

## 9 ENVIRONMENTAL MONITORING AND FOLLOW-UP

The environmental monitoring and follow-up plans presented in this section were designed to be easily integrated into the overall monitoring plan for TSMC's DSO project. The programs are presented for all VCs of the Howse EIS and they are designed to clarify some of the uncertainties inherent to the assessment process as well as to ensure that the Howse Project does not affect the VCs more than anticipated in the present document. Namely, the Proponent is committed to obtaining field data for those components which were assessed based on theoretical data. These uncertainties largely arise from environmental predictions on air emissions and permafrost conditions components.

The EPP (Volume 1 Appendix Ia) describes commitments to air, noise, surface/ground water monitoring as well as avifauna, fish and fish habitat, harvested animals, and caribou.

HML has also put in place various communication and socioeconomic monitoring mechanisms collaboratively with affected Aboriginal communities, which will be maintained for the Howse Project. During the last year of operations, the Proponent will conduct and evaluation the results of all of the environmental monitoring activities conducted on the Howse Project activities during the Operations phase. These results will allow the Proponent to adapt the closure and follow up program to the specific environmental issues identified for the Howse site. Any such environmental issue identified during the Operations phase will be targeted in order to improve the efficiency of the follow up program. Any issues or exceedances identified during the follow up program will be addressed in compliance with and applicable regulations and standards as well as in cooperation with local community.

### 9.1 PHYSICAL ENVIRONMENT

#### 9.1.1 Air Quality

The Proponent is committed to monitoring atmospheric air quality, and, when the specific emitters are quantified and identified, will propose effective reduction measures. Air quality will be monitored using a combination of standard reference and site-specific sampling methods as per NL guidance document GD-PPD-065 (Guidelines for Ambient Air Monitoring, December 16, 2010). An Ambient Air Monitoring Plan will be prepared by TSMC and submitted to the provincial authorities for approval. Atmospheric air quality measurements include: TPM, PM10, PM2.5 dustfall, NO<sub>2</sub> and metals.

Conceptually, the atmospheric air quality plan will consist of:

- selecting sampling locations based on air modelling results and identified sensitive receptors;
- selecting appropriate sampling equipment and methods allowing for short-term (e.g., 1 hour), medium-term (24 hours) and long-term (monthly) monitoring of dust and NO<sub>x</sub>;
- obtaining local meteorological information, such as wind speed, direction and temperature;
- applying monitoring methods and equipment that can provide reliable, accurate and representative data, considering the climate in this region; and
- ensuring that monitoring results are actionable and that corrective actions are applied promptly to minimize effects on air quality, if necessary.

A draft Ambient Air Quality Monitoring Plan (Volume 1 Appendix XXIV) and a Draft Plan for the Prevention and Management of Blast Generated NO<sub>x</sub> (Volume 1 Appendix XIX) are appended to this study.

#### Greenhouse Gas Emissions

Since 2012, TSMC has reported its GHG emissions through the National Pollutant Release Inventory (NPRI) on an annual basis as well as for the GNL. In addition to continuing with this practice, HML will finalize an action plan for the reduction of GHGs following the acquisition of data on emissions from the Howse Project once the Howse plant is fully operational (dryer and wet plant).

### 9.1.2 Noise and Vibration

Noise will be monitored on a monthly basis in the Howse area (timeline to be defined). HML has committed to preparing a mitigation plan for the drill noise, which will 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; and
- using a mobile noise screen.

A record of blasting data will include vibration speed, ground vibration frequency, air pressure, and dynamiting patterns. Blasts will be monitored for both vibration and overpressure, at the closest privately owned sensitive receiver adjacent to the site. HML is committed to implementing a seismograph for one year to assess vibration speed (peak particle velocity) during blasting. The blasting activity will be upgraded as needed, depending on results.

HML will employ blast monitoring techniques using seismographs in nearby deposits being mined to determine the extent of any ground vibration effects in order to ensure that there is no effect on Pinette Lake. Mining of the Howse deposit will begin in the most Northern part of the planned pit, which is also the farthest point from Pinette Lake. Continued seismographic monitoring in the Howse area away from Pinette will confirm if ground vibration behaves comparably to the areas previously monitored. Pinette Lake to an acceptable level to ensure that there is zero effect on any faults that may exist as part of the lake bed.

