is expected to occur in the open pit mine and to be occasional and sporadic in nature. Blasting will be conducted according to a comprehensive blast design and will be implemented under a strictly controlled environment. The nearest seasonal dwelling is approximately 3.5 km away from the open pit mine. Controlled blast vibration is typically negligible beyond 500 m. These receptors are well beyond the distance at which changes in vibrations could be perceived.

10.6.4.1 Mitigation of Project Environmental Effects

Construction

Vibration from construction equipment at 75 m will be below 60 VdB; therefore, vibration is not predicted to have an adverse effect at any nearby receptors during Project Construction and specific mitigation measures are not required.

Operation and Maintenance

A mitigation measure that will be employed to reduce vibration effects from the operation of the Project rail line is to limit train speed in the rail loop to 5 miles per hour or 8 km/h. An equipment maintenance program will be prepared and adhered to, such that vibration is reduced.

This design will consider nearest receptor location in relation to blast location for noise and vibration control.

10.6.4.2 Characterization of Residual Project Environmental Effects

Construction

Typical vibration levels from construction equipment are expected to be minimal. Therefore, the effect of Project Construction on ambient vibration is predicted to be low in magnitude, local in geographic extent, short term in duration, sporadic in frequency and reversible.

Operation and Maintenance

Typical vibration levels from rail operation and loading are predicted to be well below the criteria for acceptability. Therefore, the effect of Project operation and loading is considered to be low in magnitude, local in geographic extent, short term in duration, sporadic in frequency and reversible.

Typical assessments of vibration effects on sensitive receptors due to blasting, is expected to be below the limit due to the setback. Since the closest receptor is over 3.5 km from either the open pit mine or the Astray rail loop, the possibility of vibration effects from blast or rail operations is considered to be negligible.

In summary, the effect of Project Construction, Operations and Maintenance on a change in ambient vibration levels therefore predicted to be low in magnitude, local in geographical extent, medium term in duration, sporadic in frequency, and reversible.

10.6.5 Assessment of Project-Related Environmental Effects on Lighting

Construction

Portable lighting units may be used during Project Construction in the open-pit mine during mine preparations and grading, and during the construction of on-site infrastructure. Portable light units typically illuminate an area lateral to the unit and are typically bright powerful lights that unavoidably cause some glare and vertically directed illumination. This type of effect is best avoided by using full cutoff fixtures as appropriate that create directed light toward work areas as required. The full cutoff fixture will avoid the transmission of light outside of the property.

Operation and Maintenance

During Project Operation and Maintenance, lighting will be required for work areas at the open pit mine and processing areas during night shifts; this will be achieved through the use of portable lighting plants and lights on mobile equipment. Perimeter lighting (permanent outdoor light fixtures) will be required at the camp areas, surrounding the mine offices, power plant and fuel depot areas and the maintenance shops. Such lighting will be controlled by timers or photocells. There will be no street lighting on any access or haul roads. These permanent light fixtures will be of the full horizontal cut-off type where feasible. Lighting from the mining operations on the Joyce Lake side of Iron Arm will be generally visible to the cabins on the west shoreline.

10.6.5.1 Mitigation of Project Environmental Effects

Construction

The construction lighting will be subject to guidelines in the Environmental Management Plan. The principles will be to use only as much lighting as is necessary for safe and efficient construction activities, and to locate portable lighting equipment where, to the extent feasible, it is not visible at nearby cabins.

Operation and Maintenance

Design of exterior lighting systems for Project Operations and Maintenance will be guided by a strategy based on widely accepted standards and guidelines (i.e., CIE), including direction of light to limit light trespass and to avoid glare. The lighting design guidelines will be especially important on the Joyce Lake side of Iron Arm, as this is one of the few groups of Project activities that can be observed directly from cabins along the mainland side. Proper shielding via the use of full horizontal cutoff fixtures will also be incorporated into the Project lighting plan, and portable lighting plants will be positioned to limit visibility by cabins on the south west side of Iron Arm.

Most of the routes for haul trucks and service vehicles on-site will be shielded by topography and vegetation along their length, and no street lighting is currently planned for these areas. In detailed roadway design, the vehicle routing will take advantage of topographic sheltering, where feasible, and tree cover will be left in place where practicable to reduce the line-of-sight from cabins to the on-site roads.

