Howse Minerals Limited

Howse Mine Property – Environmental Assessment – Noise and Vibration Report

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Revision Log

Revision #	Revised By	Date	Issue / Revision Description
0	Brian Bulnes	January 20, 2015	Original document
1	Brian Bulnes	October 29, 2015	Updated to include new mining plan, noise sources, receptors, and address CEAA/Community comments.

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Executive Summary

In accordance with the Canadian Environmental Assessment Agency (CEAA) document *Guidelines for the Preparation of an Environmental Impact Statement – Howse Property Iron Mine,* a noise and vibration assessment is required for the operation of the proposed Howse mining site. This report documents the impact of noise, ground vibration, and blasting overpressure on sensitive receptors surrounding the Howse Mining Site.

The proposed Howse mining site is located in Newfoundland and Labrador, approximately twenty three kilometres northwest of Schefferville, Quebec, near the provincial border of Newfoundland and Labrador, and Quebec. The site will be located in close proximity to the Direct Shipping Ore 3 (DSO3) project. DSO3 consists of Timmins 3, Timmins 4, Timmins 7, and Fleming 7 mining sites, in addition to production plants.

Results of the environmental noise assessment (see Section 4.1.3) indicate that the operation of the new Howse mining site will have an impact of 5dB at receptor R13 (Naskapi-Uashat People's Camp), located northwest of the Howse Mine. The largest contributors to this exceedance are the Howse Mine track drill (used for drilling of holes for blasting at the Howse Mine) and nearby First Nations crusher (located next to the east side of the Howse mining site). It is likely that this impact will result in negative community response. Howse Minerals Limited has committed to preparing a mitigation plan for the Howse mine track drill (the highest source of noise impact), should complaints occur (discussed in Section 4.1.4). Note that the First Nation’s crusher contributes to the project noise levels (2nd highest noise impact) causing an exceedance. Addressing noise levels from the First nation’s crusher will reduce the likelihood of potential complaints.

The blast impact analysis addresses blasting feasibility based on Quebec’s “DIRECTIVE 019-SUR L’INDUSTRIE MINIÈRE, MARS 2012” and the Ministry of the Environment (MOE) Model Municipal Noise Control By-law (NPC 119). Given that mining operations have not been undertaken in the past on this specific property, site-specific blast data is not available. Vibration and overpressure levels from the blasting are predicted using MOE 1985 “Guidelines on Information Required for Assessment of Blasting Noise and Vibration” models. It is a recommendation of this report that a vibration and overpressure monitoring program be initiated onsite upon the commencement of blasting operations to further develop blasting plans. Details on blasting program and monitoring recommendations are provided in Section 4.2.4.

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1. Introduction

In accordance with the Canadian Environmental Assessment Agency (CEAA) document *Guidelines for the Preparation of an Environmental Impact Statement – Howse Property Iron Mine,* an environmental assessment is required for the operation of the proposed Howse Mine site. The proposed Howse Mine is located in close proximity to the Direct Shipping Ore 3 (DSO3) project site. As part of the environmental assessment, this report documents the impact of noise, ground vibration, and overpressure on sensitive receptors surrounding the Howse Mine site.

Noise and Vibration sensitive areas were identified using land use maps, and a DSO3 project site map. These areas include a nearby workers' camp, towns, and Innu, Uashat-Mani-Utenam, and Naskapi camps. Worst case (typically the closest to mining operations) receptors were assessed. Areas further removed from mining operations will receive lower noise and vibration impacts. Receptors are presented in Appendix A and are further discussed in Section 3.

2. Background

The proposed Howse Mine site is located in Newfoundland and Labrador, approximately twenty-three kilometres northwest of Schefferville, Quebec, near the provincial border of Quebec and Newfoundland and Labrador. The site will be located in the vicinity of the DSO3 project. The DSO3 operations include the Timmins 3, Timmins 4, Timmins 7, and Fleming 7 mine sites, in addition to the Main Processing Plant and Plant 2 complexes. Noise sources associated with DSO3 include excavation, drilling, grading, trucking activities, and ore processing (crushing, screening, drying).

The addition of the Howse Mine will result in the following operational changes:

- Additional crushing/screening/drying area near the rail loop (this area is referred to as Howse Mini-Plant)
- Operation of new Howse Mine site
- Increased haul truck and train operations
- Mining plan changes for Timmins and Fleming mine sites
- First Nations crushing plant near Howse Mine

3. Receptors

A number of locations in Newfoundland and Labrador and Quebec were identified as noise and vibration sensitive areas surrounding the production plants and mining sites. These locations included:

- Innu Camps
- Innu-Uashat-Mani-Utenam Camps
- Naskapi Camps
- Workers' Camp
- Towns (Schefferville, Kawawachikamach, Lac John and Matimekush[1])

The study area boundaries were within available land use mapping limits, and include worst case receptors in every direction surrounding the Howse Mine. Fourteen receptors were modelled representing the worst case location (typically the closest to mining operations) of each noise sensitive area. Areas further removed from mining operations will receive lower noise and vibration impacts. Assessment criteria differs between Newfoundland and

[1] *Schefferville was assessed instead of Kawawachikamach, Lac John, and Matimekush as Schefferville is in closer proximity to the mining operations.*

Labrador, and Quebec, therefore criteria for each receptor varied based upon their location. Assessment criteria for both provinces are further discussed in Section 4.1.1.

Table 1 details each modelled receptor and the noise sensitive area(s) it represents. Locations and impact results (further discussed in Section 4.1.3) are presented in Appendix A.

Table 1: Modelled Receptors

Receptor Name	Receptor ID	Province	Description
TSMC Workers' Camp	R40	Newfoundland and Labrador	Workers' camp, located approximately 700 metres south of Timmins 3 Mine site, 5.2 kilometres southeast of Howse Mine.
Innu Tent 1	R7	Newfoundland and Labrador	Innu tent site, located approximately 4.7 kilometres south of Howse Mine site, north of Elross Lake.
Innu Cabin 3	R25	Quebec	Innu cabin site, located approximately 12.8 kilometres east of Howse Mine site, near Lac La Cosa.
Young Naskapi Camp 7 (Pinette Lake)	R9	Newfoundland and Labrador	Young Naskapi camp site on east edge of Pinette Lake, located approximately 950 metres southeast of Howse Mine.
Young Naskapi Camp 3	R10	Newfoundland and Labrador	Young Naskapi camp site, located approximately 1000 metres north west of Howse Mine site, across the river from Irony Mountain.
Young Naskapi Trailer Tent (Triangle Lake)	R11	Newfoundland and Labrador	Young Naskapi trailer site, located approximately 1.6 kilometres northwest of Howse Mine site, southeast of Triangle Lake.
Young Naskapi Camp 5 (Elross Creek)	R12	Newfoundland and Labrador	Young Naskapi camp site on the east side of Elross Creek, located approximately 3.9 kilometres southeast of Howse Mine site.
Naskapi – Uashat People's Camp	R13	Newfoundland and Labrador	Naskapi-Uashat people's camp site on northwest corner of Irony Mountain, located approximately 950 metres northwest of Howse Mine site.
Innu-Uashat-Mani-Utenam Camp 1	R16	Quebec	Innu-Uashat-Mani-Utenam camp site, located approximately 3.2 kilometres north of Timmins 4 Mine site, 3.0 kilometres northeast of Howse Mine.
Innu-Uashat-Mani-Utenam Camp 2	R17	Newfoundland and Labrador	Innu-Uashat-Mani-Utenam camp site located on west side of Irony Mountain, located approximately 2.2 kilometres west of Howse Mine site.
Innu-Uashat-Mani-Utenam Camp 3 (Inukshuk Lake)	R18	Quebec	Innu-Uashat-Mani-Utenam camp site, located approximately 500 metres north of Timmins 7 Mine site, 3.9 kilometres east of Howse Mine.
Innu Cabin 2	R20	Quebec	Innu cabin site, located near Lac Star, approximately 12.5 kilometres southeast of Howse Mine site.
Irony Mountain	R24	Newfoundland and Labrador	Irony mountain, located approximately 1.2 kilometres southwest of Howse Mine site.
Schefferville (Town)	R39	Quebec	Town in Quebec located approximately 15.5 kilometres south east of Fleming 7 Mine site, 22.5 kilometres southeast of Howse Mine.

4. Assessment

4.1 Operations

4.1.1 Criteria

A review of Newfoundland and Labrador Department of Environment and Conservation information has revealed that there are no available noise and vibration guidelines. A review of Canadian Environmental Assessment Agency (CEAA) sources has also revealed no specific guidelines or limits. Health Canada states: “Health Canada does not have noise guidelines or enforceable noise thresholds or standards.” [2] However, Health Canada does utilize a formula for determining health impacts created by noise, further explained in this section below.

To determine the environmental noise effects as required by the CEAA[3], this assessment has been completed with respect to the anticipated community response to changes in noise level due to the project. Guidance on this relationship is provided in *ISO/R 1996: Assessment of the Noise with Respect to Community Response*. Table 2 below describes the estimated community response with respect to change in noise level above pre-existing background levels. Similar to traffic noise impact assessments and other projects with criteria based upon noise level difference, a 5dB exceedance of criteria has been adopted as the threshold for noise mitigation investigation.

Table 2: Estimated Community Response to Noise – ISO/R 1996

Amount in dB(A) by which the rating sound level exceeds the noise criterion.	**Estimated Community Response**	
	Category	Description
0	None	No observed reaction
5	Little	Sporadic complaints
10	Medium	Widespread complaints
15	Strong	Threats of community action
20	Very Strong	Vigorous community action

Per discussions between Howse Minerals Limited and CEAA, the DSO3 operations shall be considered as part of the background noise. Therefore, the basis of assessment, at each Newfoundland and Labrador receptor, will be the higher of either the base DSO3 operation noise levels, or the existing outdoor ambient noise level. Measurements of the existing ambient noise levels were taken by Tecsult in 2006 can be found in Howse project description documentation[4]. The Tecsult report defined the ambient background noise as the L_{95} measurement. The relevant results of the ambient background measurements are presented in Table 3.

Table 3: Ambient Background Measurements - Tecsult, 2006

Location ID (Decimal Degrees)	**Description**	**Period**	**L_{95} Ambient Noise (dBA)**
Station 1: -67,21595 54,89924	Located 4.5 kilometres southwest of Howse Mine. Background noise from natural environment includes presence of birds, wind, etc.	Day	33.0
		Night	35.5
Station 2: -67,23445 54,89814	Located 5.7 kilometres southwest of Howse Mine. Background noise from natural environment includes presence of birds, wind, etc.	Day	33.5
		Night	34.9

2 *Health Canada, Useful Information for Environmental Assessments, 2010.*

3 *Guidelines for the Preparation of an Environmental Impact Statement, Pursuant to the Canadian Environmental Assessment Act, 2012 – Howse Property Iron Mine, July 14, 2014.*

4 *Howse Minerals Limited, Project Registration/Project Desciption for the DSO – Howse Property Project, April 2014.*

Receptors in Quebec have been assessed against the Quebec guidelines for stationary noise sources[5], as the mine site is located in close proximity to the Quebec – Newfoundland and Labrador border. Guidelines state the greater of current residual noise levels, or maximum L_{eq} per "zoning" area be used as the basis of assessment. Table 4 presents maximum L_{eq} levels for receptors in Quebec, sorted by "zoning" area.

Table 4: Maximum L_{eq} per Zoning Area – Quebec Guidelines for Stationary Noise Sources

Zoning Area	Day L_{eq} (dBA)	Night L_{eq} (dBA)
I	45	40
II	50	45
III	55	50
IV	70	70

"Zoning" areas for receptors in Quebec are sorted into 4 different types:

Type I: Territory for single-family, detached or attached dwellings
Type II: Territory for multiple dwelling units, parks, mobile homes, institutions or campsites.
Type III: Lands for parks or recreational commercial uses.
Type IV: Land zoned for industrial or agricultural purposes.

The nearby camp receptors and town of Schefferville in Quebec can be classified as Type I areas per the above description. Therefore, basis of assessment for day time noise levels was either the greater of the predicted base DSO3 noise level or 45 dBA. The basis of assessment for night-time noise levels was either the greater of the predicted base DSO3 noise level or 40 dBA.

Health Canada uses a change in highly annoyed percentage (%HA_n) as a measure for determining health impacts of noise generated by wind turbine, road traffic, and industrial noise sources. For industrial noise sources, this relationship is given by the formula[6]:

$$HA_n = \frac{100}{[1+\exp(10.4-0.132(L_{dn})]} \quad (1)$$

where
%HA_n = Highly annoyed percentage
L_{dn} = Day-night sound level

Day-night sound level (L_{dn}) is the average noise level over a 24 hour period, where a 10dB penalty is applied to night time noise hours. L_{dn} (using 15 hour day and 9 hour night periods) can be calculated using the following formula:

$$L_{dn} = 10log[\frac{\left(15*10^{0.1L_{eq,day}}\right)+\left(90*10^{0.1L_{eq,night}}\right)}{24}] \quad (2)$$

where $L_{eq,day}$ and $L_{eq,night}$ are hourly equivalent sound levels for day and night hours, respectively.

Health Canada has recommended that noise mitigation be recommended when a project related increase in %HA_n is greater than 6.5%. Highly Annoyed percentage assessments for each receptor can be found in section 4.1.3.

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[5] *Ministere du Developpement durable, Environnement et Lutte contre les changements climatique, Traitement des plaintes sur le bruit et exigences aux entreprises qui le génèrent, June 2006.- Referenced in Quebec's "DIRECTIVE 019-SUR L'INDUSTRIE MINIÈRE, MARS 2012".*

[6] *A justification for using a 45 dBA sound level criterion for wind turbine projects, Stephen E. Keith, David S. Michaud, Stephen H.P. Bly, 2008.*

4.1.2 Noise Sources

The project will consist of three phases: Preparation and Construction, Operations, and Decommissioning. All three phases use similar equipment. The Operations phase has the highest amount of equipment and greatest operational areas (thus having the highest noise impact), and therefore was the only phase assessed. Operations phase noise modelling requires two scenarios for this assessment: Base DSO3, and Future Case. The base DSO3 case scenario contains noise sources at the following areas:

- Main Processing Plant
- Production Plant 2 (currently operating east of the Main Processing Plant)
- Timmins 3,4,7 Mining Sites
- Fleming 7 Mining Site
- Roads connecting production plants and Timmins and Fleming mining sites
- Road connecting DSO3 to Kivivic mine site (eg. DSO4)

Trains are not currently in daily operation during the Base DSO3 operations, and therefore were excluded from the base DSO3 noise modelling. The future worst case scenario with the highest amount of mine production contains noise sources at the same areas listed above, (with the exceptions of Timmins mine sites which will no longer be active during the worst case scenario), in addition to the following:

- Howse Mining Site
- Howse Mini-plant (processing plant for Howse ore) located near the rail loop
- Roads between Plants and Howse Mining Site
- Daily train operations east of Plant 1
- First Nations crushing site (located next to the Howse Mine site, on the east side)

Future locations of the new Howse Mini Plant and the First Nations crusher can be found in Appendix A.