### 9.1.3 Surface and Groundwater Quality

Water quality will be monitored through several means. First, GNL's RTWQ Monitoring Network already has Instant Water Monitoring Stations in Goodream Creek and Elross Creek. These stations supply live information on water levels plus a number of water quality parameters. Other stations could be installed in the LSA at the GNL's request. The Howse Project is also subject to the *Environmental Control Water and Sewage Regulations, 2003* (Newfoundland and Labrador Regulation 65/03), under the *Water Resources Act* (O.C. 2003-231), and existing effluent monitoring for physico-chemical parameters at TSMC's DSO projects will be extended to Howse Project. Finally, the mine is subject to the *Metal Mining Effluent Regulations* (SOR/2002-222), under the *Fisheries Act* (R.S.C., 1985, c. F-14); once again, the monitoring program already in place for TSMC's DSO projects will be extended to include the Howse Project. The combination of these programs will ensure proper monitoring of water quality during mine operation.

The environmental monitoring plan has been developed based on preliminary information, and should be considered a conceptual design only. The environmental monitoring plan is subject to change based on the final site plan, consultations, site visits, feasibility, and government approvals. Figure 9-1 shows the proposed water monitoring plan.

As described in EPP (Volume 1 Appendix Ia), if possible, quarterly groundwater monitoring will occur on-site in accordance with the issued Certificate of Operation.

#### **9.1.4 Surface Water Monitoring Station**

Surface water quality will be monitored weekly and four times per calendar year. There are two types of surface water monitoring stations currently operational in the LSA. There are the instant monitoring stations that were characterized and at which hydrometric and water quality data are manually collected when accessible. There are also the RTWQ monitoring stations, which provide continuous water quality data and thus better insight into the effect of the mining operations on receiving waters than traditional grab samples.

Parameters measured by RTWQ stations are: temperature, pH, specific conductivity, dissolved oxygen and turbidity, which can be used to further calculate additional parameters such as total dissolved solids (TDS) and percent saturation. Additional sensors can be added to measure additional parameters, if needed. Water quantity data can also be measured by RTWQ stations (i.e., discharge, using stage height and velocity data).

The environmental monitoring program will provide effective real-time monitoring at the Howse Project site in accordance with the Canada-Newfoundland Water Quality Monitoring Agreement. To achieve this, the two instant monitoring stations that are already operational in the area could be upgraded to RTWQ monitoring stations at the request of the authorities. The provincial and federal governments will be responsible for the installation or relocation of real-time monitoring stations, as well as data collection and maintenance, as part of the Environment Canada/GNL's RTWQ Monitoring Program. The stations and their intended use in the environmental monitoring program are listed below.

##### **IHH1 (Instant Monitoring Station)**

Hydrometric station IHH1 monitors Burnetta Creek, downstream from the proposed sedimentation ponds HOWSEA. This station currently monitors water quantity and requires that manual readings be taken. Water quality should also be monitored at this location, to provide insight into any contaminants in Burnetta Creek caused by the discharge from sedimentation ponds HOWSEA or other mining effluents. The proposed HSW1 station is at the same location as the IHH1 station and will fulfill this function (Section 9.1.6).

##### **IHH4 (Instant Monitoring Station)**

Hydrometric station IHH4 monitors Goodream Creek, close to its discharge point into Triangle Lake. It is downstream from Timmins 4 sedimentation pond 3 and sedimentation pond HOWSEB. This station currently requires manual readings.

##### **IHH3 (Instant Monitoring Station)**

Hydrometric station IHH3 is located in PIN1, the tributary to Pinette Lake. This station is located downstream from the Project, but water quality in this stream should not be affected by mining operations since all runoff from this watershed is diverted to Timmins 4 sedimentation pond 3. Currently, IHH3 also requires that stage height and velocity readings be taken manually. Surface water sampling for quality parameters is already done at sampling location COA SW13, which is part of the DSO4 project. This sampling should continue with the Howse Project, to provide insight on any contaminants of concern that may accidentally enter Pinette Lake from that source.