10.6.5.2 Characterization of Residual Project Environmental Effects

Construction

The effect of Project Construction on a change in lighting after application of mitigation measures is predicted to be low in magnitude, local in geographic extent, short term in duration, will occur sporadically, and reversible.

Operation and Maintenance

With mitigation in place, light from the Project would be visible; however, it would represent a small portion of the horizon, less than 5 degrees, therefore is not expected to have an effect on nearby sensitive receptors.

The effects of Project Operation and Maintenance on a change in lighting after application of mitigation measures are predicted to be low in magnitude, local in geographic extent (could be regional in terms of sky glow; however, sky glow diminishes with distance), medium term in duration, regular in frequency and reversible.

10.6.6 Summary of Project Residual Effects

A summary of residual environmental effects is provided in Table 10.37.

10.7 Assessment of Cumulative Environmental Effects

In addition to assessing Project-specific effects on the Atmospheric Environment and Climate, potential cumulative effects of the Project combined with effects from other current or planned activities within the RSA were also assessed.

A summary of potential cumulative interactions with the Atmospheric Environment and Climate is presented in Table 10.38. The rating system is the same as used for the assessment of Project activity effects (see Section 10.4).

Table 10.37 Summary of Residual Environmental Effects – Atmospheric Environment and Climate

Project Phase	Mitigation/Compensation Measures	Residual Environmental Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-economic Context	Significance	Prediction Confidence	
Change in Air Quality											
Construction	• Fugitive dust suppression • Equipment preventative maintenance programs • Use of qualified blasters with blast design plans • Progressive reclamation • Speed restrictions • Equipment idling policy • Equipment preventative maintenance programs	A	M	L	ST	R	R	U	N	H	Air quality monitoring plan.
Operation and Maintenance		A	M	L	MT	C	R	U	N	H	
Closure and Decommissioning		A	M	L	MT	R	R	U	N	H	
Change in Acoustic Environment											
Construction	• Equipment preventative maintenance programs • Use of mufflers on construction equipment • Speed restrictions • Use of a compliant resolution procedure • Siting of stockpiles away from cabins • Advance warning to nearby sensitive receptors (e.g., cabin occupants) of noise-causing activities.	A	M	L	ST	R	R	U	N	H	Noise monitoring plan.
Operation and Maintenance		A	M	L	MT	C	R	U	N	H	
Closure and Decommissioning		A	M	L	MT	R	R	U	N	H	

Table 10.37 Summary of Residual Environmental Effects – Atmospheric Environment and Climate

Project Phase	Mitigation/Compensation Measures	Residual Environmental Characteristics									Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-economic Context	Significance	Prediction Confidence	
Change in GHG Emissions											
Construction	• Equipment idling and cold start policy • Equipment preventative maintenance programs • Development of GHG Management Plan • Usage of electric bus to transport employees recharged using hydroelectric grid power. • Limiting speed of vehicles on the haul road and service road to improve fuel efficiency. • Lighting will be turned off when not required. • Waste heat from generators will be partially captured and used to heat living and working spaces. • Worker accommodation will offer a variety of plant-based foods to reduce the project's carbon footprint.	A	M	G	ST	R	I	D	N	M	Annual quantification of GHG emissions.
Operation and Maintenance		A	M	G	MT	C	I	D	N	M	
Closure and Decommissioning		A	M	G	ST	R	I	D	N	M	
Change in Vibration											
Construction	• Adherence to equipment maintenance programs • Limit train speed to 8 km/hr in loop	A	L	L	ST	S	R	U		H	Vibration monitoring on a compliant driven basis.
Operation and Maintenance		A	M	L	MT	S	R	U	N	H	
Closure and Decommissioning		A	L	L	ST	S	R	U	N	H	

Table 10.37 Summary of Residual Environmental Effects – Atmospheric Environment and Climate

Project Phase	Mitigation/Compensation Measures	Residual Environmental Characteristics: Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-economic Context	Significance	Prediction Confidence	Recommended Follow-up and Monitoring
Change in Lighting											
Construction	• Direct light where needed • Locate portable lighting equipment where not visible to surrounding dwellings • Use of full horizontal cut off light fixtures, where appropriate.	A	M	L	ST	S	R	U	N	M	None recommended
Operation and Maintenance		A	M	L	MT	S	R	U	N	M	
Closure and Decommissioning		A	M	L	ST	S	R	U	N	M	

Key:

Direction:
P Positive.
A Adverse.
N Neutral.