All equipment types included in the noise modelling is listed below. A full detailed equipment list (including make, model number, serial number [as applicable], negligible sources, and number at each location) for all locations is provided in Appendix B.

- Vibration Screen
- Apron Feeder
- Feed Hopper
- Hydraulic Rock Breaker
- Primary Sizer
- Secondary Sizer
- Roof Fans
- Wall fans
- HVAC Ventilation Unit
- Vacuum Pump Blowers
- 2MW Generators
- Generator Rad Fans
- Hydraulic Excavators
- Production Drill
- Track Dozer
- Road Grader
- Haul Trucks
- Train (Idling and Travelling)
- Diesel-fired Burners
- Induced draft fans

Equipment noise data was gathered from manufacturer data, previous equipment measurements, BSI British Standards, and Roadway Construction Noise Model (RCNM) data. It should be noted that RCNM data is typical of conservative worst case situations. Train data was provided by Howse Minerals Limited. A typical train consists of 2 locomotives, 212 cars, travelling between 25-50 km/h. As is typical in noise assessments, noise generated by receptors is not part of the project, and therefore have not been included in this assessment.

4.1.3 Impact Assessment

Noise levels for the Base (pre-Howse DSO3 mining) and Future scenarios were modelled with the ISO 9613 standard implemented in the CadnaA modelling package. Noise levels for the train were modelled using Federal Transit Administration (FTA) railroad methodology, also implemented in CadnaA. Ground topography for the area was obtained from publicly available resources using digital elevation data from the Geobase Initiative[7]. The digital elevation data was used to generate ground elevation contour lines in the noise model. Noise level contours are provided in Appendix A.

Predicted day-time and night-time noise level impacts at each nearby Newfoundland and Labrador receptor are presented in Table 5 and Table 6. Each receptor is representative of noise sensitive areas surrounding the two production plants and each mining site. Results for each receptor are also presented in Appendix A.

Table 5: Day-Time Base and Future Scenario Noise Levels - Newfoundland and Labrador

Receptor	Receptor ID	Base DSO3 Noise Level (dBA)	Basis of Assessment (dBA)[8]	Future Scenario Noise Level (dBA)	Impact (dBA)
TSMC Workers' Camp	R40	52.1	52.1	52.7	0.6
Innu Tent 1 (Elross Lake)	R7	31.1	33.0	32.2	-
Young Naskapi Camp 7 (Pinette Lake)	R9	40.9	40.9	45.4	4.5
Young Naskapi Camp 3	R10	29.1	33.0	37.4	4.4
Young Naskapi Trailer Tent (Triangle Lake)	R11	27.9	33.0	32.1	-
Young Naskapi Camp 5 (Elross Creek)	R12	40.9	40.9	41.6	0.7
Naskapi – Uashat People's Camp	R13	29.3	33.0	38.0	5.0
Innu - Uashat - Mani-Utenam Camp 2	R17	26.2	33.0	28.5	-
Irony Mountain	R24	33.2	33.2	37.9	4.7

Table 6: Night-Time Base and Future Scenario Noise Levels - Newfoundland and Labrador

Receptor	Receptor ID	Base DSO3 Noise Level (dBA)	Basis of Assessment (dBA)[9]	Future Scenario Noise Level (dBA)	Impact (dBA)
TSMC Workers' Camp	R40	52.1	52.1	52.7	0.6
Innu Tent 1 (Elross Lake)	R7	31.1	34.9	32.1	-
Young Naskapi Camp 7 (Pinette Lake)	R9	40.9	40.9	45.4	4.5
Young Naskapi Camp 3	R10	29.1	34.9	37.4	2.5
Young Naskapi Trailer Tent (Triangle Lake)	R11	27.9	34.9	32.1	-
Young Naskapi Camp 5 (Elross Creek)	R12	40.9	40.9	41.6	0.7
Naskapi – Uashat People's Camp	R13	29.3	34.9	38.0	3.1
Innu - Uashat - Mani-Utenam Camp 2	R17	26.2	34.9	28.4	-
Irony Mountain	R24	33.2	34.9	37.7	2.8

The predicted noise impact (≥ 5dB) at the Naskapi – Uashat People's Camp (R13) camp site (west of Howse Mine) triggers mitigation investigation. The noise sources creating the greatest noise impact on the camp site were the drill

[7] *Geobase Initiative– Canadian Digital Elevation Data. 2011. Retrieved from http://www.geobase.ca/geobase/en/find.do?produit=cded. Date accessed 15 September 2014.*

[8] *Ambient background measurements indicate an existing noise level without mining of 33-35 dBA.*

[9] *Ambient background measurements indicate an existing noise level without mining of 33-35 dBA.*

operating at the Howse mining site, and the First Nations crusher operation near Howse mine. Sporadic noise complaints are expected if no mitigation is implemented. Noise impact at Irony Mountain is close to exceeding criteria. Moving the First Nations crusher further north behind an existing berm or overburden pile may reduce likelihood of noise complaints.

Predicted day-time and night-time noise level impacts at each nearby Quebec receptor are presented in Table 7 and Table 8. For receptors in Quebec, sound levels were assessed against the greater of predicted base level ambient noise or maximum L_{eq} levels set for Zone I areas.

Table 7: Day-Time Base and Future Scenario Sound Levels - Quebec

Receptor	Receptor ID	Base DSO3 Noise Level (dBA)	Basis of Assessment (dBA)	Future Scenario Noise Level (dBA)	Impact (dBA)
Innu Cabin 3	R25	23.5	45.0	26.1	-
Innu - Uashat - Mani-Utenam Camp 1	R16	30.8	45.0	32.9	-
Innu - Uashat - Mani-Utenam Camp 3	R18	46.8	46.8	48.2	1.4
Innu Cabin 2	R20	24.0	45.0	38.7	-
Schefferville (town)	R39	12.6	45.0	24.3	-

Table 8: Night-Time Base and Future Scenario Sound Levels - Quebec

Receptor	Receptor ID	Base DSO3 Noise Level (dBA)	Basis of Assessment (dBA)	Future Scenario Noise Level (dBA)	Impact (dBA)
Innu Cabin 3	R25	23.5	40.0	24.3	-
Innu - Uashat - Mani-Utenam Camp 1	R16	30.8	40.0	32.8	-
Innu - Uashat - Mani-Utenam Camp 3	R18	46.8	46.8	48.2	1.4
Innu Cabin 2	R20	24.0	40.0	24.5	-
Schefferville (town)	R39	12.6	40.0	13.1	-

There were no predicted noise impact exceedances for any receptors in Quebec.

The following table presents the Day-Night noise levels and change in Highly Annoyed percentage for each receptor.

Table 9: Day-Night Noise Levels and Change in Highly Annoyed Percentage

Receptor Name and ID	Receptor ID	Base DSO3 Day-Night Level (dBA)	Future Scenario Day-Night (dBA)	Base DSO3 Highly Annoyed Percentage (%)	Base DSO3 Highly Annoyed Percentage (%)	Change in Highly Annoyed Percentage (%)
Innu Tent 1	R7	37.5	38.5	0.43	0.49	0.06
Young Naskapi Camp 7	R9	47.3	51.8	1.54	2.76	1.22
Young Naskapi Camp 3	R10	35.5	43.8	0.33	0.98	0.65
Young Naskapi Trailer Tent	R11	34.3	38.5	0.28	0.49	0.21
Young Naskapi Camp 5	R12	47.4	48.0	1.56	1.69	0.13
Naskapi – Uashat People's Camp	R13	35.7	44.4	0.34	1.06	0.72
Innu - Uashat - Mani-Utenam Camp 1	R16	37.2	39.3	0.41	0.54	0.13
Innu - Uashat - Mani-Utenam Camp 2	R17	32.6	34.8	0.22	0.30	0.08
Innu - Uashat - Mani-Utenam Camp 3	R18	53.2	54.6	3.30	3.94	0.64
Innu Cabin 2	R20	30.4	37.6	0.17	0.43	0.27
Irony mountain	R24	39.6	44.2	0.56	1.03	0.47
Innu Cabin 3	R25	29.9	31.0	0.16	0.18	0.02
Schefferville (town)	R39	19.0	23.9	0.04	0.07	0.03
TSMC Worker's Camp	R40	58.5	59.1	6.43	6.92	0.49

No receptors have a Highly Annoyed percentage change of 6.5% or greater. Therefore, Highly Annoyed percentage will not trigger mitigation per Health Canada criteria at any receptors. However, the Naskapi-Uashat People's Camp receptor (R13) will still undergo mitigation investigation due to the ≥5dB noise impact at that location.

4.1.4 Recommendations

Receptor R13 (Naskapi-Uashat people's camp) located northwest of the Howse mine was predicted to have a noise impact of 5 dBA, triggering noise mitigation investigation. The Howse Mine track drill and First Nations crushing equipment is expected to have the highest contribution to this exceedance.

Drill noise was modelled using RCNM noise data. As previously noted, RCNM data is conservative, which does not account for localized conditions (ground composition) and additional factors (drill speed, drilling time, equipment used). Actual noise emissions can be significantly lower than modelled; as such noise mitigation for the drill may not be required. Howse Minerals Limited has committed to preparing a mitigation plan for the drill to be implemented should complaints occur. Example methods of reducing drill noise include:

- Reducing drilling speed
- Reducing drilling time
- Using a noise shroud around the drill
- Use of a mobile noise screen

Moving the First Nations crusher further north behind an existing berm or overburden pile may avoid noise complaints, as the Irony Mountain receptor noise impact was close to (but below) the noise criteria.

4.2 Blasting

There are two main impacts from blasting – ground vibration and overpressure. When explosives detonate in a borehole, shock waves (energy from the detonation) radiate outward and crush the material adjacent to the borehole. Energy not used in the fracturing and displacement of bedrock dissipates in the form of ground vibration and air overpressure. Some of the factors and parameters that affect the proper fragmentation of the rock and the impacts of blasting include:

- The explosive type, loading densities and weights;
- The detonator delays and firing sequence;
- The decking lengths;
- The spacing of holes;
- The distance between the holes and the free or open face;
- The geology (type and condition) of the bedrock and
- The depth and composition of the earth covering deposit (soil).

Vibrations transmitted through the ground, and pressure waves through the air (overpressure) can disturb buildings and people. This may cause nuisance, or damage (in extreme cases). The propagation of ground vibration and overpressure differs between the front and back of the blast.

Ground vibration transmission is affected by the geology of the terrain and the distance to the receptor source. The transmission of ground vibration will typically move faster and at a higher frequency in rock than soil. Ground vibration is measured in peak particle velocity (PPV) in mm/s.

Air overpressure in its simplest form is the compression of air molecules in a wave travelling away from the source at a rapid rate. The overpressure propagates at the speed of sound and has an audible noise level. Thus, air blasts are measured in decibels. The transmission of air blast pressure away from the explosive source is affected by the topography and the atmospheric conditions that occur during the event. The direction and strength of the wind, the humidity and the density and ground height of the cloud cover will all affect the transmission of air blast from a source.

4.2.1 Criteria

A review of Newfoundland and Labrador Department of Environment and Conservation information, and federal sources has revealed that there are no available noise and vibration guidelines. Therefore, the ground vibration and overpressure from blasting operations are assessed per Quebec's “DIRECTIVE 019-SUR L'INDUSTRIE MINIÈRE, MARS 2012”, and Ontario's Ministry of the Environment (MOE) NPC-119 Guideline.

Quebec's “DIRECTIVE 019-SUR L'INDUSTRIE MINIÈRE, MARS 2012”, is similar to the MOE NPC-119 Guideline. However, the MOE Guideline is slightly more conservative, and also provides general guidance for vibration and overpressure where no site specific data is readily available. Therefore, MOE criteria have been adopted for this assessment.

Quebec's DIRECTIVE 019 has two criteria based on the distance between the blasting location and nearest receptor. Where there is no point of impact within a perimeter of 1 km around the mine site:

- Maximum speeds of vibration permitted ground due to operations blasting are indicated in Table 10
- Maximum level of air pressure permitted at any dwelling is 128 decibels.

Table 10: Maximum allowable ground speeds as a function of vibration frequency (Source: "Directive 019-sur l'industrie minière, mars 2012")

Frequency of vibration	Maximum Permissible Vibration Velocity (mm/sec)
frequency ≤ 15	12.7
15 < frequency ≤ 20	19.0
20 < frequency ≤ 25	23.0
25 < frequency ≤ 30	30.0
30 < frequency ≤ 35	33.0
35 < frequency ≤ 40	38.0
frequency > 40	50.0

For cases where mining activities are carried out within 1 km of a point impact, the maximum speed permitted ground vibrations due to operations blasting and recorded at the impact point is 12.7 mm/sec. The maximum threshold air pressure at any dwelling is 128 decibels. In addition, blasting is not permitted between 7:00 pm and 7:00 am if there are dwellings within 1 km from the mine. Directive 019 also indicates that the operator must install a monitoring program for ground vibration and air pressures at the nearest dwellings to the mine.

NPC-119 provides two sets of limits: (1) standard limits and (2) cautionary limits. The standard limits are used where regular monitoring is being conducted during blasting operations. Cautionary limits are slightly lower and apply when blasts are not monitored on a routine basis. Table 11 depicts these limits for both blast vibration and overpressure.

Table 11: Blast Vibration and Overpressure Limits (Source: NPC-119)

Type of Limits	Vibration (mm/sec)	Overpressure (dBL)
Standard limit	12.5	128
Cautionary limit	10.0	120

4.2.2 Blasting ground vibration and overpressure prediction models

The most commonly used formula for predicting PPV is known as the USA Bureau of Mines (BOM) prediction formula or Propagation Law. Ground vibration is estimated for a specific location using the following equation:

$$PPV = \beta(SD)^{\alpha} \quad (3)$$

where
PPV = Peak Particle Velocity (mm/s);
SD = Scaled Distance ($m/kg^{1/2}$); and
α and β are site-specific constants based on the geology of the terrain.