##### **GRH1 (Gaging ruler installed in Pinette Lake)**

Gaging ruler GRH1 is located near IHH3 station, on littoral of Pinette Lake. This ruler is a staff gage currently installed to adequately monitor the variation of lake water levels. Reading should continue to allow the knowledge of the natural regime and future changes. The staff gage can be read visually from the shore.

##### **NF03OB0040 (RTWQ Monitoring Station)**

RTWQ Monitoring station NF03OB0040 (Goodream Creek, 2 km northwest of Timmins 6) is already part of the RTWQ Program in Newfoundland and Labrador. It is currently located upstream from sedimentation pond HOWSEB, but downstream from Timmins 4 sedimentation pond 3. This monitoring station could be moved downstream from sedimentation pond HOWSEB in order to monitor contamination from both the Howse Project and TSMC’s DSO project. If the relocation of the monitoring station is determined not to be feasible or beneficial to the monitoring of both projects, an additional monitoring station should be installed in Goodream Creek, downstream from the discharge point of sedimentation pond HOWSEB, ideally at the IHH4 station, which has road access, or at the proposed HSW3 station (Section 9.1.6).

### 9.1.5 Effluent Monitoring

Effluent Discharge Criteria (EDC) parameters are usually tested weekly in effluent grab samples. Acute Lethality Test (ALT) parameters will only require monthly testing. An overview of the effluent monitoring schedule, including monitoring locations, is presented in Table 9-1.

**Table 9-1 Effluent Monitoring Schedule**

MONITORING LOCATION	PARAMETRES	FREQUENCY
1. Sedimentation Pond HOWSEA discharge into Burnetta Creek	EDC (excluding ALT) See Table 9-2 for specific parameters and limits	Weekly (minimum of 24 hours apart)
2. Sedimentation Pond HOWSEB discharge into Goodream Creek		
3. Timmins 4 Sedimentation Pond 3 discharge into Goodream Creek	ALT (conducted as per Environment Canada’s Environmental Protection Service reference method EPS/1/RM-13 Section 5 or 6)	Monthly (minimum of 15 days apart)

Monitoring locations were selected to ensure that all effluent diverted into receiving waters is monitored regularly. All measured parameters will be compared to the EDC specified by the Certificate of Approval from the GNL. The expected parameters and concentrations are shown in Table 9-2 below, but may change once the Certificate of Approval has been issued.

**Table 9-2 Effluent Discharge Criteria (EDC)**

PARAMETRE	MAXIMUM ALLOWED MONTHLY MEAN CONCENTRATION	MAXIMUM ALLOWED CONCENTRATION IN A COMPOSITE SAMPLE	MAXIMUM ALLOWED CONCENTRATION IN A GRAB SAMPLE
Arsenic	0.50 mg/L	0.75 mg/L	1.00 mg/L
Copper	0.30 mg/L	0.45 mg/L	0.60 mg/L
Lead	0.20 mg/L	0.30 mg/L	0.40 mg/L
Nickel	0.50 mg/L	0.75 mg/L	1.00 mg/L
Zinc	0.50 mg/L	0.75 mg/L	1.00 mg/L
TSS	15.00 mg/L	22.50 mg/L	30.00 mg/L
Radium 224	0.37 Bq/L	0.74 Bq/L	1.11 Bq/L

PARAMETRE	MAXIMUM ALLOWED MONTHLY MEAN CONCENTRATION	MAXIMUM ALLOWED CONCENTRATION IN A COMPOSITE SAMPLE	MAXIMUM ALLOWED CONCENTRATION IN A GRAB SAMPLE
pH	Allowable Range 5.5 – 9.0 units		
ALT	Toxic pass		

Sampling frequency will decrease or increase depending on the results of previous consecutive tests, as specified by the Certificate of Approval. The conditions that would lead to a change in sampling frequency are outlined in Table 9-3 below.

**Table 9-3 Changes in Sampling/Testing Frequency**

PARAMETRE	TEST RESULTS	NEW TESTING FREQUENCY
Arsenic	Parameter’s monthly mean concentration in the effluent is less than 10% of the maximum allowed mean concentration for the 12 months immediately preceding the most recent test	Once per calendar quarter
Copper		
Lead		
Nickel		
Zinc		
Radium 224	Concentration of radium 226 is less than 0.037 Bq/L in 10 consecutive tests	
ALT	Effluent is not determined to be acutely lethal over a period of 12 consecutive months.	
pH	Parameter testing frequency cannot be reduced.	
TSS	Parameter testing frequency cannot be reduced.	