Magnitude:
N Negligible: No measurable adverse effect anticipated;
L Low: Effect occurs that is detectable but is within normal variability of baseline conditions;
M Moderate: Effect occurs that would case an increase with regard to baseline but is within regulatory limits and objectives;
H High: Effect occurs that would singly or as a substantial contribution in combination with other sources cause exceedances of objectives or standards beyond the Project boundaries.

Geographic Extent:
S Site-specific: Effects are restricted to the PDA.
L Local: Effects restricted to the LSA.
R Regional: Effect restricted to the RSA.
G Global: Provincial, National or Global scale (GHG emissions only)

Duration:
Quantitative measure; or
ST Short-term: Effect restricted to site-preparation or construction phase of the Project
MT Medium-term: Effect extends throughout the construction and operation phases of the Project (1 to 7 years)
LT Long-term: Effect extends beyond closure

Frequency:
O Once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals.
C Continuous.
U Unlikely to occur

Reversibility:
R Reversible.
I Irreversible.

Environmental or Socio-economic Context:
U Undisturbed: Effect occurs in an area that has not currently been affected by human activity.
D Disturbed: Effect occurs in an area previously disturbed by human activity.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

Table 10.38 Potential Cumulative Environmental Effects – Atmospheric Environment and Climate

Other Projects and Activities with the Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects				
	Effect on Air Quality	Effect on the Acoustic Environment	Effect on GHGs[a]	Effect on Vibration	Effect on Lighting
Kami Iron Ore	0	0	NA	0	0
Maritime Transmission Link Project	0	0	NA	0	0
IOC Labrador Operation	0	0	NA	0	0
Fire Lake North Iron Ore Project	0	0	NA	0	0
Wabush Mines	0	0	NA	0	0
Mont-Wright Mine	0	0	NA	0	0
Bloom Lake Mine and Rail Spur	0	0	NA	0	0
Schefferville Iron Ore Mine and Houston 1&2	1	1	NA	0	0
DSO Iron Ore Project	1	1	NA	0	0
Lower Churchill Hydroelectric Generation Project	0	0	NA	0	0

Key:
0 Project environmental effects do not act cumulatively with those of other projects and activities.
1 Project environmental effects act cumulatively with those of other projects and activities, but the resulting cumulative effects are unlikely to exceed acceptable levels with the application of best management or codified practices.
2 Project environmental effects act cumulatively with those of other projects and activities and the resulting cumulative effects may exceed acceptable levels without implementation of project-specific or regional mitigation.

Note:
[a] Potential cumulative effects of GHGs has been rated as “NA” or “Not-applicable” as climate change is global and not considered a local issue, as such, a cumulative effects assessment for an increase in GHG emissions due to the cumulative operation of the Project with other existing and planned projects is not required

10.7.1 Interactions Rated as 0

Interactions between the Project and the Lower Churchill Hydroelectric Generation Project, the Maritime Transmission Link Project, the Kami Iron Ore Project, IOC Labrador Operation, Fire Lake North Iron Ore Project, Wabush Mines, Mont-Wright Mine and Bloom Lake Mine and Rail Spur on the Atmospheric Environment and Climate are not anticipated due to the extreme distance between these projects/operations and the proposed Project. Therefore, these interactions have been rated as 0, as they will not cumulatively interact with the Project.

Interactions with the Project and the Schefferville Iron Ore Mine and Houston 1 & 2 on a change in vibration and lighting are also not anticipated. Distances between projects are such that changes in vibration will be attenuated well before interacting with vibrations from other facilities at sensitive receptors. Lighting effects, including sky glow, will not interact with these other projects due to the distances between these projects within the RSA. These interactions have therefore been rated as 0 for cumulative effects and do not require further assessment.

10.7.2 Interactions Rated as 1

The existing Schefferville Iron Ore Mine and Houston 1 & 2 and the DSO Iron Ore Project are located within 25 to 30 km of the proposed Project and have the potential to result in cumulative changes in air quality and acoustics.