Scaled Distance is defined as:

$$SD = D/w^{1/2} \quad (4)$$

Where:
D = Distance between the closet blast hole to the receptor (m); and
w = maximum weight of explosive detonated per delay (kg).

The constants, α and β, are site-specific and must be determined by conducting a blast study at the site. A blast study includes multiple test blasts conducted on-site while measuring particle velocities at varying distances and charge weights for each blast. The resulting data can then be used to create a log-log plot of peak particle velocity versus scaled distance where the slope of the line-of-best-fit through the data is equal to the constant α and the value of the y-intercept is equal to β.

Blast overpressure is estimated for a specific location using the following equation:

$$P = \beta(SD)^{\alpha} \qquad (5)$$

Where:
P = Air Pressure;
SD = Scaled Distance (m/kg1/3); and
α and β are site-specific constants based on the geology of the terrain.

Scaled distance is defined as:

$$SD = D/w^{1/3} \qquad (6)$$

Where:
D = Distance between the closet blast hole to the monitoring receptor (m); and
w = maximum weight of explosive detonated per delay period (kg).

the Air Pressure Level (dBL) is calculated using the following equation:

$$APL = 10*\log(P/P_{ref})^2 \qquad (7)$$

Where:
APL = Air Pressure Level (dBL);
P_{ref} = reference pressure which is $20x10^{-6}$ Pa

Scaled distances for air blasts are generally calculated by dividing the separation distance with the cube root of the maximum charge weight, as opposed to dividing by the square root of the maximum charge weight when determining the scaled distance for peak particle velocity. Similar to the procedure for determining the propagation constants for ground vibrations, a blast study measuring overpressure (dBL) with varying distances and charge weights for each blast will provide the required information to generate a log-log plot of maximum overpressure versus scaled distance. The slope of the line-of-best-fit through the data is equal to α and the value of the y-intercept is equal to β.

Since test blasts have not been conducted at the site and no seismograph information is available, it is not possible to obtain the site-specific propagation constants, α and β. Therefore, the maximum allowable charge weight per delay was estimated using the prediction model as presented in Ontario Ministry of the Environment "Guidelines on Information Required for Assessment of Blasting Noise and Vibration – December 1985" (Appendix C). Parameters are obtained from fitting USA BOM equations to figures presented in the guidelines relating vibration and overpressure to scale distance. PPV can be estimated from the following equation:

$$PPV = 1033\ (SD)^{-1.59} \qquad (8)$$

The overpressure varies based on the location of the receptor with respect to the blast. The overpressure of a receptor in front of the blast can be estimated from:

$$P = 3873\ (SD)^{-0.97} \quad (9)$$

While the overpressure of a receptor to the back of the blast can be estimated from:

$$P = 229\ (SD)^{-0.51} \quad (10)$$

Equations 6 to 8 are typically used to calculate vibration and overpressure levels at specific locations from a given blast (charge). This equation can be reconfigured to calculate the approximate maximum blast size for a given location and level limit. These equations are therefore a useful blast design tool in establishing maximum explosive charge weights per delay for various distances from a blast site, using maximum ground vibration level and overpressure limits.

4.2.3 Blast Vibration and Overpressure estimates

Since the blasting plan is still in development, vibration and overpressure levels from the blasting were predicted using MOE 1985 “Guidelines on Information Required for Assessment of Blasting Noise and Vibration” models. Using charge size per delay (i.e., explosive weight is in kg), and separation distance between the blast location and assessment receptor, the absolute ground vibration and overpressure levels expected at the point of reception can be determined. Since insufficient detail on topographical and soil conditions was available, the predictions are based on generic environmental and topographical conditions, and no adjustments have been made to suit site specific conditions. The maximum suggested explosive loads for various distances from the blast site are based on the provincial guideline limits of 12.5 mm/s and 128 dBL discussed previously. According to MOE model, the maximum allowable charge per delay is listed in Table 12 and Table 13 for various receptor distances from the blast.

For the purpose of this assessment, the entire site is considered as a potential blasting location and the distance from the outer perimeter of the open pit to the receptor is considered as the distance to receptors in the assessment. Based on the information provided to date, the closest sensitive receptor (R13) is determined to be approximately 900 metres from the site perimeter. The maximum allowable charge per delay for the closest receptor (using generic conditions) is summarized in Table 14.

Table 12: Preliminary maximum allowable charge per delay versus distance to meet Blast vibration limit – 12.5 mm/sec

Distance to Receptor (m)	Allowable Explosive per Period - kg
100	39
200	154
300	348
400	618
500	965
600	1390
700	1892
800	2471
900	3128
1000	3862

Table 13: Preliminary maximum allowable charge per delay versus distance to meet Blast overpressure limit (128 dB)

Distance to Receptor (m)	Allowable Explosive per Period - kg	
	Front of Blast	Back of Blast
100	1	135
200	12	1082
300	40	3652
400	96	8656
500	187	16907
565	270	24394
600	324	29214
700	514	46391
800	768	69249
900	1093	98599
1000	1499	135252

Table 14: Generic maximum allowable charge per delay for the closest point of reception located at 900m from the site

Charge per delay (kg)	Criteria
3128	Blast Vibration Limit – 12.5 mm/sec
1092	Blast Overpressure Limit – 128 dBL

The impact is controlled by the overpressure limit, so charge per delay should be restricted to below 1092 kg. However, blasting vibration and overpressure is complex in nature, and variability in ground type and meteorological conditions makes it difficult to accurately predict ground vibration and overpressure without site specific measurement data. Test blasting using a lower charge should first be conducted. Furthermore, no details of the blast configuration and design have been supplied at this stage. Therefore a lower charge test blast should be conducted prior to the start of production blasting. Any blast on site should be designed by a qualified contractor and include consideration of the blasting vibration and overpressure limits outlined in this report. Upon commencement of blasting on site, these parameters will require revisions based on site specific data and attenuation equations developed. Although meeting overpressure criteria may satisfy regulatory requirements, the short duration, high noise level may cause complaints.

4.2.4 Recommendations

It is recommended that:

1. An initial four blasts as a minimum shall be monitored by a specialist in blast monitoring to obtain the site specific data needed to develop attenuation formulae, confirm the applicability of the initial guideline parameters, and assist in developing future blast designs.

2. It is recommended that the four initial test blasts be conducted with charge per delay restricted to below 700 kg per delay. Vibration and overpressure should be monitored to provide an update to the Prediction model parameters.

3. Directive 019 recommends blasts shall be monitored for both vibration and overpressure, at the closest sensitive receptor adjacent to the site. It is recommended that a minimum of one digital seismograph be used in subsequent years. Subsequent routine monitoring should be utilized to update blast designs as required.

4. Blast designs shall be continually reviewed with respect to ground vibration and overpressure. Blast designs shall be modified as required to ensure compliance with applicable guidelines and regulations. Decking, reduced hole diameters, and sequential blasting techniques will be used to ensure minimal explosives per initiated delay period.

5. Detailed blast records shall be maintained. The MOE (1985) recommends that the body of blast reports should include the following information:
   a) Location, date and time of the blast.
   b) Dimensional sketch including photographs, if necessary, of the location of the blasting operation, and the nearest point of reception.
   c) Physical and topographical description of the ground between the source and the receptor location.
   d) Type of material being blasted.
   e) Sub-soil conditions, if known.
   f) Prevailing meteorological conditions including wind speed in m/s, wind direction, air temperature in ^{o}C, relative humidity, degree of cloud cover and ground moisture content.
   g) Number of drill holes.
   h) Pattern and pitch of drill holes.
   i) Size of holes.
   j) Depth of drilling.
   k) Depth of collar (or stemming).
   l) Depth of toe-load.
   m) Weight of charge per delay.
   n) Number and time of delays.
   o) The result and calculated value of Peak Pressure Level in dB and Peak Particle Velocity in mm/s.
   p) Applicable limits.
   q) The excess, if any, over the prescribed limit.

6. A community engagement program and noise complaint process should be implemented, to advise the community of upcoming blasts and address community concerns.

The blast parameters described within this report will provide a good basis for the initial blasting operations at this location. However, it may be possible to refine these parameters once site-specific data from the blasting operations becomes available.

5. Conclusions

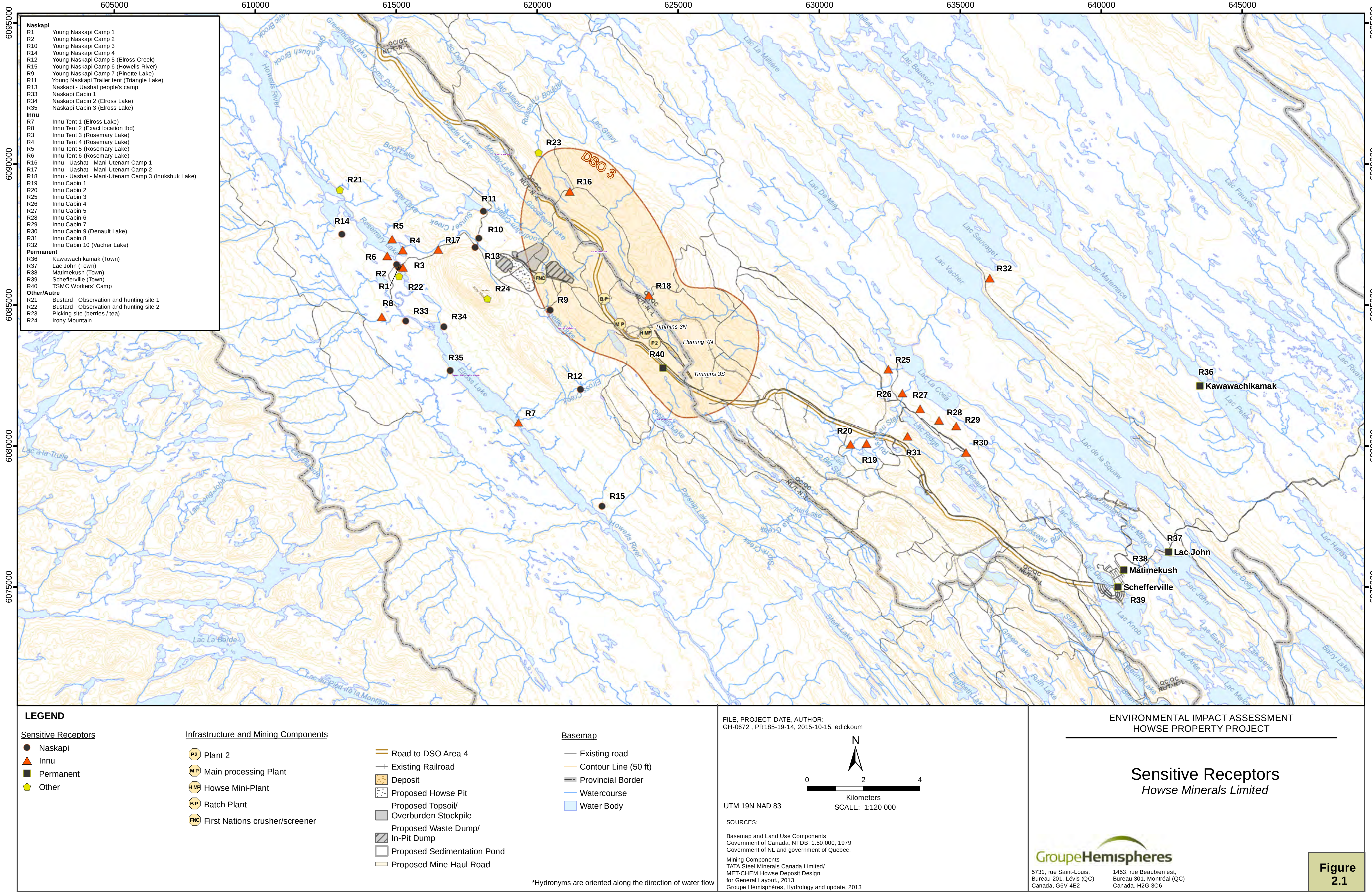
In accordance with the Canadian Environmental Assessment Agency (CEAA) document *Guidelines for the Preparation of an Environmental Impact Statement – Howse Property Iron Mine,* an environmental assessment was completed for the operation of the Howse mining site. Results of the noise assessment indicate that the operation of the new Howse mining site and addition of the First Nations crushing area will have an impact of 5dB at one Naskapi Uashat People's Camp site (R13), west of the Howse Mine. This impact is predicted to result in sporadic community complaints. If complaints occur, Howse Minerals Limited has committed to implementing a mitigation plan (discussed in Section 4.1.4) for the Howse Mine track drill. In addition, moving the First Nations crusher further north behind an existing berm or overburden pile may reduce complaints.

Since there is no blast vibration and overpressure data available for the site, generic empirical formulas were used to estimate the impact of blast vibration and overpressure at the closest point of reception. A preliminary maximum charge per delay of 1092 kg was estimated for the blast vibration and overpressure to conform to the applicable limits. An initial blast test with a charge per delay below 700 kg should be first conducted. Vibration and overpressure should be monitored during the blast test and explosive weight adjusted accordingly.

Even with overpressure levels below acceptable limits, the instantaneous noise level will be much higher than the ambient noise levels at the closest sensitive locations and may trigger negative community response. Therefore efforts to liaise with the community and advice on future blasting may improve the community response to the blasting.