The Department of Environment and Conservation will be notified in writing at least 30 days prior to a reduction in the testing frequency for any parameter. If during the next testing event, test results no longer meet the requirements for a parameter, that parameter will be tested at the original frequency shown in Table 9-1.

If an ALT determines that any sample is acutely lethal, a grab sample must be collected from the final discharge point of the failing site. An ALT must be performed, and an aliquot of the failing sample must be analyzed for the parameters listed in Table 9-2. Samples should then be collected twice per month until three consecutive tests determine that the effluent is no longer acutely lethal. After the third consecutive non-acutely lethal test, the ALTs must be conducted at the original testing frequency.

If the results of three consecutive ALTs show that the effluent is acutely lethal, a toxicity identification evaluation must be performed to determine the specific toxin causing the problem. A report outlining measures to prevent or reduce the toxin must then be submitted to the director of the Department of Environment and Conservation within 60 days of the third consecutive failed test.

Flow measurements at the effluent discharge of each sedimentation pond will be monitored through the installation of a Parshall flume in the ditches downstream from the permeable rockfill dikes of the pond. A Parshall flume reading will be taken at the same time that a water sample is collected.

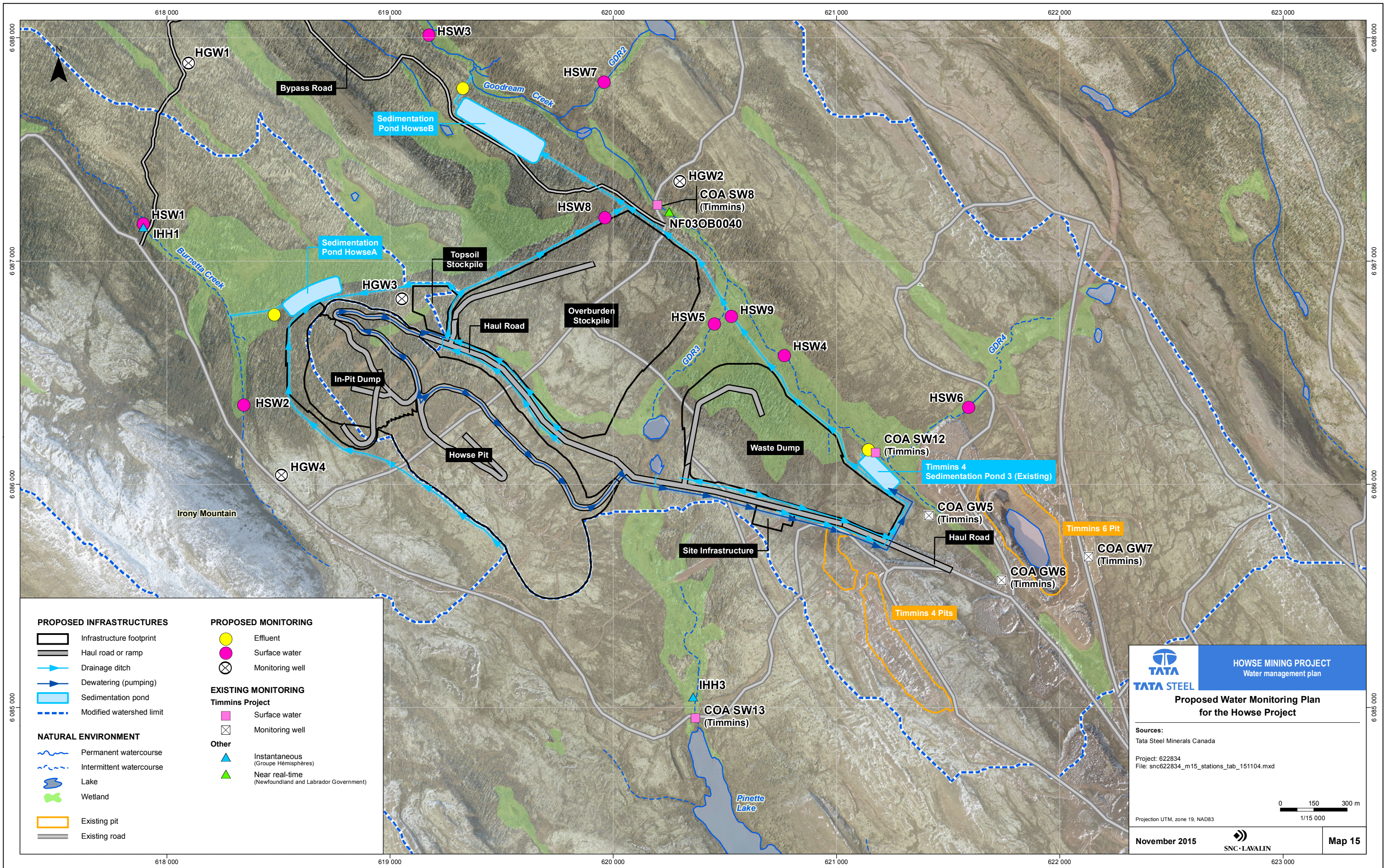
### 9.1.6 Water Chemistry Analysis (Surface and Groundwater)