10.7.2.1 Air Quality

Emissions of particulate matter, combustion gases and metals from Project Construction and Operation and Maintenance have been predicted to fall well below provincial guidelines in the vicinity of cabins, with slight exceedances of particulate matter occurring near Project activities. As the emissions resulting from the Project reach essentially zero beyond the LSA, the likelihood that they would overlap with emissions from other nearby existing, planned or future Projects, due to their separation distance, to result in a cumulative environmental effect is unlikely. The resulting residual environmental effects are therefore, not likely to be significant and these interactions have been rated as a 1 and are not further assessed.

10.7.2.2 Greenhouse Gas Emissions

It is recognized that global emissions of GHGs and consequent changes to global concentrations do represent a significant cumulative effect, However, according to IAAC (CEA Agency (2003)) the contribution of an individual Project to climate change cannot be measured. Therefore, given that climate change is global and not considered a local issue, a cumulative effects assessment for an increase in GHG emissions due to the cumulative operation of the Project with other existing and planned projects is not required.

Emissions of GHGs from the Project were quantified and their contribution to provincial and national emissions were assessed. The Project contributes GHG emissions to the provincial and national totals and will therefore hinder Newfoundland and Labrador's and Canada's ability to meet their commitments to reducing GHG emissions; however, the extent of the hinderance is small. The contribution of Project emissions of GHGs, although measurable and potentially important in comparison to local and provincial levels, will be small in a global context.

10.7.2.3 Acoustic Environment

Sound pressure levels decrease with distance from the source. Any potential overlap in noise emissions with other mining sites will be negligible. The Project is located in a remote location where the nearest neighbors are located in seasonal dwellings that currently experience a relatively quiet environment. Generally, noise emissions from the Project are expected to increase ambient sound pressure levels by approximately 5 to 20 dBA at individual receptors; still well below Health Canada's recommended noise levels for both absolute exposure to noise and relative changes in sound pressure levels.

There is the possibility of interactions in the acoustic environment with other projects due to increased rail traffic along the QNS&L and Cartier Railway Company railways. The proponent is projecting additional traffic of 240 cars per day as a result of mining production. Other mining operations could also employ the same railway routes to bring product to market. However, since the proposed Project will make use of existing transportation throughways it will not expand the current network of railways in the region. Any interaction with other development projects in the region will therefore only occur through existing thoroughfares for the delivery of product to market. Traffic along the existing railway will adhere to IACC EIS guidelines and provincial regulations in Quebec to prevent unwanted noise levels from occurring in the region.

Project environmental effects on a change in acoustic environment do have the potential to interact cumulatively with those of LIM's Schefferville Iron Ore Mine and Houston 1 & 2 and Tata's DSO Iron Ore Project; however, the resulting cumulative effects are unlikely to exceed acceptable levels due to the separation distance between these Projects and mitigation likely to be used by all projects. The resulting residual environmental effects are not likely to be significant and these interactions have therefore been rated as a 1 and are not further assessed.

10.8 Accidents and Malfunctions

Accidents and Malfunctions are unplanned events that could result in adverse effects on the Atmospheric Environment and Climate. The emergency response and potential changes in Project operations due to accidents or malfunctions could lead to increased air contaminants, noise levels and GHG emissions. The main accidents and malfunctions scenarios that could affect Atmospheric Environment and Climate:

- Train Derailment;
- Hydrocarbon Spill; and
- Forest Fire.

Accidents and malfunctions are not expected to lead to a substantial change in vibrations or lighting and these interactions are not discussed below (see Section 10.4).

10.8.1 Train Derailment

10.8.1.1 Potential Environmental Effects

Iron ore product will be transported by truck from the Project site to the Astray rail loop, which connects directly to the Tshiuetin/QNS&L railway for transport to Sept-Îles. Diesel fuel will be transported by rail to Schefferville and then by contracted trucker to site. On average, iron ore will be transported on approximately four trains each week during summer months between the Astray rail loop and the Sept-Îles port. Each train set will carry approximately 24,000 tonnes of ore in 240 gondola cars. Based on the speed the train will be travelling in the rail loop (5 miles per hour or 8 km/h), the reasonable worst case is the derailment of a maximum of four to five cars. This could result in the iron ore being spilled onto the ground or at stream crossings. Such an event is highly unlikely.

It is estimated that diesel fuel transport frequency will be a maximum of six 96,000 L tank cars per week for all site purposes.