Appendix A

Appendix A: Area Layout, Receptor Locations and Noise Level Contour Figures



Naskapi
R1 Young Naskapi Camp 1
R2 Young Naskapi Camp 2
R10 Young Naskapi Camp 3
R14 Young Naskapi Camp 4
R12 Young Naskapi Camp 5 (Elross Creek)
R15 Young Naskapi Camp 6 (Howells River)
R9 Young Naskapi Camp 7 (Pinette Lake)
R11 Young Naskapi Trailer tent (Triangle Lake)
R13 Naskapi - Uashat people's camp
R33 Naskapi Cabin 1
R34 Naskapi Cabin 2 (Elross Lake)
R35 Naskapi Cabin 3 (Elross Lake)
Innu
R7 Innu Tent 1 (Elross Lake)
R8 Innu Tent 2 (Exact location tbd)
R3 Innu Tent 3 (Rosemary Lake)
R4 Innu Tent 4 (Rosemary Lake)
R5 Innu Tent 5 (Rosemary Lake)
R6 Innu Tent 6 (Rosemary Lake)
R16 Innu - Uashat - Mani-Utenam Camp 1
R17 Innu - Uashat - Mani-Utenam Camp 2
R18 Innu - Uashat - Mani-Utenam Camp 3 (Inukshuk Lake)
R19 Innu Cabin 1
R20 Innu Cabin 2
R25 Innu Cabin 3
R26 Innu Cabin 4
R27 Innu Cabin 5
R28 Innu Cabin 6
R29 Innu Cabin 7
R30 Innu Cabin 9 (Denault Lake)
R31 Innu Cabin 8
R32 Innu Cabin 10 (Vacher Lake)
Permanent
R36 Kawawachikamak (Town)
R37 Lac John (Town)
R38 Matimekush (Town)
R39 Schefferville (Town)
R40 TSMC Workers' Camp
Other/Autre
R21 Bustard - Observation and hunting site 1
R22 Bustard - Observation and hunting site 2
R23 Picking site (berries / tea)
R24 Irony Mountain
605000
610000
615000
620000
625000
630000
635000
640000
645000
6095000
6090000
6085000
6080000
6075000
DSO 3
Timmins 3N
Fleming 7N
Timmins 3S
Kawawachikamak
Lac John
Matimekush
Schefferville
Lac Vacher
Lac de la Squaw
Howells River
Elross Lake
Lac La Borde
LEGEND
Sensitive Receptors
Naskapi
Innu
Permanent
Other
Infrastructure and Mining Components
Plant 2
Main processing Plant
Howse Mini-Plant
Batch Plant
First Nations crusher/screener
Road to DSO Area 4
Existing Railroad
Deposit
Proposed Howse Pit
Proposed Topsoil/
Overburden Stockpile
Proposed Waste Dump/
In-Pit Dump
Proposed Sedimentation Pond
Proposed Mine Haul Road
Basemap
Existing road
Contour Line (50 ft)
Provincial Border
Watercourse
Water Body
*Hydronyms are oriented along the direction of water flow
FILE, PROJECT, DATE, AUTHOR:
GH-0672 , PR185-19-14, 2015-10-15, edickoum
N
0 2 4
Kilometers
UTM 19N NAD 83
SCALE: 1:120 000
SOURCES:
Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,
Mining Components
TATA Steel Minerals Canada Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2013
Groupe Hémisphères, Hydrology and update, 2013
ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT
Sensitive Receptors
Howse Minerals Limited
GroupeHemispheres
5731, rue Saint-Louis,
Bureau 201, Lévis (QC)
Canada, G6V 4E2
1453, rue Beaubien est,
Bureau 301, Montréal (QC)
Canada, H2G 3C6
Figure
2.1

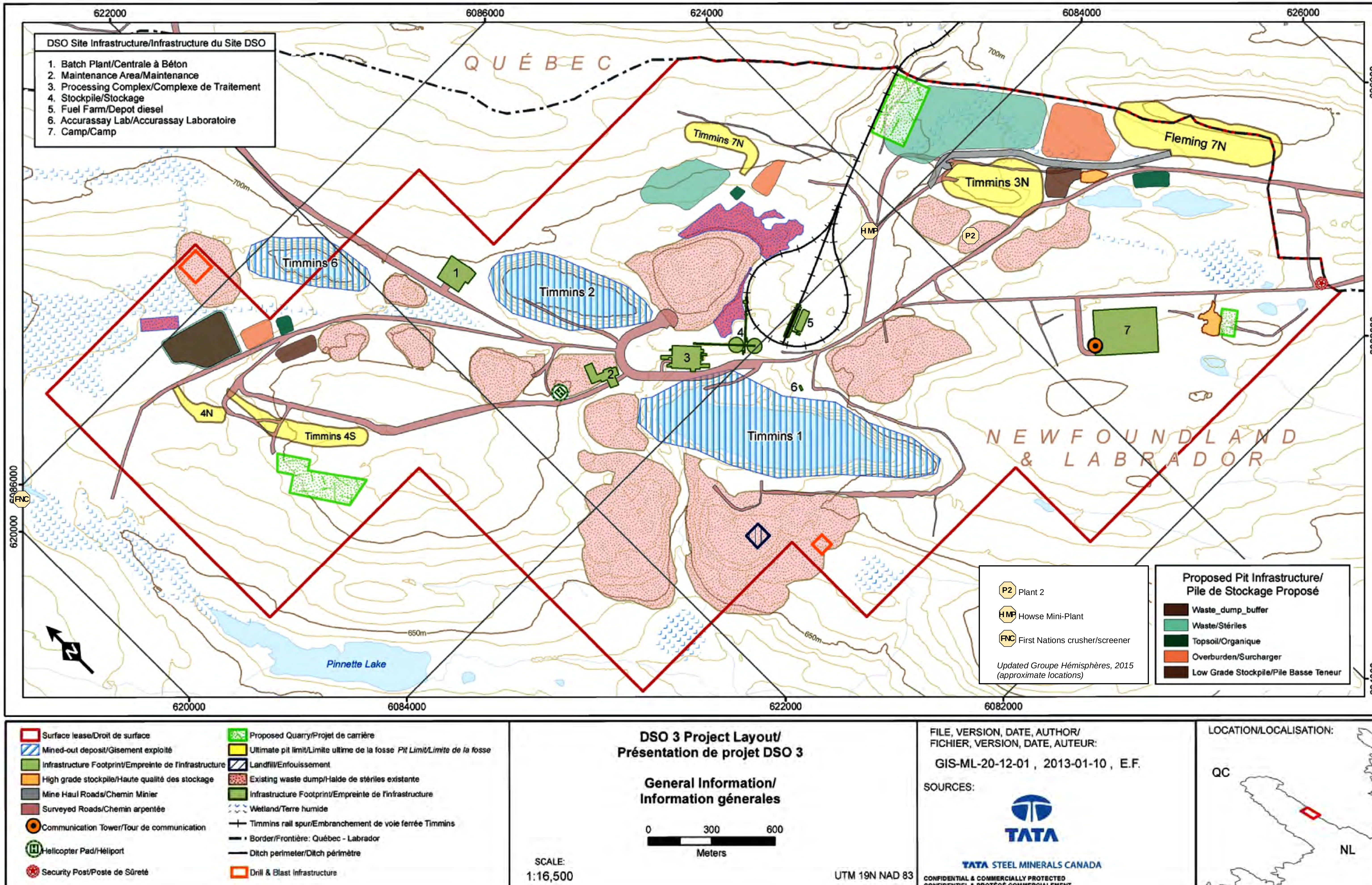
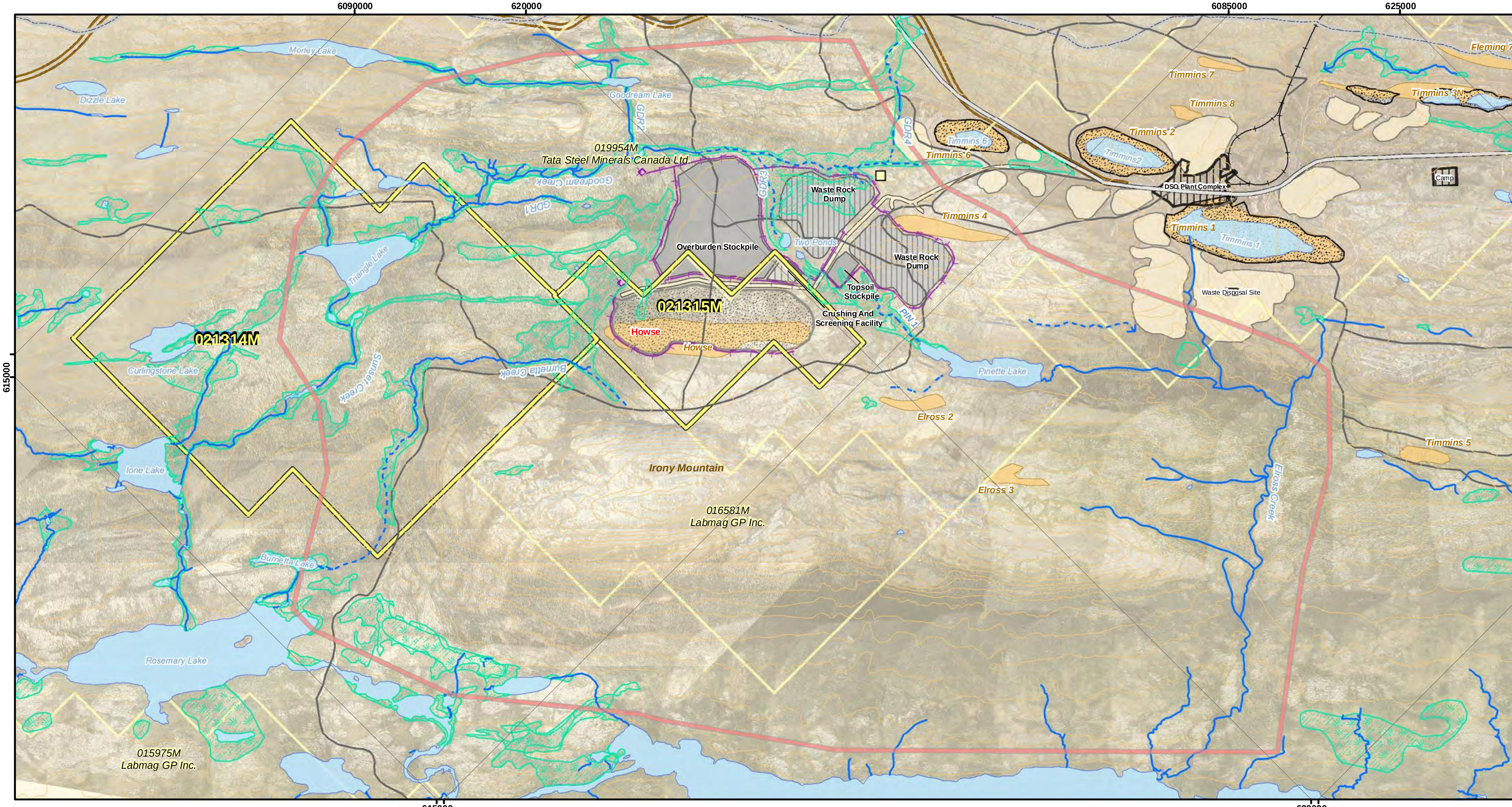

DSO Site Infrastructure/Infrastructure du Site DSO
1. Batch Plant/Centrale à Béton
2. Maintenance Area/Maintenance
3. Processing Complex/Complexe de Traitement
4. Stockpile/Stockage
5. Fuel Farm/Depot diesel
6. Accurassay Lab/Accurassay Laboratoire
7. Camp/Camp
QUÉBEC
NEWFOUNDLAND & LABRADOR
Timmins 7N
Fleming 7N
Timmins 3N
Timmins 6
Timmins 2
Timmins 1
4N
Timmins 4S
Pinnette Lake
700m
650m
HMP
P2
FNC
622000
6086000
624000
6084000
626000
620000
6082000
624000
Plant 2
Howse Mini-Plant
First Nations crusher/screener
Updated Groupe Hémisphères, 2015 (approximate locations)
Proposed Pit Infrastructure/ Pile de Stockage Proposé
Waste_dump_buffer
Waste/Stériles
Topsoil/Organique
Overburden/Surcharger
Low Grade Stockpile/Pile Basse Teneur
Surface lease/Droit de surface
Mined-out deposit/Gisement exploité
Infrastructure Footprint/Empreinte de l'infrastructure
High grade stockpile/Haute qualité des stockage
Mine Haul Roads/Chemin Minier
Surveyed Roads/Chemin arpentée
Communication Tower/Tour de communication
Helicopter Pad/Héliport
Security Post/Poste de Sûreté
Proposed Quarry/Projet de carrière
Ultimate pit limit/Limite ultime de la fosse Pit Limit/Limite de la fosse
Landfill/Enfouissement
Existing waste dump/Halde de stériles existante
Infrastructure Footprint/Empreinte de l'infrastructure
Wetland/Terre humide
Timmins rail spur/Embranchement de voie ferrée Timmins
Border/Frontière: Québec - Labrador
Ditch perimeter/Ditch périmètre
Drill & Blast Infrastructure
DSO 3 Project Layout/ Présentation de projet DSO 3
General Information/ Information génerales
0 300 600
Meters
SCALE:
1:16,500
UTM 19N NAD 83
FILE, VERSION, DATE, AUTHOR/ FICHIER, VERSION, DATE, AUTEUR:
GIS-ML-20-12-01 , 2013-01-10 , E.F.
SOURCES:
TATA
TATA STEEL MINERALS CANADA
CONFIDENTIAL & COMMERCIALLY PROTECTED
CONFIDENTIEL & PROTÉGÉ COMMERCIALEMENT
LOCATION/LOCALISATION:
QC
NL

Figure 2.2



LEGEND

Basemap

- Permanent Watercourse
- Intermittent Watercourse
- Storm Run-off
- Disappearing Stream
- Artesian Spring
- Waterbody
- Contour Line (50 ft)
- Provincial Border
- Existing Road
- Main Access Road
- Wetland
- Local Study Area

Infrastructure And Mining Components

- Proposed Howse Pit
- Proposed Low Grade/ Overburden Stockpile
- Proposed Crushing/ Screening Facility
- Proposed Waste Rock Dump
- Proposed Sedimentation Pond
- Proposed Mine Haul Road
- Proposed Ditch
- Potential Road To DSO Area 4
- Proposed Railroad
- Timmins 4 Sedimentation Pond-3
- DSO Howse - Claims Labrador Iron Mines Limited(49%)/ Howse Minerals Ltd.(51%)
- Other Claim
- Elross Lake Area Iron Ore Mine (ELAIOM) Plant Infrastructure footprint
- Existing Dump
- Existing Pit
- Deposit

*Hydronyms are oriented along the direction of water flow

FILE, VERSION, DATE, AUTHOR:
GH-0467-05, 2014-03-26, E.D., J.T.