In addition to the RTWQ monitoring system and effluent monitoring, groundwater and surface water grab samples will be collected four times a year and analyzed by a laboratory that has been certified by the Canadian Association for Environmental Analytical Laboratories. Monitoring locations and parameters to be tested are presented in Table 9-4 and Figure 9-1. As the monitoring program progresses, it may be appropriate to relocate, add or remove monitoring locations as needed.

**Table 9-4 Water Chemistry Analysis Program**

SAMPLE TYPE	STATION NUMBER	MONITORING LOCATIONS	PARAMETRES
Surface Water	HSW1	Burnetta Creek, downstream from Sedimentation Pond HOWSEA	<p><u>General Parameters:</u>                      temperature, dissolved oxygen (DO), nitrate + nitrite, nitrate, nitrite, pH, TSS, color, sodium, potassium, calcium, sulfide, magnesium, ammonia, alkalinity, sulfate, chloride, turbidity, reactive silica, orthophosphate, phenolics, carbonate (CaCO<sub>2</sub>), hardness (CaCO<sub>3</sub>), bicarbonate, TPH.</p> <p><u>Metals Scan:</u>                      aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, mercury, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, radium, vanadium, zinc.</p>
	HSW2	Burnetta Creek, upstream from Sedimentation Pond HOWSEA	
	HSW3	Goodream Creek, downstream from Sedimentation Pond HOWSEB	
	HSW4	Goodream Creek, northeast of Waste Rock Dump 2	
	COA SW12 (Timmins)	North of Timmins 4 Sedimentation Pond 3 (COA SW12 from Timmins Site)	
	HSW5	GDR3 stream between the Overburden Stockpile and Waste Rock Dump 2	
	HSW6	GDR4 stream northeast of Timmins 4 Sedimentation Pond 3	
	HSW7	GDR2 stream flowing into Goodream Creek, northeast of Sedimentation Pond HOWSEB	
	HSW8	Drainage ditch north of the Overburden Stockpile	
	COA SW8 (Timmins)	Goodream Creek, northeast of the Overburden Stockpile (COA SW8 – Timmins Site)	
	COA SW13	Stream north of Pinette Lake (COA SW13 – Timmins Site)	
	HSW9	Drainage ditch north of Waste Rock Dump 2	
Groundwater	HGW1	Northwest of the Howse Pit	
	HGW2	East of the Overburden Stockpile and Goodream Creek	
	HGW3	West of the Overburden Stockpile	
	COA GW5 (Timmins)	Southeast of Timmins 4 Sedimentation Pond 3 (COA GW5 -Timmins Site)	
	HGW3	West of the Howse Pit	

SAMPLE TYPE	STATION NUMBER	MONITORING LOCATIONS	PARAMETRES
		TSS analysis not required for groundwater samples. TPH analysis to be performed on sedimentation pond samples.	