Fuel tank car numbers are based on shipment in standard 96,000 L tank cars similar to those already in fuel haulage service between Sept-Îles and Labrador City. In a reasonable worst case scenario (i.e., where six tanks of diesel fuel are de-railed), approximately 576,000 L (127,000 Imperial gallons) of diesel fuel could be released.

The emergency response to a train derailment could the use of heavy trucks and diesel operated construction equipment (e.g., loaders). The operation of such equipment would result in releases of CACs and GHGs, and increased noise levels.

10.8.1.2 Emergency Response/Mitigation of Environmental Effects

The trains will be operated under current Tshiuetin/QNS&L environmental and safety procedures. A detailed Emergency Response and Spill Response Plan will also be developed by Labec Century. This plan will include measures such as:

- Immediate response through the use of absorbent booms and pads;
- Liquid clean up using a vacuum truck, when available (both fuel and groundwater); and
- Reclamation of contaminated soils, removal of contaminated soils and replacement with clean soil.

Additional mitigation measures to be implemented to limit the potential for a train derailment include:

- Manual inspection of rolling stock to confirm there are no problems with the wheels, couplers, carbody or brakes;
- Track inspections in accordance with Transport Canada regulations;
- Properly maintained equipment; and
- Fuel transport amounts will be limited to the amounts required by the Project.

10.8.1.3 Characterization of Residual Environmental Effects

Changes to air quality, acoustics and GHG emissions due to a train derailment are expected to be moderate in magnitude, local in geographic extent (global for GHG) and will cease at the conclusion of the clean-up. Residual effects on Atmospheric Environment and Climate are predicted to be not significant; this prediction is made with a high level of confidence.

10.8.2 Hydrocarbon Spill

10.8.2.1 Potential Environmental Effects

Fuel storage on the site will include diesel and fuel oil tanks located at the rail unloading area, near the diesel generators at the mine site, and the process plant area. The maximum total storage capacity for diesel fuel will be 250,000 L. The fuel storage tanks will be located in secondary containment to control spills and will comply with requirements of the applicable provincial and federal acts and regulations, as well as the conditions of the permit and authorizations. The control measures will be able to contain the maximum capacity of all tanks in a storage area.

If a hydrocarbon fuel spill was to occur within the PDA, releases of CACs, GHGs and increased noise levels would occur as a result of the operation of various pieces of equipment needed to contain, clean up the spill and remediate. There would also be the release of volatiles directly to the atmosphere from the fuel spill itself.

10.8.2.2 Emergency Response/Mitigation of Environmental Effects

The main mitigation measures for a hydrocarbon spill relate to prevention and rapid and effective cleanup. As part of the Emergency Response and Spill Response Plan, spill prevention and response protocols will include the inspection of vehicles and hydraulics on a daily basis for leaks or damage that could cause minor spills and rapid spill response. Vehicles and equipment will be stored in controlled areas where secondary containment of spills can be provided. Staff will be trained in the handling of emergency response and spill scenarios. Response equipment stored on site will include containment and absorbent booms, pads, barriers, sand bags, and skimmers, as well as natural and synthetic sorbent materials.

10.8.2.3 Characterization of Residual Environmental Effects

Changes to air quality, acoustics and GHG emissions due to a hydrocarbon spill will be low to moderate in magnitude, local in geographic extent (global for GHG emissions), short term in duration and will cease at the conclusion of the clean-up. Residual effects on Atmospheric Environment and Climate are predicted to be not significant; this prediction is made with a high level of confidence.

10.8.3 Forest Fire

10.8.3.1 Potential Environmental Effects

Although unlikely, Project activities involving the use of heat or flame could result in a fire. Fires can alter habitat, consume vegetation, and lead to air emissions. The extent and duration of a fire would be dependent on response efforts and meteorological conditions.

10.8.3.2 Emergency Response/Mitigation of Environmental Effects

Fire suppression water systems will be maintained on site. The fire suppression water supply at the mine and processing sites will be extracted from Attikamagen Lake and stored in water reservoirs prior to use. The fire suppression water at the Astray rail loop will be extracted from Astray Lake. Staff will be trained to prevent and control fires. A plan for preventing and combating forest fires will be incorporated into the Emergency Response and Spill Response Plan.

The nearest district forest management unit office in Labrador is in Wabush, which has staff and equipment to provide initial suppression activities. The Town of Schefferville also provides fire control services. Labec Century is discussing a reciprocal response arrangement with the Town of Schefferville, approximately 20 km away from the site. In the event of a fire, the on-site response and proximity of fire suppression services in Schefferville will limit the size of any burn.