SCALE: 1:30 000

UTM 19N NAD 83

0 500 1 000 2 000

Meters

SOURCES:
Basemap
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec, Boundary used for claims
SNC Lavalin, Groupe Hémisphères, Hydrology update, 2013

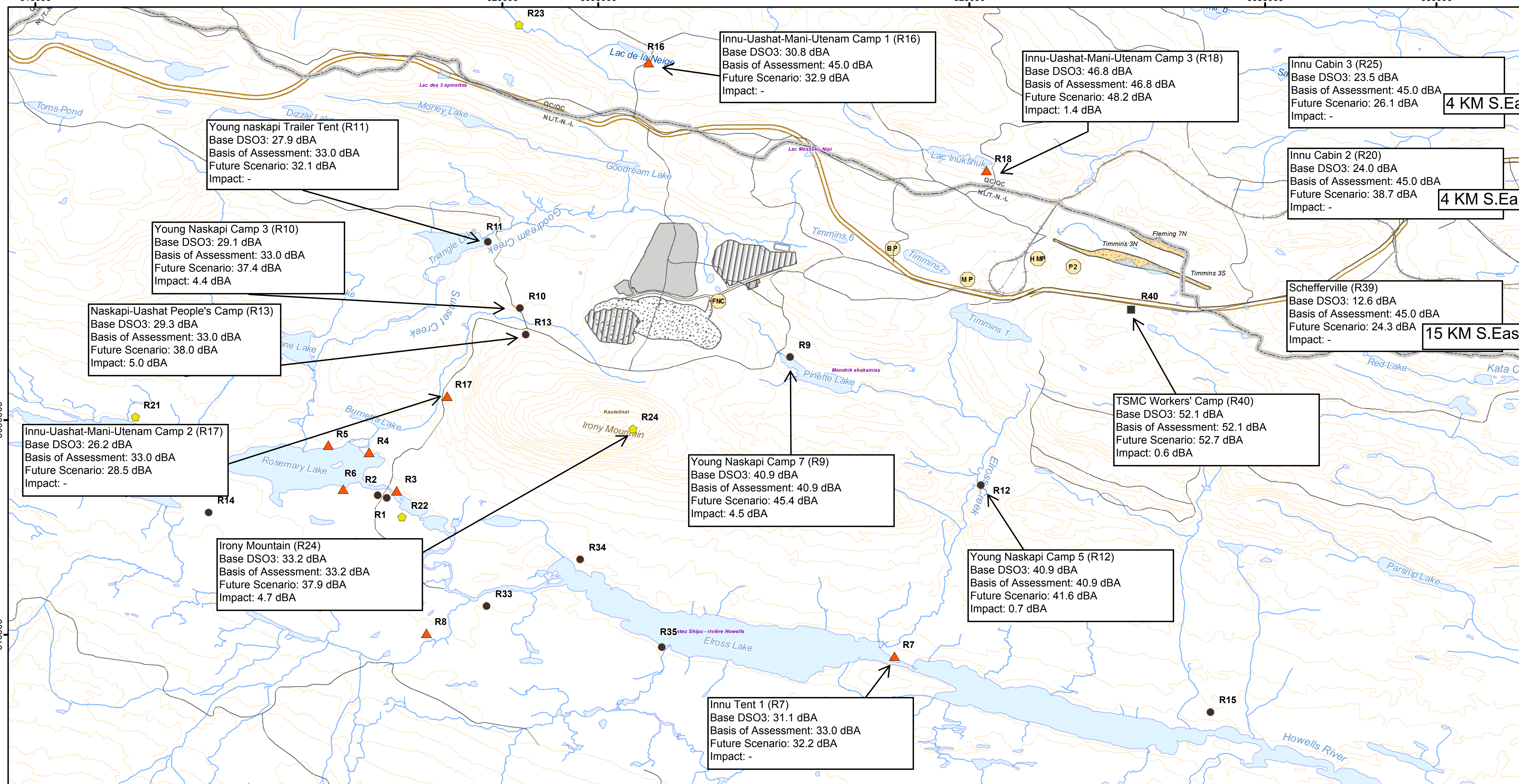
Infrastructure and Mining Components
New Millennium Capital Corp., Mining sites and roads
TATA Steel Minerals Canada Limited/ MET-CHEM Howse
Deposit Design for General Layout, 2013

Howse Property And TSMC DSO Project Infrastructure

DSO Howse Property

Figure 2.3

GroupeHemispheres



LEGEND

Sensitive Receptors

- Naskapi
- Innu
- Permanent
- Other

Infrastructure and Mining Components

- P2 Plant 2
- MP Main processing Plant
- HMP Howse Mini-Plant
- BP Batch Plant
- FNC First Nations crusher/screener
- Road to DSO Area 4
- Existing Railroad
- Deposit
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Site Infrastructure
- Proposed Waste Dump/ In-Pit Dump
- Proposed Sedimentation Pond
- Proposed Mine Haul Road

Basemap

- Existing road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0672 , PR185-19-14, 2015-10-15, edickoum

N

0 2 4
Kilometers

UTM 19N NAD 83 SCALE: 1:50 000

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,

Mining Components
TATA Steel Minerals Canada Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2013
Groupe Hémisphères, Hydrology and update, 2013

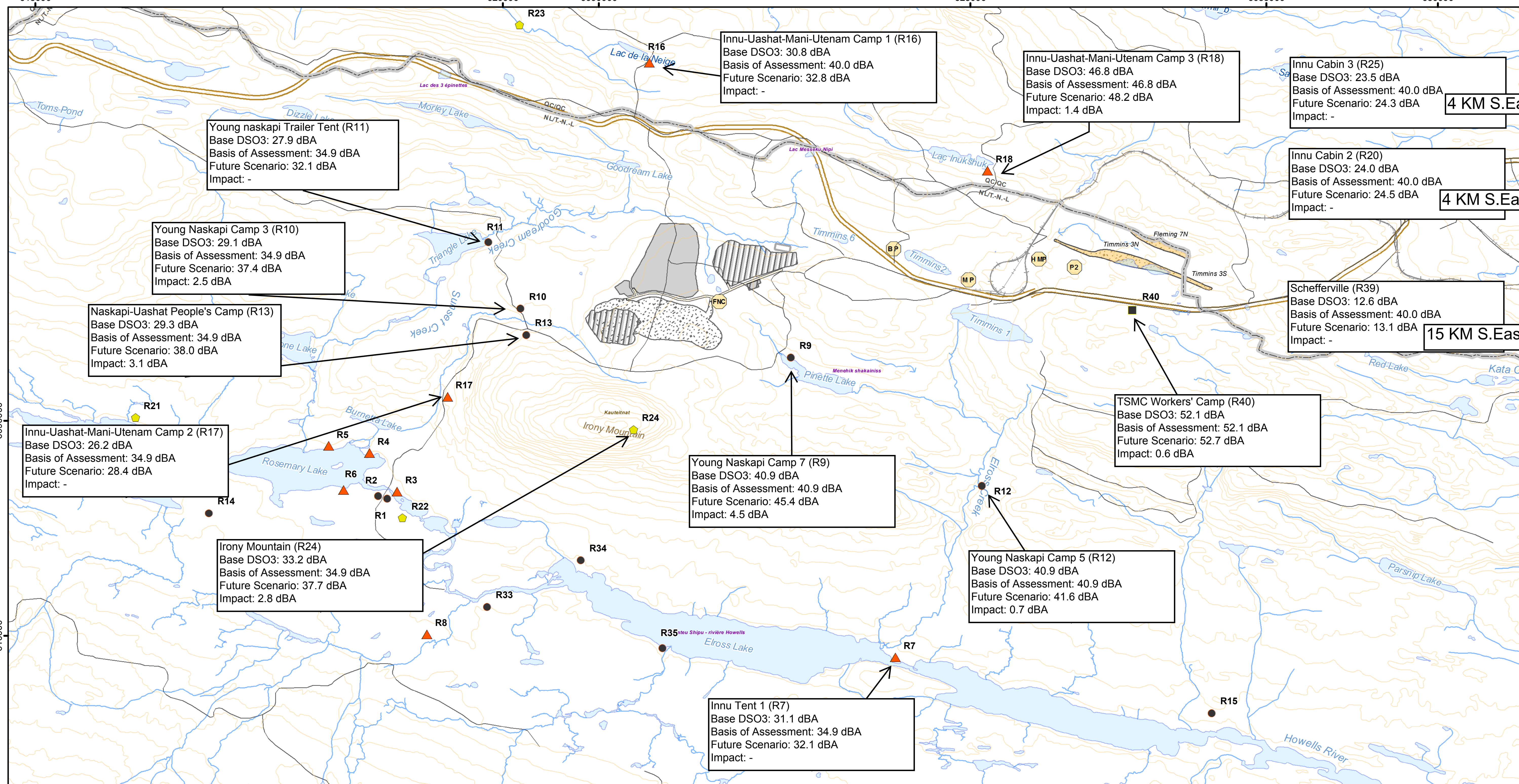
ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

Noise and Vibration Receiver Location and Impact Results

Howse Minerals Limited

GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 2.4



LEGEND

Sensitive Receptors
- Naskapi
- Innu
- Permanent
- Other

Infrastructure and Mining Components
- P2 Plant 2
- MP Main processing Plant
- HMP Howse Mini-Plant
- BP Batch Plant
- FNC First Nations crusher/screener
- Road to DSO Area 4
- Existing Railroad
- Deposit
- Proposed Howse Pit
- Proposed Topsoil/ Overburden Stockpile
- Proposed Site Infrastructure
- Proposed Waste Dump/ In-Pit Dump
- Proposed Sedimentation Pond
- Proposed Mine Haul Road

Basemap
- Existing road
- Contour Line (50 ft)
- Provincial Border
- Watercourse
- Water Body

*Hydronyms are oriented along the direction of water flow

FILE, PROJECT, DATE, AUTHOR:
GH-0672 , PR185-19-14, 2015-10-15, edickoum

N

0 2 4
Kilometers

UTM 19N NAD 83 SCALE: 1:50 000

SOURCES:

Basemap and Land Use Components
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec,

Mining Components
TATA Steel Minerals Canada Limited/
MET-CHEM Howse Deposit Design
for General Layout., 2013
Groupe Hémisphères, Hydrology and update, 2013

ENVIRONMENTAL IMPACT ASSESSMENT
HOWSE PROPERTY PROJECT

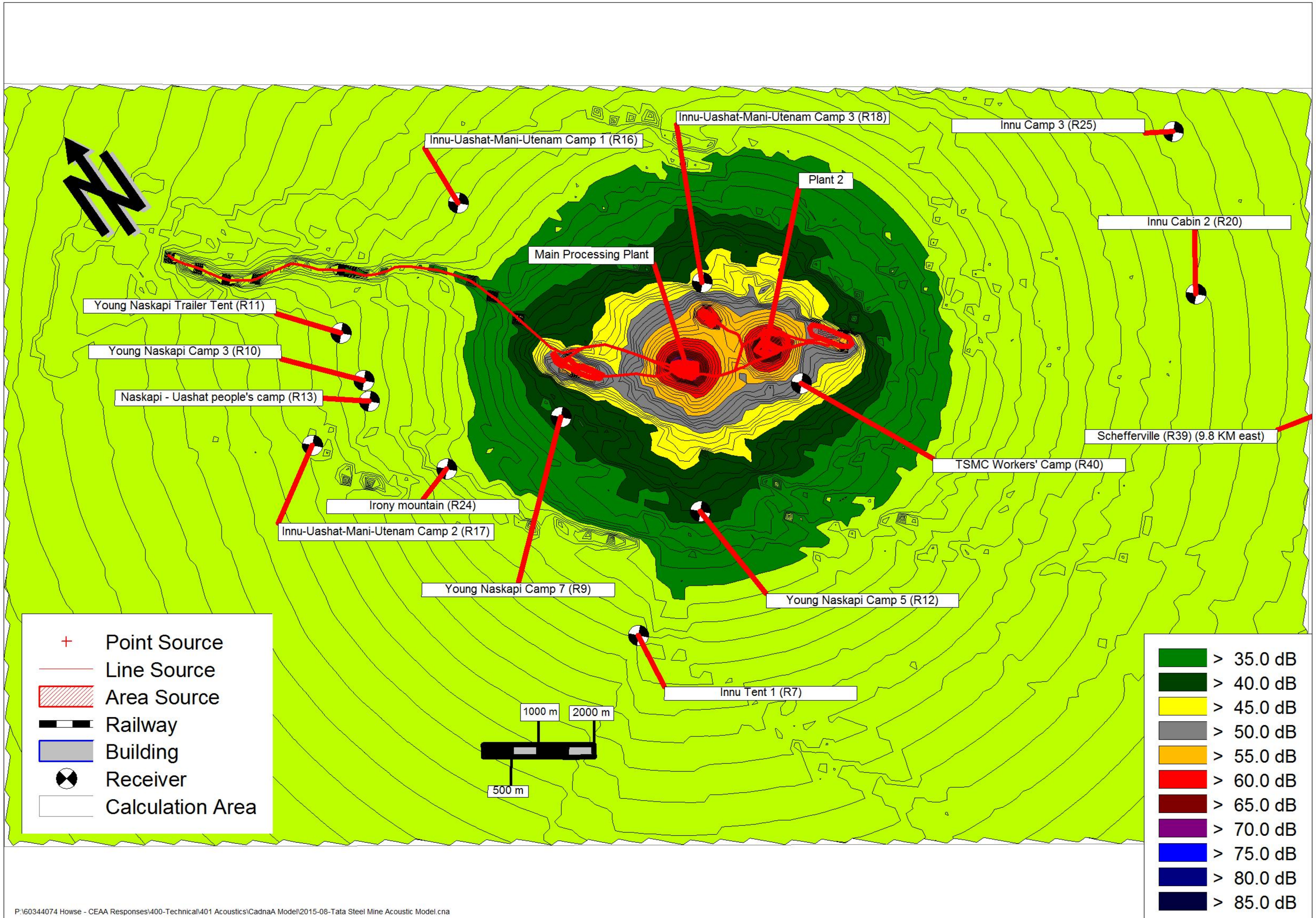
Noise and Vibration Receiver Location and Night-time Noise Impact Results