Groundwater will be sampled using monitoring wells. The latter will be selected not only to obtain groundwater samples, but also to monitor the depth of groundwater, fluctuations in the water table and changes in groundwater flow direction that could be caused by pit dewatering, changes in surface drainage and permafrost melting. The installation of additional monitoring wells may be required if the current wells prove unsuitable for groundwater sampling/monitoring, based on hydrogeology/geology data, well depth, and well condition. Monitoring wells will be selected and installed in areas affected by potential mine effluents and also in areas that allow background sample collection. At least one monitoring well will be required as a reference well within each watershed of concern, up-gradient and away from all potential mine influences.

The number of surface water sampling sites required and their locations were determined based on the hydrological and geological characteristics of the area, the characteristics of the expected contaminants, anthropologic influences and ease of access. Sampling sites will be established downstream from contamination points, and reference sites will also be established up-gradient from potential contamination points.

### **Quality Assurance / Quality Control (QA/QC)**

QA/QC samples will be taken regularly to ensure that proper field and laboratory techniques are being followed and to ensure the integrity of the results. A minimum of 10% of the samples submitted will be QA/QC samples, such as field duplicates, split samples, trip blanks and/or field blanks. Before each sampling event, discussions with the laboratory analyzing the samples will help determine the QA/QC protocols to be followed.

#### **9.1.7 Permafrost**

Two thermistors will be installed in spring of 2016 to monitor ground temperature in strategic locations, e.g. those that are inside an area with (low) permafrost potential.

## **9.2 BIOLOGICAL ENVIRONMENT**

Currently, the Proponent is committed to performing wildlife surveys every five years on the TSMC / HML properties. Further, In addition, the Proponent is analyzing the feasibility of performing water footprint surveys on TSMC properties.

### **9.2.1 Wetlands**

Although it is not expected that wetlands be affected by pit dewatering, (Section 7.4.2), the Proponent is committed to monitoring of wetlands during the routine site inspections and a wetland disturbance survey will also be conducted every five years.

Water table monitoring wells, consisting of perforated pipe should be installed before the beginning of the construction phase in order to obtain some measures before pit dewatering begins. Measurement should be taken once a month, but once every two week from the beginning of operation phase until dewatering ends. Construction of water table monitoring wells is described in USACE (2005). Transects of wells should be positioned in CMH-04, CMH-05 and CMH-06 (see Figure 7-30 for the location of these wetlands). The wells should be spaced 50 m apart.

Monitoring for rare plants

Prior to any work in a non-disturbed area, TSMC's environmental team will perform a screening for rare plants in the area. If a rare plant is discovered, the area will be isolated and specific measures to protect the species will be implemented.

### 9.2.2 Caribou

Caribou are being monitored for HML under an agreement between TSMC and the Ungava project and CARMA. This monitoring consists of telemetric data currently available from the CARMA program. Under this program, HML's Environmental Specialist / Permit Manager will be notified when migratory tundra caribou venture within 100 km of the Howse Project. Upon receipt of such a notice, operations will continue with caution. If monitoring data from the radio collars indicate that some of the caribou have moved to within 20 km of the Howse Project, TSMC will institute surveys within that radius to monitor their movements in greater detail.

Survey details will be evaluated during the early years of operation. Initially, preference will be given to fixed-point observations along high ground areas adjacent to the Howse Project activity sites and to snowmobile- and ATV-based searches by members of the local First Nations hired by HML, with instructions to avoid disturbing the animals. It is expected that the inclusion of Aboriginal people's help will benefit from the knowledge about the movements of caribou in the area. If ground-based surveys do not prove to be useful or feasible, HML will initiate aerial surveys. Special care will be taken at all times not to interfere with the activities of First Nation hunters.

The data collected during the surveys (number, age and sex; location of sightings; topography of sighting location) will be communicated frequently to the authorities concerned, who will be asked for advice with respect to the course of action to be followed, the overall goal being to reduce nuisance.

As per EPP (Volume 1 Appendix Ia) document, sedentary caribou will be monitored on site through regular site inspections and employee information sessions. Should a sedentary caribou be detected in the vicinity of the DSO Timmins project, the animal's location and direction should be noted and monitored.