10.8.3.3 Characterization of Residual Environmental Effects

Changes to air quality, acoustics and GHG emissions will be moderate in magnitude, local in extent, sporadic in frequency, short term in duration and will cease at the conclusion of the fire suppression response. Changes to air quality and GHGs could range in magnitude and extent depending on the extent and duration of a forest fire. In a worst case scenario, a large forest fire caused by Project activities could result in significant effects on air quality (i.e., temporary exceedance of air quality standards). This prediction is made with a moderate level of confidence.

10.8.4 Summary of Residual Effects Resulting from Accidents and Malfunctions

A summary of residual environmental effects resulting from accidents and malfunctions is summarized in Table 10.39.

10.9 Determination of Significance of Residual Adverse Environmental Effects

This section summarizes the predicted residual effects on Atmospheric Environment and Climate based on criteria provided in Section 10.3.

10.9.1 Project Residual Environmental Effects

10.9.1.1 Change in Air Quality

Project Construction will result in emissions of CACs (particulate matter and combustion gases) from operation of heavy equipment and vehicle travel on unpaved roads. Such emissions will be localized and temporary.

Table 10.39 Summary of Residual Environmental Effects – Accidents and Malfunctions

Project Phase	Emergency Response/Contingency Measures	Direction	Residual Environmental Characteristics						Significance	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental/Socio-economic Context			
Change in Air Quality											
Fuel Spill	• Develop and Implement Emergency Response and Spill Response Plan	A	L	L	ST	R	R	U	N	H	Remediation and monitoring, as required
Train Derailment	• Develop and Implement Emergency Response and Spill Response Plan	A	L	L	ST	R	R	U	N	H	Remediation and monitoring, as required
Forest Fire	• Develop and Implement Emergency Response and Spill Response Plan	A	L-H	L-R	ST	R	R	U	N-S	M	Remediation and monitoring, as required
Change in Acoustics											
Fuel Spill	• Develop and Implement Emergency Response and Spill Response Plan	A	L	L	ST	R	R	U	N	H	Remediation and monitoring, as required
Train Derailment	• Develop and Implement Emergency Response and Spill Response Plan	A	L	L	ST	R	R	U	N	H	Remediation and monitoring, as required
Forest Fire	• Develop and Implement Emergency Response and Spill Response Plan	A	L	L	ST	R	R	U	N	H	Remediation and monitoring, as required
Change in GHG Emissions											
Fuel Spill	• Develop and Implement Emergency Response and Spill Response Plan	A	L	L-G	ST	R	R	U	N	H	Remediation and monitoring, as required,
Train Derailment	• Develop and Implement Emergency Response and Spill Response Plan	A	L	L-G	ST	R	R	U	N	H	Remediation and monitoring, as required

Table 10.39 Summary of Residual Environmental Effects – Accidents and Malfunctions

Project Phase	Emergency Response/Contingency Measures	Direction	Residual Environmental Characteristics						Significance	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental/Socio-economic Context			
Forest Fire	• Develop and Implement Emergency Response and Spill Response Plan	A	L-H	L-G	ST	R	R	U	N	H	Remediation and monitoring, as required

KEY:

Direction:
P Positive.
A Adverse.
N Neutral.

Magnitude:
N Negligible: No measurable adverse effect anticipated;
L Low: Effect occurs that is detectable but is within normal variability of baseline conditions;
M Moderate: Effect occurs that would case an increase with regard to baseline but is within regulatory limits and objectives;
H High: Effect occurs that would singly or as a substantial contribution in combination with other sources cause exceedances of objectives or standards beyond the Project boundaries.

Geographic Extent:
S Site-specific: Effects are restricted to the PDA.
L Local: Effects restricted to the LSA.
R Regional: Effect restricted to the RSA.
G Global: Provincial, National or Global scale (GHG emissions only)

Duration:
Quantitative measure; or
ST Short-term: Effect restricted to site-preparation or construction phase of the Project
MT Medium-term: Effect extends throughout the construction and operation phases of the Project (1 to 7 years)
LT Long-term: Effect extends beyond closure

Frequency:
O Once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals.
C Continuous.
U Unlikely to occur

Reversibility:
R Reversible.
I Irreversible.