Howse Minerals Limited

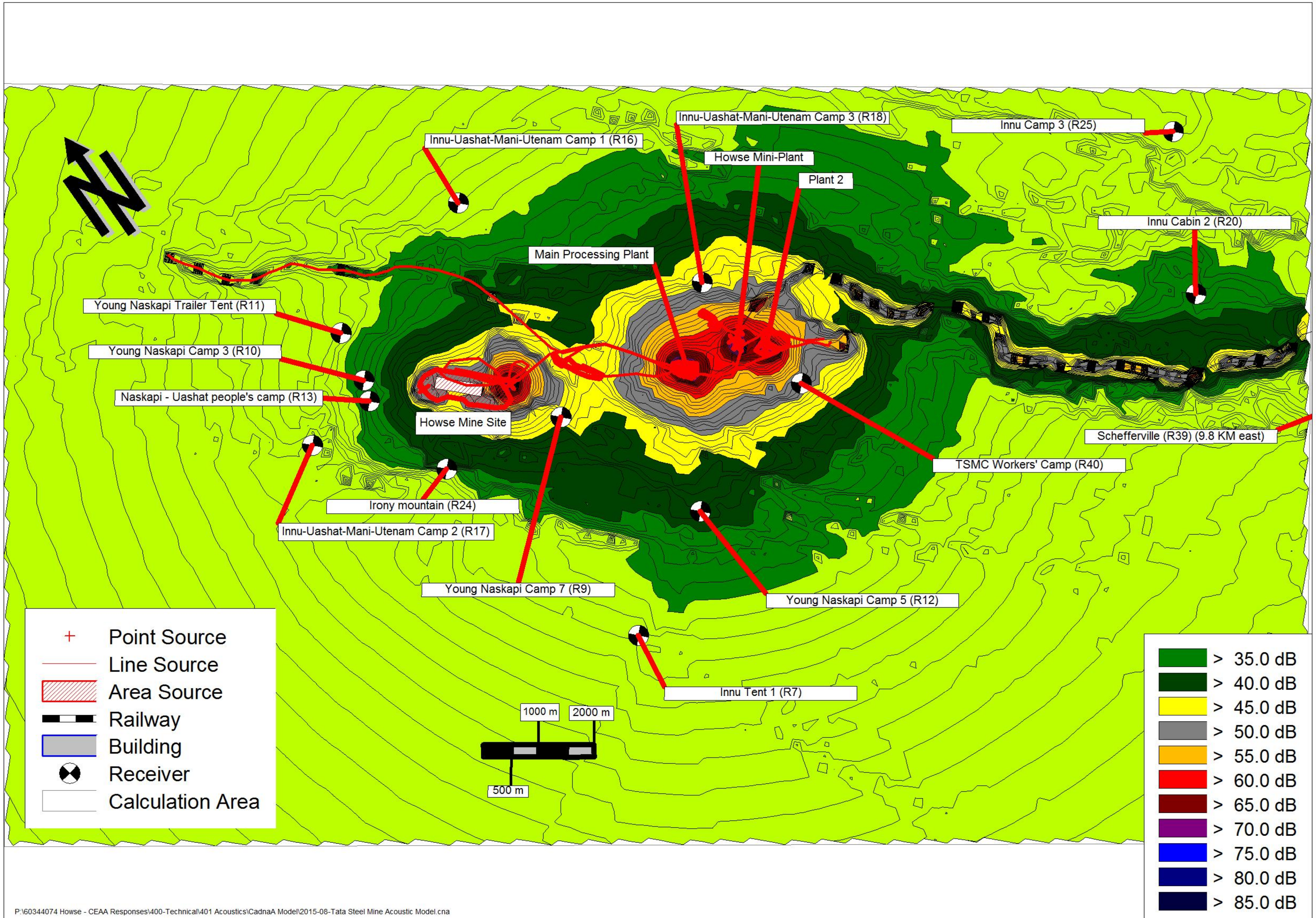
GroupeHemispheres
5731, rue Saint-Louis, Bureau 201, Lévis (QC) Canada, G6V 4E2
1453, rue Beaubien est, Bureau 301, Montréal (QC) Canada, H2G 3C6

Figure 2.5

Base DSO3 Scenario -Noise Contours



Future Scenario - Noise Contours



Appendix B

Appendix B: Noise Source Information

Full Equipment List

Location	Equipment Description	Make	Model Number	Serial Number	Negligible?	Number
Plant 1	DIVERTER GATE-MAIN PLANT BYPASS				YES	1
	CONVEYOR-SCREEN FEED	MODULAR			YES	1
	VIBRATION SCREEN	METSO		SNSM2129	NO	1
	CONVEYOR-UNDER SCREEN	MODULAR			YES	1
	CONVEYOR-FINES TRANSFER #1	THOR	TC115-15	2126	YES	1
	CONVEYOR-FINES TRANSFER #2	THOR	TC115-15	2127	YES	1
	CONVEYOR-FINES STOCKPILER	THOR	T170-15	2123	YES	1
	CROSS CONVEYOR-LUMP	MODULAR			YES	1
	CONVEYOR-LUMP TRANSFER	THOR	TC150-4	2176	YES	1
	CONVEYOR-LUMP STOCKPILER	THOR	T170-15	2124	YES	1
	CONVEYOR-OVERSIZE STOCKPILER	THOR	RS70-2	2175	YES	1
	HOPPER-FEED HOPPER	SANDVIK	PX200-1200		NO	1
	APRON FEEDER-MINERAL SIZER	SANDVIK	PX200-1200		NO	1
	HYDRAULIC ROCK BREAKER	ALLIED	1505HD	02227	NO	1
	SIZER-PRIMARY HYBRID	SANDVIK	CR810/12-20		NO	1
	OVERHEAD CRANE-PRIMARY SIZER (10T)	SANDVIK			YES	1
	CONVEYOR-TRANSFER	SANDVIK	PX200-1200		YES	1
	BELT MAGNET-SELF CLEANING	ERIEZ			YES	1
	SIZER-SECONDARY HYBRID	SANDVIK	CR810/08-30		NO	1
	CONVEYOR-PROCESSING PLANT FEED	TS MANUFACTURING			YES	1
	Side Wall Fans	Aerovent	BSBP 42B304		NO	14
	Roof Fans	Aerovent	BSBP 42B304		NO	8
	Side Ventilation Fans	Bousquet	BC-500-RH-THD-O-HW	33035 130103	NO	6
	Dryer Fan	Robinson	BC0928		YES	1
	2 MW Generator	CAT			NO	6
	Vacuum Pump	NASH	2BE4-52		NO	2
	Centrifugal Blower	Gardner Denver			NO	1
	Generator Rad Fans	Sutton Stromart	SVS-0412053		NO	6

Location	Equipment Description	Make	Model Number	Serial Number	Negligible?	Plant 2 Number	Mini-Plant Number
Plant 2/Howse Mini-Plant	DIVERTER GATE-MAIN PLANT BYPASS				YES	1	1
	CONVEYOR-SCREEN FEED	MODULAR			YES	1	1
	VIBRATION SCREEN	METSO		SNSM2129	NO	1	1
	CONVEYOR-UNDER SCREEN	MODULAR			YES	1	1
	CONVEYOR-FINES TRANSFER #1	THOR	TC115-15	2126	YES	1	1
	CONVEYOR-FINES TRANSFER #2	THOR	TC115-15	2127	YES	1	1
	CONVEYOR-FINES STOCKPILER	THOR	T170-15	2123	YES	1	1
	CROSS CONVEYOR-LUMP	MODULAR			YES	1	1
	CONVEYOR-LUMP TRANSFER	THOR	TC150-4	2176	YES	1	1
	CONVEYOR-LUMP STOCKPILER	THOR	T170-15	2124	YES	1	1
	CONVEYOR-OVERSIZE STOCKPILER	THOR	RS70-2	2175	YES	1	1
	HOPPER-FEED HOPPER	SANDVIK	PX200-1200		NO	1	1
	APRON FEEDER-MINERAL SIZER	SANDVIK	PX200-1200		NO	1	1
	HYDRAULIC ROCK BREAKER	ALLIED	1505HD	02227	NO	1	1
	SIZER-PRIMARY HYBRID	SANDVIK	CR810/12-20		NO	1	1
	OVERHEAD CRANE-PRIMARY SIZER (10T)	SANDVIK			YES	1	1
	CONVEYOR-TRANSFER	SANDVIK	PX200-1200		YES	1	1
	BELT MAGNET-SELF CLEANING	ERIEZ			YES	1	1
	SIZER-SECONDARY HYBRID	SANDVIK	CR810/08-30		NO	1	1
	CONVEYOR-PROCESSING PLANT FEED	TS MANUFACTURING			YES	1	1
	Dryer - Induced Draft Fan				NO	1	2
	Dryer - Burner	Gencor	Astraflame AF-100		NO	1	2
	2 MW Generator	CAT			NO	1	1

Location	Equipment Description	Make	Model Number	Serial Number	Negligible?	Number
Howse, Timmins, and Flemming Mine Sites (Each)	Hydraulic Excavators 6m^3	Komatsu	PC1250 Class		NO	2
	Haul Trucks - 64/100 tonne payload	CAT	775/777 Class		NO	8
	Production Drill -160mm diameter holes	CAT	MD5125 Class		NO	1
	Track dozer - 250 kW	CAT	D8 Class		NO	1
	Road Grader - 200 kW	CAT	14M Class		NO	1

Location	Equipment Description	Make	Model Number	Serial Number	Negligible?	Number
Roads (Howse)	Haul Trucks - 64/100 tonne payload	CAT	775/777 Class		NO	71/hour
Roads (Mini-Plant)	Haul Trucks - 64/100 tonne payload	CAT	775/777 Class		NO	10/hour
Roads (Plant 2 to Rail Loading)	Haul Trucks - 64/100 tonne payload	CAT	775/777 Class		NO	15/hour

Location	Equipment Description	Make	Model Number	Serial Number	Negligible?	Base DSO3 Number	Future Number
Roads (Timmins, Fleming)	Haul Trucks - 64/100 tonne payload	CAT	775/777 Class		NO	24/hour	25/hour
Roads (Kivivic to DSO3)	Haul Trucks - 64/100 tonne payload	CAT	775/777 Class		NO	46/hour	46/hour

Location	Equipment Description	Make	Model Number	Serial Number	Negligible?	Number
Trains	Rail Cars - 25km/h				NO	212
	Locomotives -25 km/h				NO	2
	Dust Collector Fan	Twin City			NO	1

Performance Number: DM7916 **Change Level:** 01

Sales Model: 3516B
Application: PACKAGED GENSET
Rating Level: STANDBY

Rated Speed (RPM): 1,800
Rated Power (BKW): 2,145.0
Rated Power (BHP): 2,876

EXHAUST Sound Pressure Data (OBCF) Distance: 1.5 Meters (4.9 Feet)

GENSET POWER WITH FAN EKW	PERCENT LOAD %	ENGINE POWER BKW	ENGINE POWER BHP	OVERALL DB(A)	125 HZ DB	250 HZ DB	500 HZ DB	1000 HZ DB	2000 HZ DB	4000 HZ DB	8000 HZ DB
2.000.0	100	2.151.2	2.885	116	121	117	109	108	109	109	107
1.800.0	90	1.939.6	2.601	116	121	117	109	107	108	108	106
1.600.0	80	1.730.2	2.320	114	119	115	107	106	107	107	105
1.500.0	75	1.626.0	2.181	114	119	115	107	105	107	107	105
1.400.0	70	1.521.9	2.041	113	118	114	106	105	106	106	104
1.200.0	60	1.314.8	1.763	112	117	113	105	104	105	105	103
1.000.0	50	1.108.5	1.487	111	116	112	104	103	104	104	102
800.0	40	904.2	1.213	110	115	111	103	101	102	102	100
600.0	30	698.9	937	108	113	109	101	100	101	101	99
500.0	25	595.2	798	107	112	108	100	99	100	100	98
400.0	20	490.4	658	106	111	107	99	98	99	99	97
200.0	10	276.6	371	104	109	105	97	96	97	97	95

EXHAUST Sound Pressure Data (OBCF) Distance: 7 Meters (23.0 Feet)

GENSET POWER WITH FAN EKW	PERCENT LOAD %	ENGINE POWER BKW	ENGINE POWER BHP	OVERALL DB(A)	125 HZ DB	250 HZ DB	500 HZ DB	1000 HZ DB	2000 HZ DB	4000 HZ DB	8000 HZ DB
2.000.0	100	2.151.2	2.885	103	111	105	97	95	96	96	93
1.800.0	90	1.939.6	2.601	102	110	104	96	94	95	95	92
1.600.0	80	1.730.2	2.320	101	109	103	95	93	94	94	91
1.500.0	75	1.626.0	2.181	101	109	103	94	93	93	93	90
1.400.0	70	1.521.9	2.041	100	108	102	94	92	93	93	90
1.200.0	60	1.314.8	1.763	99	107	101	92	91	92	91	89
1.000.0	50	1.108.5	1.487	98	106	100	91	90	90	90	87
800.0	40	904.2	1.213	96	104	98	90	88	89	89	86
600.0	30	698.9	937	95	103	97	88	87	87	87	85
500.0	25	595.2	798	94	102	96	88	86	87	86	84
400.0	20	490.4	658	93	101	95	87	85	86	86	83
200.0	10	276.6	371	91	99	93	84	83	83	83	81

EXHAUST Sound Pressure Data (OBCF) Distance: 15 Meters (49.2 Feet)

GENSET POWER WITH FAN EKW	PERCENT LOAD %	ENGINE POWER BKW	ENGINE POWER BHP	OVERALL DB(A)	125 HZ DB	250 HZ DB	500 HZ DB	1000 HZ DB	2000 HZ DB	4000 HZ DB	8000 HZ DB
2.000.0	100	2.151.2	2.885	96	104	99	90	88	89	89	86
1.800.0	90	1.939.6	2.601	96	104	98	89	88	88	88	85
1.600.0	80	1.730.2	2.320	94	102	97	88	86	87	87	84
1.500.0	75	1.626.0	2.181	94	102	96	88	86	87	87	84
1.400.0	70	1.521.9	2.041	93	101	96	87	85	86	86	83
1.200.0	60	1.314.8	1.763	92	100	94	86	84	85	85	82
1.000.0	50	1.108.5	1.487	91	99	93	85	83	84	84	81
800.0	40	904.2	1.213	90	98	92	83	82	82	82	79
600.0	30	698.9	937	88	96	90	82	80	81	81	78
500.0	25	595.2	798	87	95	90	81	79	80	80	77
400.0	20	490.4	658	86	94	89	80	78	79	79	76
200.0	10	276.6	371	84	92	86	78	76	77	77	74

Performance Number: DM7916 **Change Level:** 01

Sales Model: 3516B
Application: PACKAGED GENSET
Rating Level: STANDBY

Rated Speed (RPM): 1,800
Rated Power (BKW): 2,145.0
Rated Power (BHP): 2,876

MECHANICAL Sound Pressure Data (OBCF) Distance: 1 Meters (3.3 Feet)

GENSET POWER WITH FAN EKW	PERCENT LOAD %	ENGINE POWER BKW	ENGINE POWER BHP	OVERALL DB(A)	125 HZ DB	250 HZ DB	500 HZ DB	1000 HZ DB	2000 HZ DB	4000 HZ DB	8000 HZ DB
2.000.0	100	2.151.2	2.885	105	100	101	99	100	101	99	103
1.800.0	90	1.939.6	2.601	105	100	101	99	100	101	99	103
1.600.0	80	1.730.2	2.320	105	100	101	99	100	101	99	103
1.500.0	75	1.626.0	2.181	105	100	101	99	100	101	99	103
1.400.0	70	1.521.9	2.041	105	100	101	99	100	101	99	103
1.200.0	60	1.314.8	1.763	105	100	101	99	100	101	99	103
1.000.0	50	1.108.5	1.487	105	100	101	99	100	101	99	103
800.0	40	904.2	1.213	105	100	101	99	100	101	99	103
600.0	30	698.9	937	105	100	101	99	100	101	99	103
500.0	25	595.2	798	105	100	101	99	100	101	99	103
400.0	20	490.4	658	105	100	101	99	100	101	99	103
200.0	10	276.6	371	105	100	101	99	100	101	99	103