### 9.2.3 Avifauna

The Proponent will engage in breeding birds and species at risk monitoring surveys every five years. Surveys with point count methods will allow HML to stay informed on avifauna in the area. In order to keep track of possible changes in bird populations, these surveys will be conducted in every habitat present in the Howse area, after the end of the construction phase.

Special attention will be directed on species at risk. Uses of playback in proper habitat will be part of an adapted protocol to ensure that Rusty Blackbird and Gray-cheeked Thrush are still using the remaining habitats. Red-necked Phalarope will be monitored in marshy habitats as Burnetta Creek. A surveillance program will be developed as well in existing pits for Bank Swallows. Finally, uses of wetlands and lakes in the study zone by waterfowl for breeding and staging will also be monitored properly every five years.

The Rusty Blackbird, Gray-cheeked Thrush, Red-necked Phalarope and the Bank Swallow will all be specifically monitored at a local scale.

The proponent is committed to surveying the Howse Pit vertical walls in early and mid-summer every year that the mine is in the operations phase. Should the Bank Swallow be detected, deterrence measures will be taken to render the site inhospitable (noise, plastic covering of pit walls, etc.) for nesting. Any nest found will be protected with a buffer zone determined by a setback distance appropriate to the species, the level of the disturbance and the landscape context, until the young have permanently left the vicinity of the nest. Setback distance suggested by Environment Canada (Environment Canada, 2015) is up to 50 m or more for swallow colonies.

Bank Swallow is the only species at risk susceptible to use the habitat left by the mining sites where restoration activities will take place. If a Bank Swallow nest or a colony is found during the follow up program, the Proponent is committed to ceasing all activities in order to allow for any natural behavior to

proceed. Further, it is recommended that the Proponent stop any restoration activities in the vicinity of the sighting in order to improve the chances that an at-risk species establish at the Howse site following the operations phase. As per during the operations phase above, any nest found will be protected with a buffer zone determined by a setback distance appropriate to the species, the level of the disturbance and the landscape context, until the young have permanently left the vicinity of the nest. Setback distance suggested by Environment Canada (Environment Canada, 2015) is up to 50 m or more for swallow colonies.

#### **9.2.4 Aquatic Fauna**

Aquatic fauna will be monitored in accordance with the *Metal Mining Effluent Regulations* (SOR/2002-222), under the *Fisheries Act* (R.S.C., 1985, c. F-14). These regulations require rigorous monitoring of fish and benthic invertebrates potentially affected by mine effluent, hence ensuring proper monitoring of this component. They also include an effluent and water quality monitoring program that allows for sound scientific interpretation of the results.

Any worker observations of unusual fish mortality will also be conveyed to local environmental technicians for immediate follow-up, and adequate measures will be taken to eliminate the identified cause.

### **9.3 SOCIOECONOMIC ENVIRONMENT**

HML has put in place various communication and socioeconomic monitoring mechanisms collaboratively with affected Aboriginal communities, which will be maintained for the Howse Project. In addition to complying with all regulatory requirements, and to applying its EPP, HML will continue to carry-out the following monitoring, mitigation and communication measures pertaining to community issues:

- community HSE Committee meetings, held 3-4 times per year, to provide a forum for HML and affected Aboriginal communities to discuss and address as a group health, safety and environmental matters relating to the Howse and DSO Projects, and to assess Project effects and monitoring measures in place. Participation in meetings by experts on matters requiring specific advice, will continue to be possible and encouraged. Information from Committee meetings, including presentations and minutes, is made available electronically to Committee members and environmental information on the Project is made available on the Committee shared drive. HML will work with Committee members to inform the community at-large of the salient points of the matters discussed;
- agreement Implementation Committee meetings, held periodically and on an individual basis with each Aboriginal group, to assess :
  - aboriginal employment levels and training carried out, in relation to HML's activities, and gender equity;
  - aboriginal contracting levels;
  - financial benefits flowing to the communities, as per its agreements;
- regional Steering Committee on Mining Issues to discuss and address issues faced by residents in the region as they relate to mining activities; and
- HML Environment, Safety and Community Affairs personnel present on-site, in the Schefferville region and that can be reached 7 days per week, responsible for assessing and responding to community matters and/or concerns.