Environmental or Socio-economic Context:
U Undisturbed: Effect occurs in an area that has not currently been affected by human activity.
D Disturbed: Effect occurs in an area previously disturbed by human activity.

Significance:
S Significant.
N Not Significant.

Prediction Confidence:
Based on scientific information and statistical analysis, and effectiveness of mitigation or effects management measure
L Low level of confidence.
M Moderate level of confidence.
H High level of confidence.

Project Operation and Maintenance will result in emissions of particulate matter and combustion gases from vehicles, haul trucks, mining equipment, locomotives and generators. Fugitive releases of particulate matter will also occur through material (waste rock, overburden and ore) handling, ore crushing and screening, vehicle and haul truck travel on unpaved roads, wind erosion of waste, overburden and product stockpiles, and the loading of rail cars. The residual environmental effects will include an increase in CACs above baseline conditions, but within provincial regulatory limits and federal objectives at the closest cabins locations and will be restricted to the LSA.

In summary, with proposed mitigation, the residual environmental effects of the Project on a change in air quality are not likely to be significant. This prediction is made with a high level of confidence.

10.9.1.2 Change in Acoustic Environment

Project Construction will result in increased ambient noise levels in the LSA from operation of heavy equipment. Construction noise emissions will be localized and temporary and are not anticipated to increase sound levels substantially beyond baseline conditions at nearby sensitive receptors.

Project Operation and Maintenance will result in noise emissions from vehicles and trucks involved in the mining process, drilling and blasting activities, ore handling and processing, and material movement to stockpiling facilities or to rail cars. Noise modelling predicted that Project Operation and Maintenance will result in slightly increased sound pressure levels at the nearest sensitive receptors; however, with proposed mitigation, these increases are not predicted to result in an exceedance of noise levels recommended by Health Canada.

In summary, with the proposed mitigation, the residual environmental effects of the Project on a change in the acoustic environment are not likely to be significant. This prediction is made with a high level of confidence.

10.9.1.3 Change in Greenhouse Gases

Provincial and federal policies and regulations do not identify specific thresholds or standards for determining significance when assessing the residual effects of a single Project’s GHG emissions. The primary criterion used to assess significant effects of Project-related changes in GHG emissions is magnitude. The GHG emissions from the Project are compared to provincial and national GHG inventories to establish a context for the magnitude of emissions following the Strategic Assessment of Climate Change (ECCC 2020a) guidance. As described in Section 10.3, the Project GHG emission contributions will be ranked as low, moderate or high as per guidance from IAAC (CEA Agency 2003).

The Project contributes GHG emissions to the provincial and national totals and will therefore hinder Newfoundland and Labrador’ and Canada’s ability to meet their commitments to reducing GHG emissions; however, the extent of the hinderance is small. The Project GHG emissions during construction and operation represent a small contribution to provincial and national GHG emissions. On the maximum annual basis, the construction emissions contribute approximately

0.27% and 0.004% to provincial and national GHG emission totals, respectively. The operation contributes approximately 0.64% and 0.010% to the provincial and national emission totals, respectively. The Project emissions are ranked as low during construction and moderate during operation. The Project life is only eight years, afterwards the GHG emissions would cease and no long hinder Canada's abilities to their GHG emission reduction commitments. Based on these results and the characterization of residual effects in Section 10.6.3, the residual environmental effects from the Project on GHG emissions are predicted to be not significant.

10.9.1.4 Change in Vibration

Project Construction will result in vibration from the operation of heavy machinery and from blasting that may be required during site preparation. Due to the distance from the Project site to the nearest receptors, vibration during Construction will generally be negligible.

Project Operation and Maintenance will result in vibration from the blasting within the open pit mine and from rail transport. As with construction blasting, blasting during mining operations will be conducted by specialized contractors according to approved blast design plans. An assessment of the potential vibration at the nearest cabins was within the applicable n criteria.

In summary, with the proposed mitigation measures, the residual environmental effects of the Project on vibration are not likely to be significant. This prediction is made with a high level of confidence.

10.9.1.5 Change in Lighting

Project Construction and Operation and Maintenance will require night-time lighting. Exterior lighting will be designed to reduce the amount of light trespass, sky glow and glare.

In summary, with the proposed mitigation the residual environmental effects of the Project on a change in lighting are not likely to be significant. This prediction is made with a high level of confidence.