MECHANICAL Sound Pressure Data (OBCF) Distance: 7 Meters (23.0 Feet)

GENSET POWER WITH FAN EKW	PERCENT LOAD %	ENGINE POWER BKW	ENGINE POWER BHP	OVERALL DB(A)	125 HZ DB	250 HZ DB	500 HZ DB	1000 HZ DB	2000 HZ DB	4000 HZ DB	8000 HZ DB
2.000.0	100	2.151.2	2.885	94	88	89	87	89	90	87	91
1.800.0	90	1.939.6	2.601	94	88	89	87	89	90	87	91
1.600.0	80	1.730.2	2.320	94	88	89	87	89	90	87	91
1.500.0	75	1.626.0	2.181	94	88	89	87	89	90	87	91
1.400.0	70	1.521.9	2.041	94	88	89	87	89	90	87	91
1.200.0	60	1.314.8	1.763	94	88	89	87	89	90	87	91
1.000.0	50	1.108.5	1.487	94	88	89	87	89	90	87	91
800.0	40	904.2	1.213	94	88	89	87	89	90	87	91
600.0	30	698.9	937	94	88	89	87	89	90	87	91
500.0	25	595.2	798	94	88	89	87	89	90	87	91
400.0	20	490.4	658	94	88	89	87	89	90	87	91
200.0	10	276.6	371	94	88	89	87	89	90	87	91

MECHANICAL Sound Pressure Data (OBCF) Distance: 15 Meters (49.2 Feet)

GENSET POWER WITH FAN EKW	PERCENT LOAD %	ENGINE POWER BKW	ENGINE POWER BHP	OVERALL DB(A)	125 HZ DB	250 HZ DB	500 HZ DB	1000 HZ DB	2000 HZ DB	4000 HZ DB	8000 HZ DB
2.000.0	100	2.151.2	2.885	88	83	84	82	83	84	82	86
1.800.0	90	1.939.6	2.601	88	83	84	82	83	84	82	86
1.600.0	80	1.730.2	2.320	88	83	84	82	83	84	82	86
1.500.0	75	1.626.0	2.181	88	83	84	82	83	84	82	86
1.400.0	70	1.521.9	2.041	88	83	84	82	83	84	82	86
1.200.0	60	1.314.8	1.763	88	83	84	82	83	84	82	86
1.000.0	50	1.108.5	1.487	88	83	84	82	83	84	82	86
800.0	40	904.2	1.213	88	83	84	82	83	84	82	86
600.0	30	698.9	937	88	83	84	82	83	84	82	86
500.0	25	595.2	798	88	83	84	82	83	84	82	86
400.0	20	490.4	658	88	83	84	82	83	84	82	86
200.0	10	276.6	371	88	83	84	82	83	84	82	86

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Measurement Date ASHRAE PREDICT

Last Updated September 8, 2015

Project Name Tata Mines

Project Code 60344074

2 DataType = 2

Staff BB

TABLE B1

ASHRAE PREDICTED SOUND POWER LEVELS

Sheet #(1)	Source ID	Source Tag	Source Description	Flow rate ($A.m^3/s$)	Flow rate (cfm)	Static Pressure (inches WG)	ASHRAE FanType	Fan Efficiency Ratio%	Fan Efficiency Correction Factor (dB)	Band Frequency (Hz)	Band Frequency Correction (dB)
	AMU	AMU	Air Make Up Unit	23.60	50,000	3.86	2	85	3	250	3
	RoofFan	RoofFan	Roof Fans	10.38	22,000	0.63	12	85	3	63	5
	SideFan	SideFan	SideFan	10.38	22,000	0.63	12	85	3	63	5
	VacuumPumpFan	VacuumPumpFan	Vacuum Pump Fan	3.15	6,680	140.00	1	74	9	250	3
	IDFan	IDFan	ID Fan for Bag House	35.40	75,000	6.00	1	85	3	250	3
					0				0		#N/A

Source ID	ASHRAE Predicted Base Total Sound Power (dB ref. 10-12W) 63	125	250	500	1k	2k	4k	8k	ASHRAE Pressure/ Flowrate Adj (dB)	ASHRAE Predicted Efficiency and BFI Adjustments (dB) 63	125	250	500	1k	2k	4k	8k
AMU	45	45	43	39	34	28	24	19	58.72	3	3	6	3	3	3	3	3
RoofFan	48	51	58	56	55	52	46	42	39.34	8	3	3	3	3	3	3	3
SideFan	48	51	58	56	55	52	46	42	39.34	8	3	3	3	3	3	3	3
VacuumPumpFan	40	40	39	34	30	23	19	17	81.17	9	9	12	9	9	9	9	9
IDFan	40	40	39	34	30	23	19	17	64.31	3	3	6	3	3	3	3	3
	###	###	###	###	###	###	###	###	#NUM!	0	0	0	0	0	0	0	0

Source ID	Total Sound Power (dB re 10^{-12} Watts) 63	125	250	500	1000	2000	4000	8000	Overall Sound Power (dB)	Overall Sound Power (dBA)	NOTES: Source Notes	Source Character (16)	CADNA IMPORT (17)
AMU	107	107	108	101	96	90	86	81	112	103	Taken from manufacturing data.	S	1
RoofFan	95	93	100	98	97	94	88	84	105	102	Taken from fan submittal data.	S	1
SideFan	95	93	100	98	97	94	88	84	105	102	Taken from fan submittal data.	S	1
VacuumPumpFan	130	130	132	124	120	113	109	107	136	127	Taken from fan manufacturer data.	S	0
IDFan	107	107	109	101	97	90	86	84	113	104	Taken from baghouse data using fan specs. Remember to subtract 3	S	0
	#N/A	#N/A	###	#N/A	###	###	###	###	#N/A	#######			

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TABLE B2

SOUND POWER LEVEL PREDICTIONS BASED ON CALCULATIONS

Measurement Date: ~ — Last Updated: September 8, 2015
Project Name: Tata Mines
Project Code: 60344074
Staff: BB

4 DataType = 4

Sheet #[1]	Source ID	Source Tag	Source Description	Wtd[2]	Calculated L_W in Octave Bands [Hz] 31.5	63	125	250	500	1k	2k	4k	8k	Overall Leq	Dir Type[4]	Angle[5]
	HaulTruck	HaulTruck775	CAT Haul Truck 775	Linear		99	95	87	86	84	83	77	73	101	0	0
	Excavator	Excavator	Komatsu PC1250	Linear	69	79	69	68	66	63	59	55	54	80	0	0
	Dozer	Dozer	250 kW CAT D8	Linear		89	92	83	81	82	78	73	65	95	0	0
	Loader	Loader	Loader	Linear	72	77	85	77	78	80	77	70	68	88	0	0
	Grader	Grader	200 kW CAT 14M Class	Linear		81	87	79	77	77	74	70	67	89	0	0
	Vibration_Screen	VibrationScreen	Metso SNSM2129	Linear										10	0	0
	Primary Hybrid_Crusher	Crusher1	Sandvik CR810/12-20	Linear										10	0	0
	Secondary_Hybrid Crusher	Crusher2	Sandvik CR810/08-30	Linear										10	0	0
	Feed_Hopper	Feed_Hopper	Feed Hopper	Linear	77	84	85	79	76	76	72	67	63	89	0	0
	Apron_Feeder	Apron_Feeder	Feed Hopper	Linear	77	84	85	79	76	76	72	67	63	89	0	0
	HydraulicRockBreaker	HydraulicRockBreaker	Hoe Ram	Linear	79	79	82	81	82	86	86	86	85	93	0	0
	OverheadCrane	OverheadCrane	Overhead Crane - Sandvik	Linear										10	0	0
	TruckLoading	TruckLoading	Truck Loading	Linear	77	84	85	79	76	76	72	67	63	89	0	0
	Crushers_Generator	Crushers_Generator	Primary, Secondary Crushers and Gensets	Linear	73	84	86	81	79	84	79	73	64	91	0	0
	Track_Drill	TrackDrill	CAT MD5125 Track Drill	Linear		86	92	85	88	84	83	78	77	95	0	0
	Fans	Fan	Generator Rad Fan	Linear		48	51	58	56	55	52	46	42	62	0	0
	GenIntake	GenIntake	5 Generator Intake	Linear		53	125	125	120	118	118	116		130	0	0
	GenandDryerFan	GenandDryerFan	Generator Exhaust and Dryer Fan	Linear		34	142	137	127	125	126	126		144	1	0
	IdlingDiesel	IdlingDiesel	Idling Diesel locomotive	Linear	123	131	132	123	125	125	118	114	110	136	0	0
	Generator_for_calc		Mechanical Noise	A			83	84	82	83	84	82	86	92	0	0
	GeneratorExhaust	GenExhaust	2MW Generator	Linear			104	99	90	88	89	89	86	106	0	0
	DustCollector	DustCollector	Dust Collector	Linear		81	80	79	78	75	69	61	52	86	0	0
	VacuumBlowerHoused	VacuumBlowerHoused	Vacuum Blower with fan housing	Linear		40	40	39	34	30	23	19	17	45	0	0
	VacuumBlowerHousingAdj	VacuumBlowerHousingAdj	uum Blower with fan housing 85dBA adjusted @	Linear	0	40	40	34	24	15	3	-3	-8	44	0	0
	VacuumBlower	VacuumBlower	Vacuum Blower	Linear	56	96	96	90	80	71	59	53	48	100	0	0
	VacuumBlowerDucted	VacuumBlowerDucted	Vacuum Blower Ducted	Linear		84	89	81	58	38	22	18		91	0	0
	IDFan	IDFan	IDFan	Linear		107	107	109	101	97	90	86	84	113	0	0
	VacuumPumps	VacuumPumps	Vacuum Pump 2BE4	Linear		53	53	43	36	36	31	26	21	56	0	0
	VacuumPumpDucted1	VacuumPumpDucted1	Vacuum Pump 2BE4 1 Ducted	Linear		95	96	84	73	70	67	67		99	0	0
	VacuumPumpDucted2	VacuumPumpDucted2	Vacuum Pump 2BE4 2 Ducted	Linear		95	96	84	73	70	67	67		99	0	0
	DryerBurner	DryerBurner	Dryer Burner	Linear	24	24	23	21	18	15	12	9	6	30	0	0

Sound Pressure Level Corrections/Adjustments

Source ID	Directivity Corrections in dB[6] 32	63	125	250	500	1k	2k	4k	8k	Adj[7]	misc Corrections in dB 31.5	63	125	250	500	1k	2k	4k	8k
HaulTruck	0	0	0	0	0	0	0	0	0	-32	0	0	0	0	0	0	0	0	0
Excavator	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0
Dozer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loader	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grader	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vibration_Screen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Primary Hybrid_Crusher	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Secondary_Hybrid Crusher	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feed_Hopper	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apron_Feeder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HydraulicRockBreaker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OverheadCrane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TruckLoading	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crushers_Generator	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Track_Drill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fans	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0
GenIntake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GenandDryerFan	-8	-8	-8	-8	-9	-9	-10	-10	-10	0	0	0	0	0	0	0	0	0	0
IdlingDiesel	0	0	0	0	0	0	0	0	0	-55	0	0	0	0	0	0	0	0	0
Generator_for_calc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GeneratorExhaust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DustCollector	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VacuumBlowerHoused	0	0	0	0	0	0	0	0	0	0	0	0	0	-5	-10	-15	-20	-22	-25
VacuumBlowerHousingAdj	0	0	0	0	0	0	0	0	0	0	49	49	49	49	49	49	49	49	49
VacuumBlower	0	0	0	0	0	0	0	0	0	0	0	0	0	5	10	15	20	22	25
VacuumBlowerDucted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IDFan	0	0	0	0	0	0	0	0	0	-3	0	0	0	0	0	0	0	0	0
VacuumPumps	0	0	0	0	0	0	0	0	0	57	0	0	0	0	0	0	0	0	0
VacuumPumpDucted1	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
VacuumPumpDucted2	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
DryerBurner	0	0	0	0	0	0	0	0	0	92	0	0	0	0	0	0	0	0	0

Source ID	Corrected/Adjusted L_{EQ}[8] 31.5	63	125	250	500	1k	2k	4k	8k	Overall Leq	STYPI[9]	SPH%[10]	Dist[11] (m)	Area[12] (m^2)
HaulTruck	-32	67	63	55	54	52	51	45	41	69	4	50	10.00	
Excavator	82	92	82	81	79	76	72	68	67	93	4	50	15.24	
Dozer	0	89	92	83	81	82	78	73	65	95	4	50	10.00	
Loader	72	77	85	77	78	80	77	70	68	88	4	50	5.10	
Grader	0	81	87	79	77	77	74	70	67	89	4	50	10.00	
Vibration_Screen	0	0	0	0	0	0	0	0	0	10				
Primary Hybrid_Crusher	0	0	0	0	0	0	0	0	0	10				
Secondary_Hybrid Crusher	0	0	0	0	0	0	0	0	0	10				
Feed_Hopper	77	84	85	79	76	76	72	67	63	89	4	50	15.20	
Apron_Feeder	77	84	85	79	76	76	72	67	63	89	4	50	15.20	
HydraulicRockBreaker	79	79	82	81	82	86	86	86	85	93	4	50	10.00	
OverheadCrane	0	0	0	0	0	0	0	0	0	10				
TruckLoading	77	84	85	79	76	76	72	67	63	89	4	50	15.20	
Crushers_Generator	73	84	86	81	79	84	79	73	64	91	4	50	30.50	
Track_Drill	0	86	92	85	88	84	83	78	77	95	4	50	10.00	
Fans	16	64	67	74	72	71	68	62	58	78	4	50	7.00	
GenIntake	0	53	125	125	120	118	118	116	0	130	2			
GenandDryerFan	-8	26	134	129	118	116	116	116	-10	135	2			
IdlingDiesel	68	76	77	68	70	70	63	59	55	81	4	50	15.24	
Generator_for_calc	0	0	83	84	82	83	84	82	86	92	4	50	15.00	
GeneratorExhaust	0	0	104	99	90	88	89	89	86	106	4	50	15.00	
DustCollector	0	81	80	79	78	75	69	61	52	86				
VacuumBlowerHoused	0	40	40	34	24	15	3	-3	-8	44				
VacuumBlowerHousingAdj	49	89	89	83	73	64	52	46	41	93	4	50	0.91	
VacuumBlower	56	96	96	95	90	86	79	75	73	101				
VacuumBlowerDucted	0	84	89	81	58	38	22	18	0	91				
IDFan	-3	104	104	106	98	94	87	83	81	110				
VacuumPumps	57	110	110	100	93	93	88	83	78	113				
VacuumPumpDucted1	0	95	96	84	73	70	67	67	0	99				
VacuumPumpDucted2	0	95	96	84	73	70	67	67	0	99				
DryerBurner	116	116	115	113	110	107	104	101	98	122	4	50	0.91	

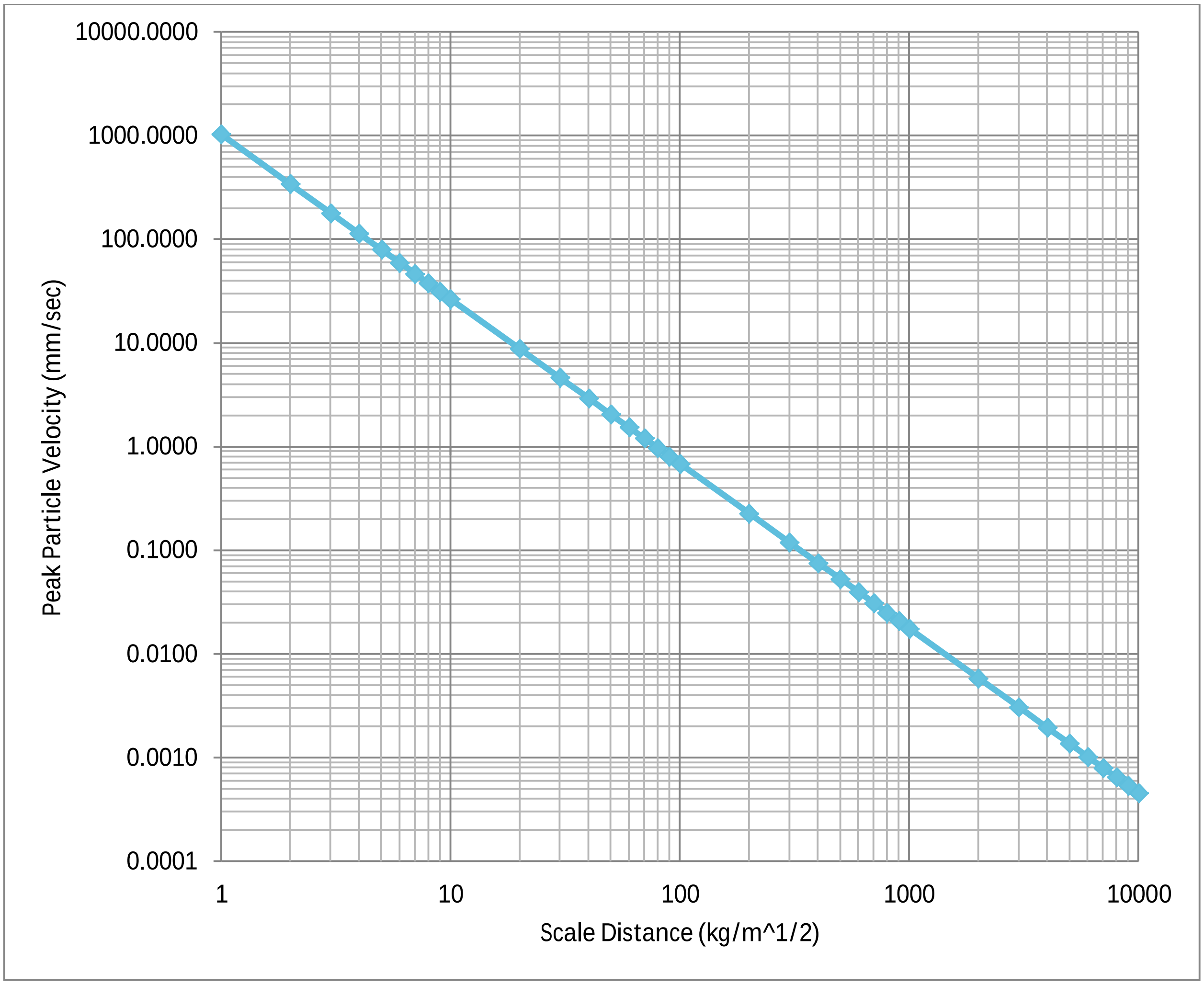
Source Power/Intensity Level Calculations and **NOTES**

Source ID	Sound Power Lw or Sound Intensity Li[13] 31.5	63	125	250	500	1k	2k	4k	8k	Overall Lw/Li	Overall Lw/Li dBA	TYPE[14]	Measurement/Source Notes	Source Character[15]	CADNA IMPORT[16]
HaulTruck	-4	95	91	83	82	80	79	73	69	97	86	Lw(D)	Spectrum of dump truck taken from BS5228-1:2009, adjusted to 86 dBA per manufacturer's spec data (SAE J88)	S	1
Excavator	114	124	114	113	111	108	104	100	99	125	113	Lw(D)	Spectrum of excavator taken from Gravenhurst, adjusted to 81 dBA per RCNM data	S	1
Dozer	28	117	120	111	109	110	106	101	93	123	114	Lw(D)	Levels taken from BS5228-1:2009	S	1
Loader	94	99	107	99	100	102	99	92	90	110	106	Lw(D)	Cat 996 from Gravenhurst	S	1
Grader	28	109	115	107	105	105	102	98	95	117	110	Lw(D)	Levels taken from BS5228-1:2009	S	1
Vibration_Screen	0	0	0	0	0	0	0	0	0	10	7	Li	From Dunville, use measurement of combined gen-crushers below	S	0
Primary Hybrid_Crusher	0	0	0	0	0	0	0	0	0	10	7	Li	From Dunville Quarry Project, use measurement of combined gen-crushers below	S	0
Secondary_Hybrid Crusher	0	0	0	0	0	0	0	0	0	10	7	Li	From Dunville Quarry Project, use measurement of combined gen-crushers below	S	0
Feed_Hopper	109	116	117	111	108	108	104	99	95	121	112	Lw(D)	Used measurements from Truck loading	S	1
Apron_Feeder	109	116	117	111	108	108	104	99	95	121	112	Lw(D)	Used measurements from Truck loading	S	1
HydraulicRockBreaker	107	107	110	109	110	114	114	114	113	121	120	Lw(D)	Levels taken from BS5228-1:2009	S	1
OverheadCrane	0	0	0	0	0	0	0	0	0	10	7	Li	Electric powered, inside dome, negligible	S	0
TruckLoading	109	116	117	111	108	108	104	99	95	121	112	Lw(D)	Truck loading from Dunnville Quarry	S	1
Crushers_Generator	111	122	124	119	117	122	117	111	102	129	124	Lw(D)	Screen, primary crusher, secondary crusher, and 2MW generator lumped together using Dunville Quarry measurements	S	1
Track_Drill	28	114	120	113	116	112	111	106	105	123	118	Lw(D)	Levels taken from BS5228-1:2009	S	1
Fans	41	89	92	99	97	96	93	87	83	103	100	Lw(D)	ASHRAE spectrum adjusted to value given from designer - e-mail from Barbara Ruttle	S	1
GenIntake	0	53	125	125	120	118	118	116	0	130	125	Lw	Duct and opening calcs performed in soundcalc	S	1
GenandDryerFan	-8	26	134	129	118	116	116	116	-10	135	125	Lw	Duct and opening calcs performed in soundcalc	S	1
IdlingDiesel	100	108	109	100	102	102	95	91	87	113	105	Lw(D)	Measurements taken from Willowbrook project, adjusted to 73dBA Lmax from FTA at 50ft	S	1
Generator_for_calc	32	32	115	116	114	115	116	114	118	124	124	Lw(D)	For use in calc from Manufacturer data	S	0
GeneratorExhaust	32	32	136	131	122	120	121	121	118	137	129	Lw(D)	Taken from DM8779-10, data sent by Alex Lee	S	0
DustCollector	0	81	80	79	78	75	69	61	52	86	79	Li	Taken from fan specifications	S	1
VacuumBlowerHoused	0	40	40	34	24	15	3	-3	-8	44	29	Li	Centrifugal Fan Data from Architectural Acoustics (Marshall Long) Table 13.5, Enclosure Adjustment from Table 13.8	S	0
VacuumBlowerHousingAdj	56	96	96	90	80	71	59	53	48	100	85	Lw(D)	Adjusted to 85dBA at 3 feet per Manufacturing data for blower w/ fan housing	S	0
VacuumBlower	56	96	96	95	90	86	79	75	73	101	92	Li	Adjusted to remove fan housing to obtain outlet value	S	0
VacuumBlowerDucted	0	84	89	81	58	38	22	18	0	91	76	Li	Vacuum Blower sound powel level used with Soundplan duct calcs	S	1
IDFan	-3	104	104	106	98	94	87	83	81	110	101	Li	ID ASHRAE Sound level adjusted for outlet only	S	1
VacuumPumps	57	110	110	100	93	93	88	83	78	113	99	Li	Pump correction level (architectural acoustics, Long) subtracted from whole number, and adjusted to 2BE4 manufacturing data overall sound power level	S	0
VacuumPumpDucted1	0	95	96	84	73	70	67	67	0	99	82	Li	Duct calculations performed in soundcalc	S	1
VacuumPumpDucted2	0	95	96	84	73	70	67	67	0	99	82	Li	Duct calculations performed in soundcalc	S	1
DryerBurner	123	123	122	120	117	114	111	108	105	129	120	Lw(D)	Overall dBA taken from manufacturing data, spectrum from Engineering noise control book (Bies&Hansen) Table 11.16 (boilers)	S	1

SEE ATTACHED NOTES

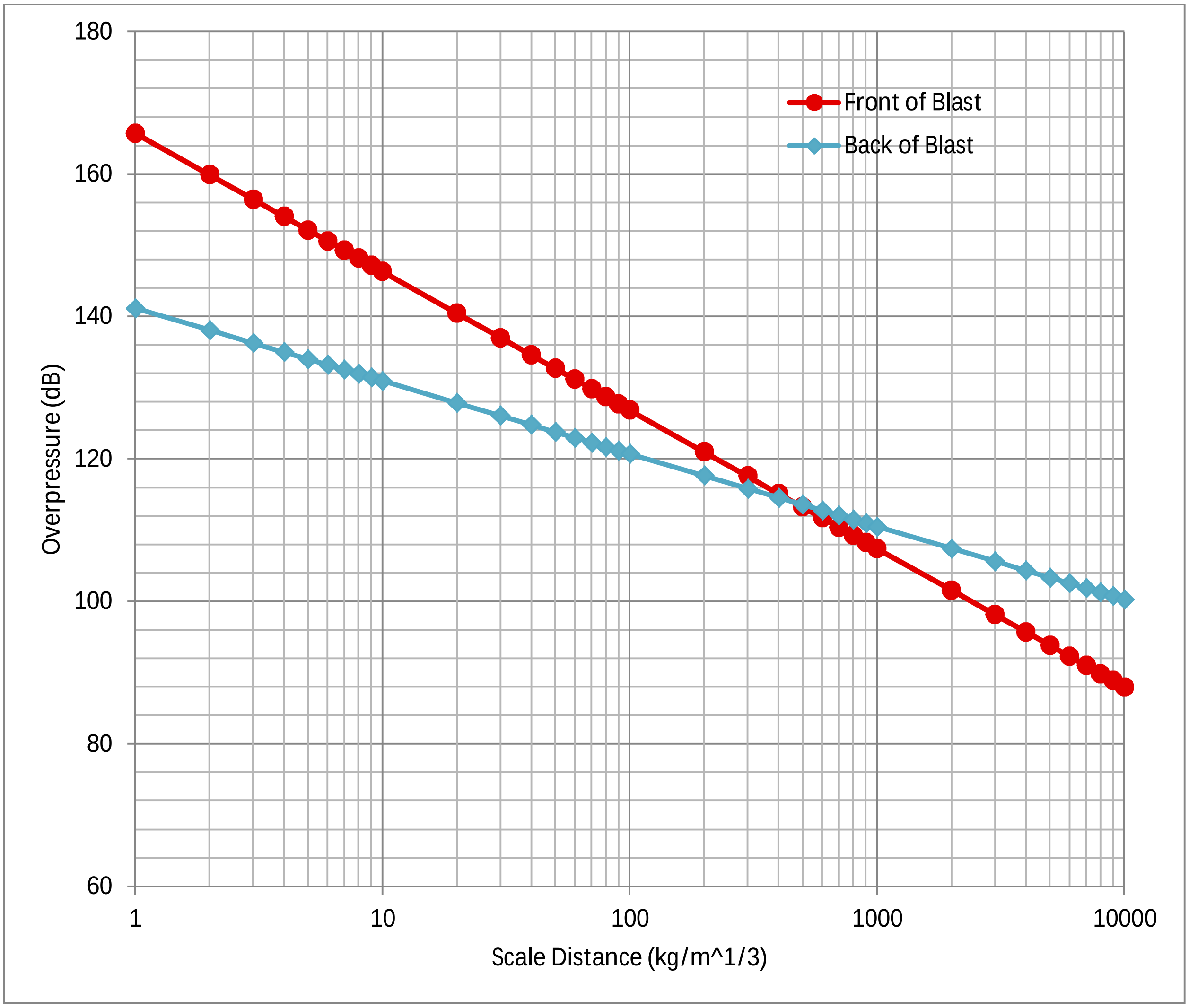
Appendix C

Appendix C: Ontario Ministry of the Environment Predictive Models for Blast ground vibration and overpressure



Peak Particle Velocity (mm/sec) versus scale distance (kg/m$^{1/2}$ - charge weight per delay divided by square root of distance)

Source: Ontario Ministry of the Environment "Guidelines on Information Required for Assessment of Blasting Noise and Vibration – December 1985 ".



Blast overpressure versus scale distance (kg/m$^{1/3}$ - Charge weight per delay divided by square root of distance)

Source: Ontario Ministry of the Environment "Guidelines on Information Required for Assessment of Blasting Noise and Vibration – December 1985 ".