10.9.2 Cumulative Environmental Effects

10.9.2.1 Change in Air Quality

Air emissions from the construction and operation of the proposed Project are not expected to overlap with the operation of the closest existing or planned Projects as Project air emissions have been predicted to be negligible outside of the LSA. Therefore, with the proposed mitigation the residual cumulative effect of a change in air quality is predicted to be not significant.

10.9.2.2 Change in Acoustics

The separation distances between the proposed Project and other current or planned projects in the RSA indicate that there will be little to no overlap of noise emissions from the projects. The Project will be utilizing existing rail infrastructure to deliver product to the market, and will therefore not be facilitating the creation of additional noise sources through the construction of new railway lines. Therefore, with the proposed mitigation the residual cumulative effect of a change in the acoustic environment is predicted to be not significant.

10.9.2.3 Change in Greenhouse Gases

As the contribution of the Project's GHG emissions is a considered a global cumulative effect, a cumulative effects assessment for an increase in GHG emissions due to the cumulative operation of the Project with other existing and planned projects in the RSA or LSA is not required. Emissions of GHGs from the Project were quantified and their contribution to provincial and national emissions were assessed. The Project contributes GHG emissions to the provincial and national totals and will therefore hinder Newfoundland and Labrador'ss and Canada's ability to meet their commitments to reducing GHG emissions; however, the extent of the hinderance is small. The contribution of Project emissions of GHGs, although measurable and potentially important in comparison to provincial levels, will be small in a global context. Therefore, the cumulative effect of a change in GHG emissions from the Project is predicted to be not significant.

10.9.3 Accidents and Malfunctions

10.9.3.1 Air Quality and Greenhouse Gases

Accidents and malfunctions during the lifetime of the Project, including train derailment, hydrocarbon spill and forest fire, will result in additional emissions of CACs and GHGs. Those related to a train derailment and hydrocarbon spill will be low in magnitude, local in geographic extent and temporary in nature. Therefore, with the proposed mitigation and emergency response planning the residual adverse environmental effect on air quality and GHG emissions as a result of a train derailment or hydrocarbon spill is not likely to be significant. Depending on the geographic extent and severity of a forest fire however, the residual adverse environmental effect on air quality and GHG emissions could be significant.

10.9.3.2 Acoustics

An accident or malfunction during any phase of the project will result in a temporary increase in noise emissions through the deployment of emergency crews and some heavy machinery to the affected area. The residual effects due to an accident or malfunction, including train derailment, hydrocarbon spill and forest fire, on the acoustic environment is predicted to be not significant.

10.10 Follow-up and Monitoring

10.10.1 Air Quality

An air quality monitoring plan will be developed in consultation with regulatory authorities, and will be incorporated into the Project EMP and/or EPP.

10.10.2 Acoustic Environment

A complaint driven noise monitoring plan will be developed in consultation with regulatory authorities, and will be incorporated into the Project Environmental Management and/or Protection Plans.

10.10.3 Greenhouse Gases

Greenhouse gas emissions resulting from the Project will be quantified on an annual basis and depending on the magnitude, will report accordingly to provincial and federal reporting programs as described in Section 10.2.1.3. In addition, depending on the magnitude of the annual GHG emissions, the Project will be subject to GHG emission verifications, both provincial and federal GHG reduction targets, and carbon pricing, as described in Section 10.2.1.3.

10.10.4 Vibrations

Monitoring for vibration for construction and operation will be conducted on a complaint driven basis. If, upon monitoring, levels exceed the criteria levels, further mitigation may be required.

Vibration monitoring will be conducted for the first blasting at a representative distance of the nearest house or 500 metres, whichever is closer. If the levels are below the criteria, no subsequent monitoring will be conducted. If they are above the criteria, monitoring will be conducted at the nearest dwelling for all subsequent blasting and blast design will consider the setback as well.

10.10.5 Lighting

No follow-up monitoring is proposed for lighting.

10.11 Summary

Project Construction and Operation and Maintenance will result in an interaction with the Atmospheric Environment and Climate. However, with the deployment of proposed mitigation measures outlined in this assessment, no exceedances of applicable objectives, criteria, or standards are expected at the cabin locations.

In conclusion, the residual effects of the Project on a change in the Atmospheric Environment and Climate are predicted to be not significant.

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